Siting Renewable Energy in Utah: Identifying Locations Compatible with Department of Defense Operations

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Utah Governor's Office of Energy Development
Utah Geological Survey
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List of Acronyms and Abbreviations

BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
CUP	Conditional Use Permit
CX (CE)	Categorical Exclusion
dBA	Decibel A-weighting, a measure of sound pressure level
DNA	Documentation of NEPA Adequacy
DoD	Department of Defense
DLAs	Designated Leasing Areas
EA	Environmental Assessment
EIA	Energy Information Administration
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FLPMA	Federal Land Policy Management Act
FONSI	Finding of No Significant Impact
FWS	U.S. Fish and Wildlife Service
JLUS	Joint Land Use Studies
MOA/MOU	Memorandum of Agreement/Memorandum of Understanding
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NFMA	National Forest Management Act
NOA	Notice of Availability
OED	Utah Governor's Office of Energy Development
PEIS	Programmatic Environmental Impact Statement
PLPCO	Public Lands Policy Coordinating Office
POD	Plan of Development
PV	Photovoltaic
RDCC	Resource Development Coordinating Committee
RE	Renewable Energy
REPI	Readiness and Environmental Protection Integration Program
RMPs	Resource Management Plans
RMP	Rocky Mountain Power
ROD	Record of Decision
ROW	Right-of-Way
SEZs	Solar Energy Zones
SHPO	State Historic Preservation Officer
SITLA	School and Institutional Trust Lands Administration
THPO	Tribal Historic Preservation Officer
UGS	Utah Geological Survey
USFS	U.S. Forest Service
USU	Utah State University

Section 1: Executive Summary

This report details the regulatory process and procedures for stakeholders to identify and develop compatible renewable energy sites without negatively impacting military operations. The presence of the military in the State of Utah provides significant economic benefits. As the population of Utah continues to grow, demands for energy will increase. Development of renewable energy is an important component of meeting that demand and achieving a diverse, energy portfolio to support sustainable economic outcomes for Utah.

Renewable energy is not without its challenges. Current and emerging technologies in the field of renewable energy are working to overcome these challenges of production, storage and delivery of renewable energy. Stakeholders within the renewable energy sector are tasked with developing technologies to meet these demanding challenges for renewable energy projects in the State of Utah. Developers are also tasked with meeting regulations and requirements from multiple government agencies (federal, state, local, and tribal) as well as achieving compatibility with military testing, training and operations.

This report provides a regulatory framework and is a culmination of information and data collected from many stakeholders over a two-year period. Associated with this report is an interactive ArcGIS map providing extensive data on renewable energy potential throughout the state and on potential conflicts with the military. Information about the process and procedures were collected from online surveys, personal interviews, stakeholder meetings, and data collected from individual stakeholders used to develop the interactive map. Stakeholders will now have access to information and procedures that are not commonly known by using both the final report and the interactive map to assist with the selection of a site for a renewable energy project.

The most significant lesson learned from this project is the importance of early communication and collaboration with all appropriate entities that will lead to efficient and productive steps toward renewable energy projects in Utah while maintaining ongoing and vital military operations. Access to the power grid continues to be one of the limiting factors of development of renewable energy in Utah. Exploring solutions to grid access and potential expansion can help to increase the development of renewable energy in the state.

An issue presented by stakeholders is to resolve challenges that may exist on metering and accounting of renewable energy utilized by customers but is beyond the scope of this project. A final suggestion from stakeholders was to continue stakeholder meetings annually or semiannually to continue the dialog. Stakeholders found the collaboration and connection with each other to be a valuable tool in meeting the scope of work of their agency. The stakeholder meetings helped to develop best practices and opportunities to enhance collaboration and address data/process gaps.

Section 2: Introduction

2.1 Background

The Utah Governor's Office of Energy Development (OED) partnered with Utah Geological Survey (UGS) and Utah State University (USU) on a U.S. Department of Defense (DoD) grant to facilitate the compilation of information to aid effective identification of sites with renewable energy potential that are compatible with military testing, training, and operations. This proactive approach is critical to enabling Utah to meet the expected energy needs of its growing population.

Nationally, Utah boasts significant renewable energy potential, ranking third nationally for geothermal power [OED, 2018]. and eighth for solar power [NEO, 2010]. Utah's population is (3.1 million, US Census Bureau) one of the fastest growing states in the nation [Jordan, 2016]. and is projected to double by 2050, likely increasing energy demands and energy costs statewide [Perlich, 2017]. Growing the state's energy infrastructure through heightened production and distribution will help meet these demands.

Utah is home to Hill Air Force Base (AFB), the Utah Test and Training Range (UTTR), Dugway Proving Ground (DPG), Tooele Army Depot, Green River Test and Launch Complex, Camp Williams and associated ranges, Military Operations Areas (MOAs), and Military Training Routes (MTRs). Associated ranges and MTRs for Naval Air Station Fallon and Nellis Air Force Base also extend from Nevada into limited areas of western and southern parts of Utah. Coincidentally, these areas overlap Utah's strongest renewable energy resources, and their development could impair mission activities across the installations, ranges, and routes. Specific impairments can include radar interference, low-level flight obstructions, momentary flash glint, continuous source glare, night vision goggle reflection, electromagnetic interference and competition for water resources. These critical areas of concern for impairments have been placed in map layers with data to assist stakeholders identify possible conflicts at certain locations and provide a regulatory roadmap to explain where developers need to go to have discussions about their siting project.

The map and findings captured in this final report serve as a pathway for energy developers to safely site renewable energy, meeting the needs of a burgeoning population without interfering with military operations. Where appropriate, State and local governments can also utilize this report and map to support continued community economic development, enhance civilian and military communication and collaboration, and increase public awareness of the military mission in the State of Utah. The interactive map and process and procedures are addressed in detail in Section 5.

2.2 Project Description

This two-year project consisted of five primary tasks. First, the project team worked with stakeholders to develop a comprehensive data set that identified renewable energy sites in Utah that are compatible with military operations. These sites and data layers are provided in an online, interactive ArcGIS map. The data was contributed by stakeholders or had already existed in the UGS database.

Task 1 of the project was to create a multi-layer map:

Task 1 - Multi-layer map
Subtask 1a - Data collection to integrate with an interactive map.
Subtask 1b - Gap identification and resolution to validate functionality of map.

Second, USU identified the regulatory procedures and processes associated with energy development at the sites. To successfully understand these elements, USU conducted 27 tailored interviews with all relevant stakeholders. As part of this project, a network of military, utility, industry, federal, state, county and tribal stakeholders contributed input, guidance, and information to generate an online interactive map and this final report, which aim to guide compatible community planning. Each stakeholder type was asked a set of questions designed for their circumstances and areas of expertise. These interviews were captured in notes, and the USU team identified themes across interviews and general findings.

Task 2 - Qualitative assessment
Subtask 2a - Stakeholder identification; create list of stakeholders and representatives.
Subtask 2b - Conduct interviews with the majority of stakeholders.

Third, findings were captured in this final report and disseminated through a robust education and outreach effort.

Task 3 - Synthesis and assessment of results into a list of compatible energy sites and a final report.

Stakeholders were briefed of the team's progress at quarterly stakeholder meetings held in Salt Lake City, Utah, and at the final quarterly meeting. The map and report were uploaded to the OED website and presented to the public at conferences and outreach events.

Task 4 – Presentation of the final report to stakeholders and posting the ArcGIS map and final report online.

Task 5 - Quarterly stakeholder meetings, including a kick-off meeting, and: finalized requirements list of the ArcGIS map layers, finalized requirements list and

outline for the final report, approved final report outline, and finalized list of stakeholders and representatives.

2.3 Roles and Responsibilities

OED provided oversight for the project. USU reviewed the existing regulatory processes and procedures with federal, state, county and tribal agencies for energy development at such sites and conducted stakeholder interviews. In preparation for this final report, education and explanation of the sites available for renewable energy development were provided to stakeholders through meetings and partner websites. UGS, in conjunction with USU, developed an ArcGIS map to identify current and potential sites for renewable energy development that are compatible with military operations in Utah.

References to Section 2

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Section 3: Military Operations in Utah and Renewable Energy in Utah Outlook

3.1 Military and Renewables

Renewables and the Military Mission

It is the mission of the Department of Defense to "provide the military forces needed to deter war and to protect the security of our country" [U.S. Department of Defense, 2018]. Energy availability and reliance, however, can affect the ability of the military to uphold its mission. The DoD, Army, and Air Force have stated that energy security is not only key for military operations, but that it is also critical for national and economic security [U.S. Air Force, 2013; U.S. Army, 2015; U.S. Department of Defense, 2015]. The U.S. Air Force stated that

> *"Energy is critical for the U.S. military's core national defense mission, yet it is simultaneously a vulnerability to the military's ability to confront 21st century challenges that are global and increasingly more complex."* [U.S. Air Force, 2013].

In the Strategic Sustainability Performance Plan released by the DoD in 2016, the DoD explained its reliance on the commercial energy grid and the continual and critical risk this reliance places on missions [U.S. Department of Defense, 2015]. Commercial grids pose a risk because they are vulnerable to intermittency and power disruptions that are caused by weather events, physical attacks, cyber-attacks, and system overloads [U.S. Air Force, 2013; U.S. Department of Defense, 2015]. The military is dependent on a diverse energy supply chain, which includes energy sources obtained through trade overseas. A non-domestic supply of energy is susceptible to piracy and political instability [U.S. Department of Defense, 2015]. Additionally, the military's current energy supplies are vulnerable to physical shortages and price volatility from increasing global competition [U.S. Air Force, 2013].

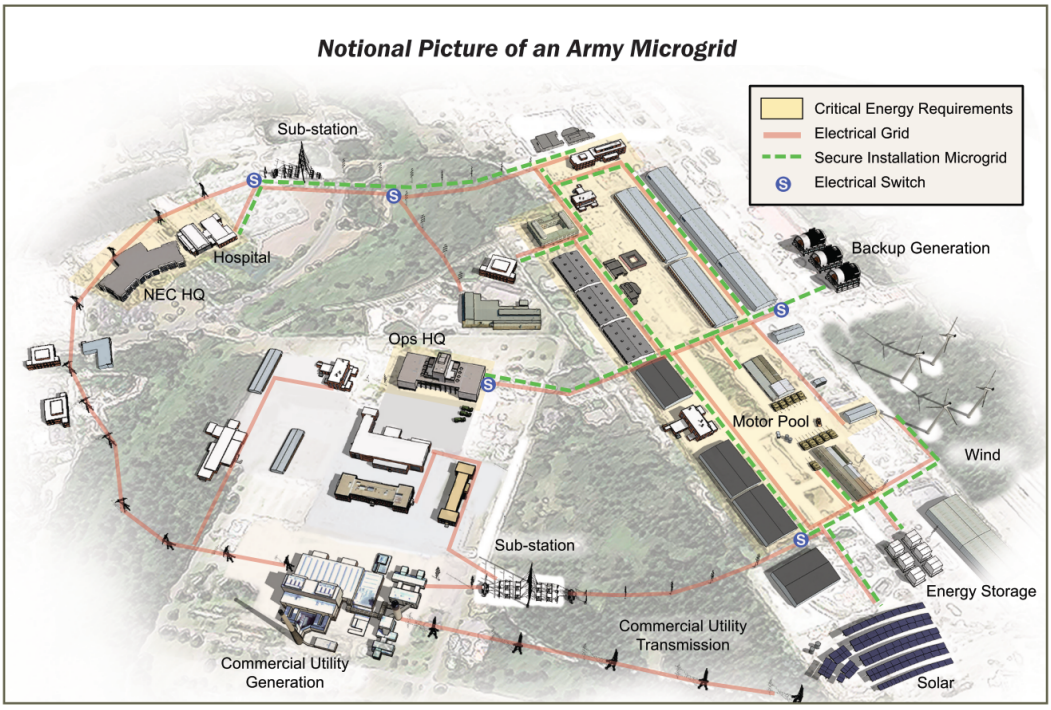
To ensure energy security, the DoD, Army, and Air Force have all expressed the need to improve energy resiliency and assure energy supply and access. Resiliency means that the military will be able to "recover from energy interruptions and sustain the mission" [U.S. Air Force, 2013]. Some of the ways the military plans to do this is to diversify its existing energy supply through the incorporation of renewable energy sources, reduce energy consumption through efficiency upgrades, and develop microgrids to improve energy management, flexibility, security, and reliability [U.S. Army, 2015; U.S. Department of Defense, 2015].

The goals and strategies released in these federal reports were echoed in the interviews conducted with military personnel from Tooele Army Depot, Camp Williams, Dugway Proving Ground, and Hill Air Force Base. Throughout these interviews, it was repeatedly stressed that a critical goal is to ensure zero mission interruptions resulting from energy disturbances. The military personnel interviewed also stated that it is essential to procure available and reliable energy. Additional and similar comments from these interviews, within the context of energy

security, included the need for energy resilience and the ability to be self-sustaining and independent from the commercial grid. To provide secure and reliable energy, many of these military members discussed the need for local microgrids that are powered by energy sources that can be installed on or near base.

Renewable energy sources, such as wind, solar, and geothermal power, offer independence, security, and reliability, especially when incorporated with energy storage [American Council on Renewable Energy, 2018]. Additionally, renewable energy can be developed very easily into a microgrid design, providing the military an option for a power source that is self-sustaining and independent. Figure 3.1-1 depicts what a microgrid could look like on an army base. Solar, wind, and geothermal options are all available in Utah, providing the possibility for a diverse microgrid that can fuel military operations across the state.

Figure 3.1- 1: Representation of a Microgrid on an Army Base [U.S. Army, 2015].



The Air Force is committed to developing on-site sources of renewable energy because these sources can protect operations from grid failure and other disruptions, while also providing consistency in energy pricing [U.S. Air Force, 2013]. The local generation aspect of renewable energy decreases opportunities for disruptions as these sources are not reliant on fuel supply chains [American Council on Renewable Energy, 2018]. Because renewables do not require combustible fuels, risks of explosions and dangerous leaks that could threaten public health and safety are reduced [American Council on Renewable Energy, 2018]. Additionally, renewables can be less vulnerable to terrorism because energy generation is localized and dispersed

throughout different regions [American Council on Renewable Energy, 2018]. Because renewables offer independence and reliability, strengthening energy security, the development of renewables is critical for the enhancement of national security.

Federal Mandates with Regard to Renewable Energy and the Military

Since 2005 there have been five federal mandates requiring federal agencies, including the DoD and its military branches, to meet specific renewable energy targets. Table 3.1-1 provides a general overview of each of these mandates.

Table 3.1- 1: Federal Renewable Energy Targets

Federal Mandate	Renewable Energy Targets
Energy Policy Act of 2005	Total amount of electric energy consumption must be at least ● 3% FY2007- FY 2009 ● 5.5% FY2010-FY2012 ● 7.5% FY2013 and each year after
Energy Independence and Security Act of 2007	"Sense of Congress" goal that 25% of the total energy consumed in the United States is sourced from renewable resources by January 1, 2025.
National Defense Authorization Act, 2010	Department of Defense established a renewable energy goal, as specified in section 2911(e) of title 10, United States Code, to ● Produce or procure 25% of its total quantity of facility energy with renewable electricity by 2025. ● "Produce or procure facility energy from renewable energy sources whenever the use of such renewable energy source is consistent with the energy performance goals and energy performance master plan for the Department and supported by the special considerations specified in subsection."
Executive Order 13693: Planning for Federal Sustainability in the Next Decade, March 2015	Federal agencies must "ensure that at a minimum, the following percentage of the total amount of building electric energy and thermal energy shall be clean energy, accounted for by renewable electric energy and alternative energy:" ● 10% FY 2016 and 2017 ● 13% FY 2018 and 2019 ● 16% FY 2020 and 2021 ● 20% FY 2022 and 2023 ● 25% FY 2025 and each year thereafter Federal agencies must "ensure that the percentage of the total amount of building electric energy consumed by the agency that is renewable electric energy is:" ● 10% FY 2016 and 2017 ● 15% FY 2018 and 2019 ● 20% FY 2020 and 2021 ● 25% FY 2022 and 2023 ● 30% FY 2025 and each year thereafter
Executive Order 13834 Efficient Federal Operations, May 2018	Revoked EO 13693 but still requires federal agencies to "meet the statutory requirements relating to the consumption of renewable energy and electricity" in a cost-effective manner.

A recent change in federal mandates affected the requirement for the military to meet renewable energy targets. Executive Order 13693: Planning for Federal Sustainability in the Next Decade, was issued by President Obama in March of 2015 and required all federal agencies to obtain 25%

of the total amount of building electric energy and thermal energy to be renewable electric energy by 2025. However, the latest mandate, Executive Order 13834: Efficient Federal Operations issued by President Trump in May 2018, revoked EO 13693. The newly issued EO 13834 instead affirms "that agencies shall meet such statutory requirements in a manner that increases efficiency, optimizes performance, eliminates unnecessary use of resources, and protects the environment." EO 13834 thus lessens the urgency and removes the requirement for agencies to meet renewable energy targets established in the former ordinance. In 2010, however, the Department of Defense established its own energy policy, section 2911(e) title 10 of the United States Code, also written in Subtitle D: Energy Security within the National Defense Authorization Act, to achieve 25% renewable electricity by 2025. This energy policy is unaffected by EO 13834 and the Department of Defense will still need to acquire renewable sources to achieve this goal.

Renewables and Interference with Military Operations

While the Department of Defense supports the development of renewable energy, renewable energy projects must be carefully sited so that they do not interference with military operations. Depending on the position and proximity of wind turbines, the wind turbines can interfere with military radar [Durkay & Schultz, 2016]. This is due to the fluctuating velocity from rotating turbine blades which can block or weaken radar signals [Durkay & Schultz, 2016]. Additionally, taller wind turbines, such as those that extend 600 feet, can affect low-flying aircraft [Durkay & Schultz, 2016]. Solar photovoltaics and concentrated solar systems can affect military operations through glint (a momentary flash of bright light) and glare (a continuous source of bright light) [Durkay & Schultz, 2016]. Solar photovoltaics have an anti-reflective coating to help reduce glint and glare but interference is still possible [Durkay & Schultz, 2016]. Thus, to mitigate these potential interferences, it is crucial that renewable energy projects are properly sited.

3.2 Introduction to and analysis on military presence in Utah, population growth projections, and energy demands

Military Employment Trends in Utah

In 2015, defense employment accounted for 32,700 jobs, 1.8% of Utah's total employment [Downen & Pace, 2017]. In 1990, federal defense employment in Utah employed nearly an additional 10,000 people and made up 4.5% of Utah's total employment [Downen & Pace, 2017]. By 2000, the federal defense employment had decreased to about 30,500 and made up 2.2% of Utah's total employment [Downen & Pace, 2017]. Table 3.2-1 portrays Utah's defense employment in 5-year increments between 1990 and 2015. In the Downen & Pace economic study, federal defense employment includes the military, both active and part-time employment

in reserve or National Guard units, federal civilian employment for national security, and medical care provided by the Department of Veterans Affairs and Department of Defense.

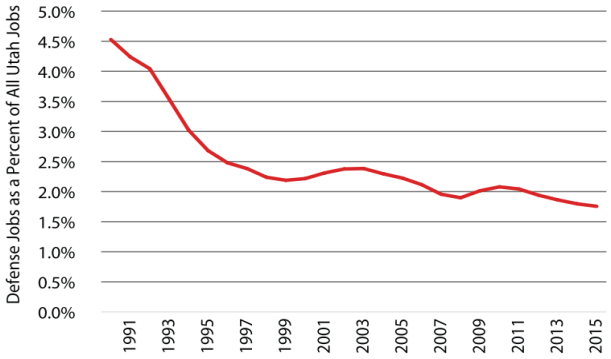
Table 3.2- 1: Defense Employment in Utah, Selected Years 1990-2015 [Downen & Pace, 2017].

County	1990	1995	2000	2005	2010	2015
Military	19,399	16,695	16,222	17,608	16,886	16,166
Federal Civilian	23,067	14,134	14,290	16,232	16,881	16,549
Total Defense	**42,466**	**30,829**	**30,512**	**33,840**	**33,767**	**32,715**
Share of All Utah Jobs	4.5%	2.7%	2.2%	2.2%	2.1%	1.8%

Source: Bureau of Economic Analysis; Bureau of Labor Statistics, Quarterly Census of Employment and Wages.

Much of the decline in defense jobs was a result of military downsizing in the 1990s [Downen & Pace, 2017]. Despite the sharp decline of defense employment in the 1990s, defense employment in Utah has steadily employed more than 30,000 people between 2000 and 2015 [Downen & Pace, 2017]. Decreases in percent of defense jobs out of total employment in Utah is partially due to the increase in non-defense employment across the state, which has grown 104% between 1990 and 2015 [Downen & Pace, 2017]. The percent decline in defense employment out of total Utah employment is depicted in Figure 3.2-1. Between 2000 and 2015, defense employment increased by 7%, however during that time there was a 35% increase in employment across the state, resulting in a decrease in the share of military employment.

Figure 3.2- 1: Defense Share of Total Employment in Utah, 1990-2015 [Downen & Pace, 2017].

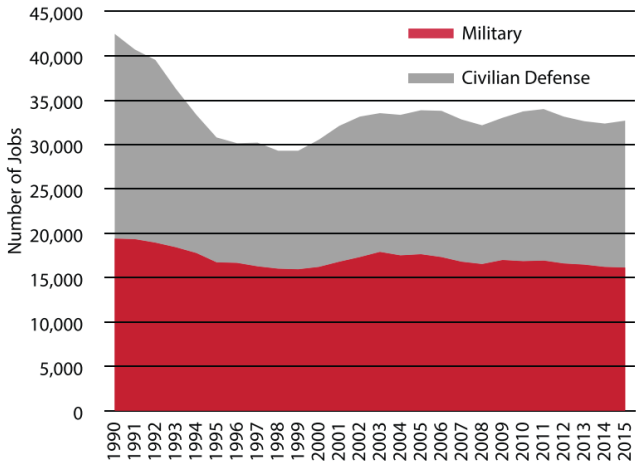


Source: Bureau of Economic Analysis, Bureau of Labor Statistics.

Military employment includes full-time active-duty, as well as part-time soldiers with the National Guard and reserves [Downen & Pace, 2017]. Federal civilian employment largely consists of individuals working in the national security sector, but also comprises of medical careers within the military [Downen & Pace, 2017]. In 2015, 84% of civilian defense employment was in the national security sector, supporting 13,854 jobs across 13 counties in Utah [Downen & Pace, 2017]. In 1990, more than 23,000 Utahns held jobs within civilian

defense [Downen & Pace, 2017]. The reduction in civilian defense employment occurred in the early 1990s as a result of base realignment and closures following the Cold War and Gulf War [Downen & Pace, 2017]. From 2000 to 2015, civilian defense employment rose 16%, supporting more than 16,500 jobs in this [Downen & Pace, 2017]. These changes in civilian defense employment can be seen in Figure 3.2-2. Military employment, shown in Figure 3.2-2 in red, has remained more constant, consistently supporting more than 15,000 jobs throughout the 25-year time frame [Downen & Pace, 2017].

Figure 3.2- 2: Military and Federal Civilian Defense Employment in Utah, 1990-2015 [Downen & Pace, 2017].

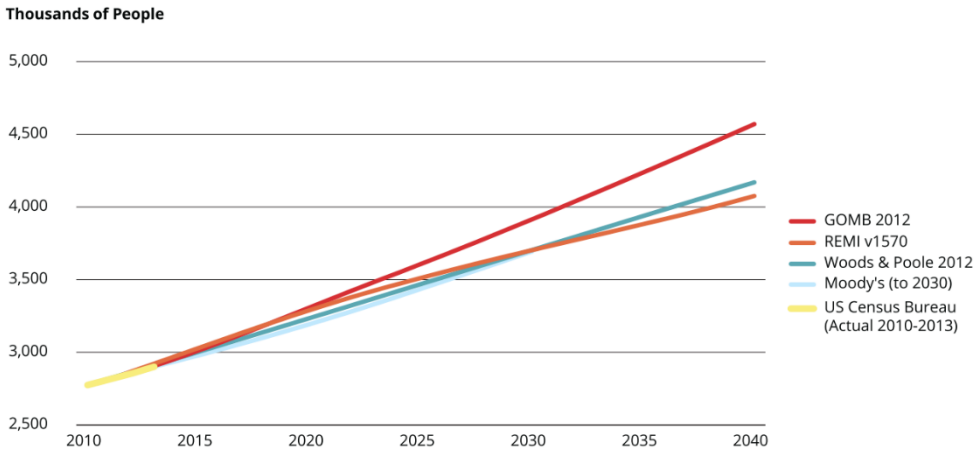


Source: Bureau of Economic Analysis, Bureau of Labor Statistics.

Utah Population Growth Projections

For the last 10 years, Utah has been one of the fastest growing states in the nation [Harbeke et al., 2014]. Utah was the fastest growing state in the country in 2016 [U.S. Census Bureau, 2016]. That year, Utah's population exceeded three million with a growth rate of 2.0% from July 2015 to July 2016 [US Census Bureau, 2016]. Since 1970, Utah's population more than tripled, and the rapid growth is expected to continue [Harbeke et al., 2014]. Population projections estimate an increase anywhere from one million to two and a half million new Utahns by 2050 [Harbeke et al., 2014]. Figure 3.2-3 illustrates the variation in population growth projections for Utah, all of which, however show a significant increase in Utah's population by 2040. From 1990-2012, natural increases, which are births minus deaths, accounted for 75% of the state's population growth [Harbeke et al., 2014]. And, since 2009, 90% of the state's population growth is due to natural increases [Harbeke et al., 2014]. Utah's fertility rate is 20 points higher than the national average [Harbeke et al., 2014]. These trends are likely to continue due to the state's culture, which values large families [Harbeke et al., 2014].

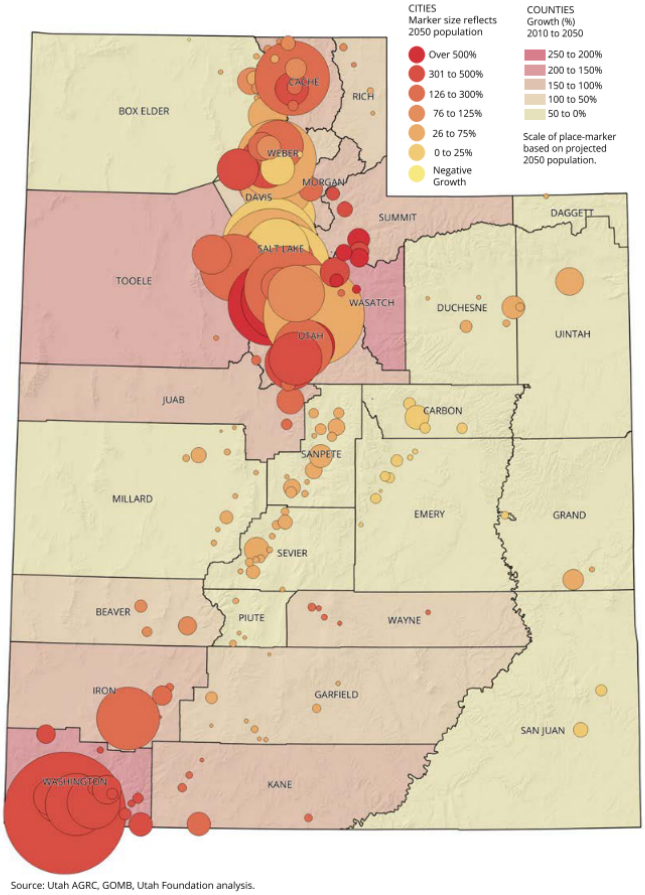
Figure 3.2- 3: Utah Population Projection Comparison, 2010-2040 [Harbeke et al., 2014].



Sources: Moody's, Woods and Poole, REMI, and US Census Bureau as presented in analysis by GOMB.

While natural increases are expected to continue contributing to Utah's population growth, migration into the state is a point of variability. Net-migration, which is moving into Utah minus moving out, fluctuates with Utah's economic performance [Harbeke et al., 2014]. Thus, growth rate projections in Utah are dependent on the state's economic success [Harbeke et al., 2014]. Utah has been recognized as a state that has economic opportunity and a high quality of life, which drives migration [Harbeke et al., 2014]. Business development and job opportunities, recreation, technological advances, and economic mobility draw many people to Utah [Harbeke et al., 2014]. In 2010, 90.6% of Utahns lived in urban areas, compared to 1970 where 80% of the state's population inhabited urban locations [Harbeke et al., 2014]. Of the urban areas in Utah, 85% of the urban population lived along the Wasatch Front (Salt Lake, Utah, Weber, Davis counties) in 2010 [Harbeke et al., 2014]. An increase in urban development is anticipated to continue, with majority of Utah's population growth to occur along the Wasatch Front [Harbeke et al., 2014]. Figure 3.2-4 displays the projected population growth across Utah by 2050, with much of the anticipated growth occurring along the Wasatch Front.

Figure 3.2- 4: Heat Map of Population Growth Through 2050
[Harbeke et al., 2014].



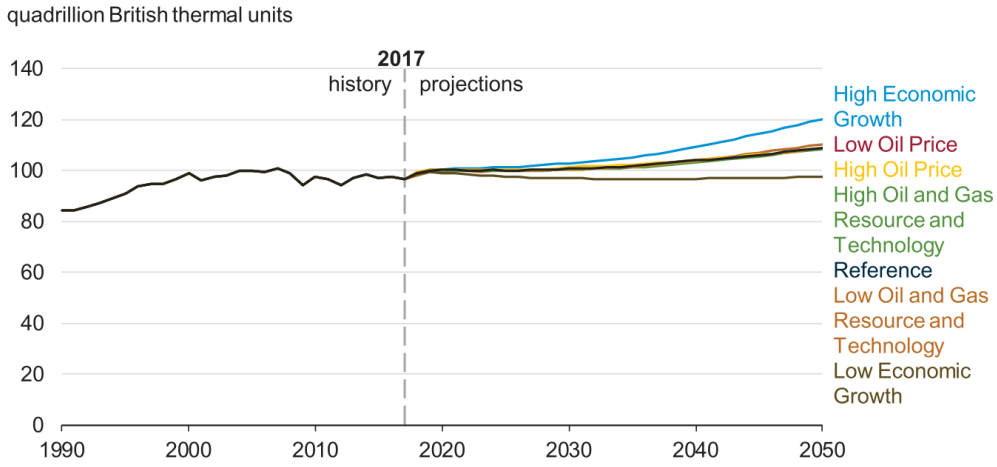
With an increasing population and expansion of urban areas, thoughtful planning efforts are necessary to preserve the high quality of life that Utah currently offers. Utah must be proactive with how to provide and sustain public and natural resources, such as energy, water, transportation, and other public services [Harbeke et al., 2014].

Projected Energy Demands

The Energy Information Administration (EIA) releases annual energy outlooks to report trends and projections of energy supply and usage. The outlook report published by the EIA in 2018 provides a variety of energy consumption projection scenarios out to 2050. These projections are shown in Figure 3.2-5. While these energy projections are designed around national trends, these projections can suggest what may occur with energy consumption in Utah. In fact, the rate of

energy consumption in Utah may be higher than the national average due to Utah's accelerating population.

Figure 3.2- 5: Total Energy Consumption
[U.S. Energy Information Administration, 2018].



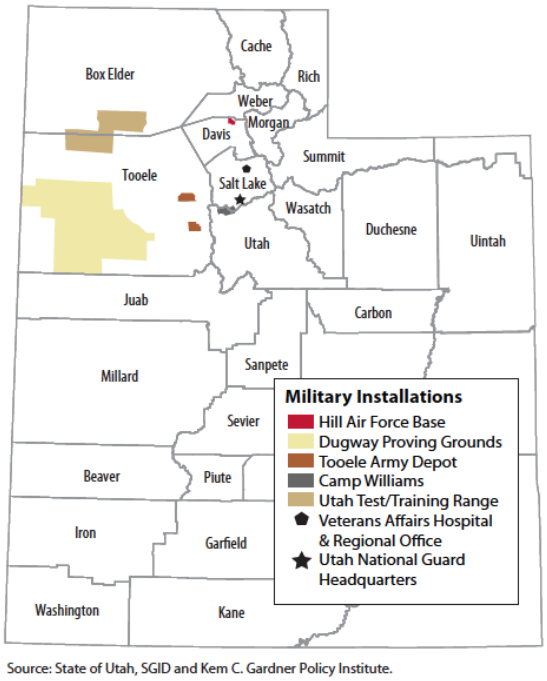
The Reference projection from the EIA report assumes laws and regulations affecting the energy sector are unchanged during the projection period [U.S. Energy Information Administration, 2018]. It also assumes the current trends in technology improvements, the economy, and demographics [U.S. Energy Information Administration, 2018]. In the Reference projection displayed in Figure 3.2-5, GDP grows annually at a rate of 2.0% from 2017 to 2050, and projected energy consumption grows at 0.4% per year, surpassing the energy consumption peak in 2007 by 2033 [U.S. Energy Information Administration, 2018]. In the High Economic Growth projection, GDP grows at a rate of 2.6% and energy consumption grows at 0.7% [U.S. Energy Information Administration, 2018]. In the Low Economic Growth projection, GDP grows at 1.5% annually and energy consumption is essentially flat [U.S. Energy Information Administration, 2018]. In 2050, the Low Economic Growth projection is roughly 10% less than the Reference, and the High Economic Growth projection is about 10% more than the Reference projection [U.S. Energy Information Administration, 2018].

3.3 Economic analysis on benefits of military operations in Utah

Military operations in Utah contribute greatly to the state's economy. The military installments across the state provide Utahns with jobs, support the state's GDP, and generate tax revenue. Utilizing the economic impact report, *Utah's Defense Sector: Economic Impacts of the Military and Veterans*, conducted by the Kem C. Gardner Policy Institute at the University of Utah in 2017, this section provides the major economic outcomes of military operations in the state of Utah. The military operations accounted for in this economic analysis includes the Department of

Defense (DOD) and Department of Veteran Affairs (VA) employment, pensions, contracts and grants [Downen & Pace, 2017]. Department of Defense operations in Utah consists of Hill Air Force Base, Dugway Proving Ground, Tooele Army Depot, the Utah National Guard, reserves, recruiting, and ROTC [Downen & Pace, 2017]. Figure 3.3-1 depicts the locations of these operations across the state of Utah.

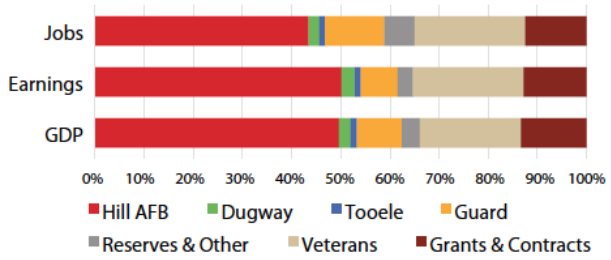
Figure 3.3- 1: Major Military Installations in Utah
[Downen & Pace, 2017].



Source: State of Utah, SGID and Kem C. Gardner Policy Institute.

In 2015, Utah's defense sector directly and indirectly supported more than 109,000 jobs and $9.2 billion in economic activity [Downen & Pace, 2017]. Placing these values into percentages, federal defense funds supported 5.8% of Utah's jobs, 7.1% of Utah's earnings, and 6.2% of the state's GDP [Downen & Pace, 2017]. The $9.2 billion in economic activity spurred an estimated $378.7 million in state income and sales tax revenue [Downen & Pace, 2017]. The defense sector also drew economic migrants to Utah, which generated an estimated $232.4 million in state government operations spending for public and higher education, roads, public safety, etc. [Downen & Pace, 2017]. When accounting for military operating costs, the net fiscal effect of Utah's defense sector in 2015 was $146.3 million [Downen & Pace, 2017]. Figure 3.3-2 displays a percent comparison of the 2015 economic impacts across each of the defense sectors in Utah. Nearly half of the combined jobs, earnings, and GDP from Utah's defense industry is generated by Hill AFB.

Figure 3.3- 2: Share of Economic Impacts by Utah Defense Sector Components, 2015 [Downen & Pace, 2017].



Note: Reserves & Other comprises the reserve branch of each military service, as well as military recruiting and ROTC.
Source: Kem C. Gardner Policy Institute analysis using the REMI PI+ model.

A detailed overview of the economic impacts from each of these defense sectors is provided in the following two tables. Table 3.3-1 displays the employment, earnings, and GDP generated from each defense sector. State revenues and operating expenditures are shown in Table 3.3-2. In Table 3.3-2, Hill AFB accounts for over half of the net state operating revenue generated by the defense industry in Utah [Downen & Pace, 2017].

Table 3.3- 1: Statewide Economic Impacts of Utah Defense Sector by Component, 2015 [Downen & Pace, 2017].

(Millions of Dollars)

Category	Hill Air Force Base	Dugway Proving Ground	Tooele Army Depot	Utah National Guard	Reserves, Recruiting & ROTC*	Veterans	Grants & Contracts*	Total
Total Employment	47,341	2,479	1,164	13,176	6,746	24,480	13,635	109,021
Total Earnings	$3,202.3	$175.9	$75.0	$477.3	$199.2	$1,437.8	$816.8	$6,384.3
Gross Domestic Product	$4,569.8	$225.0	$113.8	$841.9	$339.8	$1,891.9	$1,230.4	$9,212.7

* To avoid double counting, reserves, recruiting, contracts and grants impacts reported here include only additional economic activity not included under a Utah military installation or other defense component in this table.
Source: Kem C. Gardner Policy Institute analysis using the REMI PI+ model.

Table 3.3- 2: Statewide Fiscal Impacts of Utah's Defense Sector, 2015 [Downen & Pace, 2017].

(Millions of Dollars)

Category	Hill Air Force Base	Dugway Proving Ground	Tooele Army Depot	Utah National Guard	Reserves, Recruiting & ROTC*	Veterans	Grants & Contracts*	Total
Total State Revenues	$157.5	$8.8	$3.7	$24.8	$9.6	$130.9	$43.4	$378.7
Total State Operating Expenditures	$71.5	$2.8	$1.3	$13.3	$4.7	$126.7	$12.1	$232.4
Net State Operating Revenue	**$85.9**	**$6.0**	**$2.4**	**$11.5**	**$4.9**	**$4.2**	**$31.4**	**$146.3**

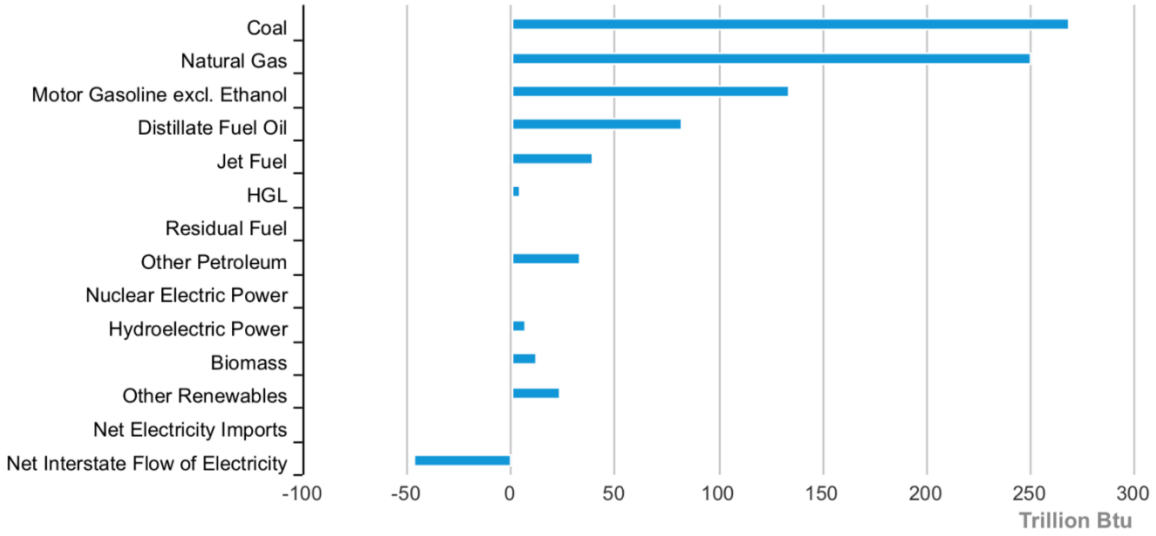
* To avoid double counting, reserves, recruiting, contracts and grants fiscal impacts reported here include only state revenue and expenses associated with economic activity not included under a Utah military installation or other defense component.
Source: Kem C. Gardner Policy Institute analysis using the REMI PI+ model and the Gardner Policy Institute fiscal model.

3.4 Economic analysis on benefits of renewable energy and its use for military and Utah

Current Utah Energy Consumption

Figure 3.4-1 depicts Utah's energy consumption by source. Utah's energy consumption is dominated by fossil fuels, particularly coal and natural gas.

Figure 3.4- 1: Utah Energy Consumption Estimates, 2016
[U.S. Energy Information Administration, 2019].



Utah electricity generation is also heavily fossil fuel sourced. In 2017, 70% of Utah electricity was generated by coal and 16% from natural gas [U.S. Energy Information Administration, 2019]. The remaining 14% was generated by renewable sources, which consists of a combination of solar, wind, hydropower, geothermal, and biomass [U.S. Energy Information Administration, 2019]. systems. In 2017, nearly half of all electricity generated from renewable sources came from solar power. Wind energy produced almost one-fifth of Utah's renewable electricity generation in 2017 [U.S. Energy Information Administration, 2019].

National Renewable Energy Trends

The recent transition from coal to natural gas for electricity generation in the United States has led to a 53% decline in coal from 2006 to 2016 and a 33% increase in natural gas [U.S. Department of Energy, 2017]. Renewable electricity generation in the United States has grown substantially since 2006. The latest EIA statistics (2018) indicate that 17.1 % of the US electric generation mix today is associated with renewable energy sources, including wind solar, hydro, biomass, and geothermal.

Figure 3.4-2 displays these trends and changes for the United States electricity generation by source.

Figure 3.4- 2: United States Electric Power Sector Energy Consumption [U.S. Energy Information Administration, 2017].

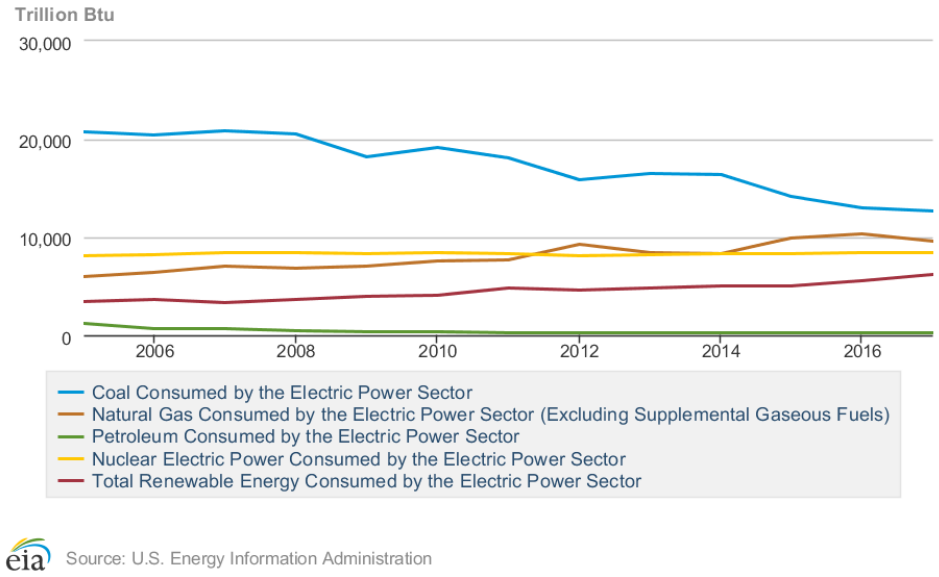
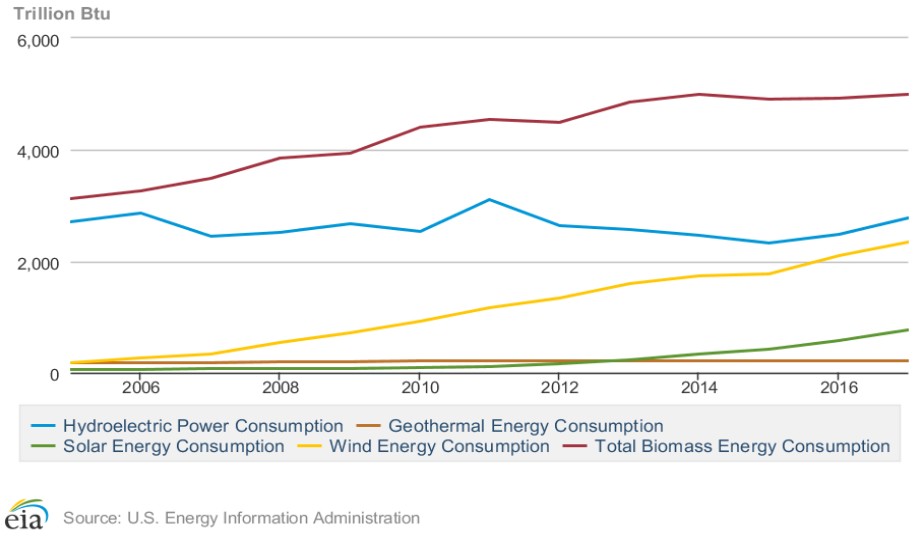


Figure 3.4-3 provides a depiction of renewable source specific trends from 2005-2017. Wind energy has grown considerably within the renewable sector. In 2005, wind energy accounted for 5% of total renewable energy generation, but by 2016, wind energy accounted for 37.6% of renewable energy generation. Solar energy has also increased in the last few years, contributing only 0.9% of total renewable energy generation in 2012 to 6% in 2016. Renewable energy growth is also apparent through the increase in renewable energy employment. From 2015 to 2016, employment in solar energy grew by 25% and wind energy employment increased by 32% [U.S. Department of Energy, 2017].

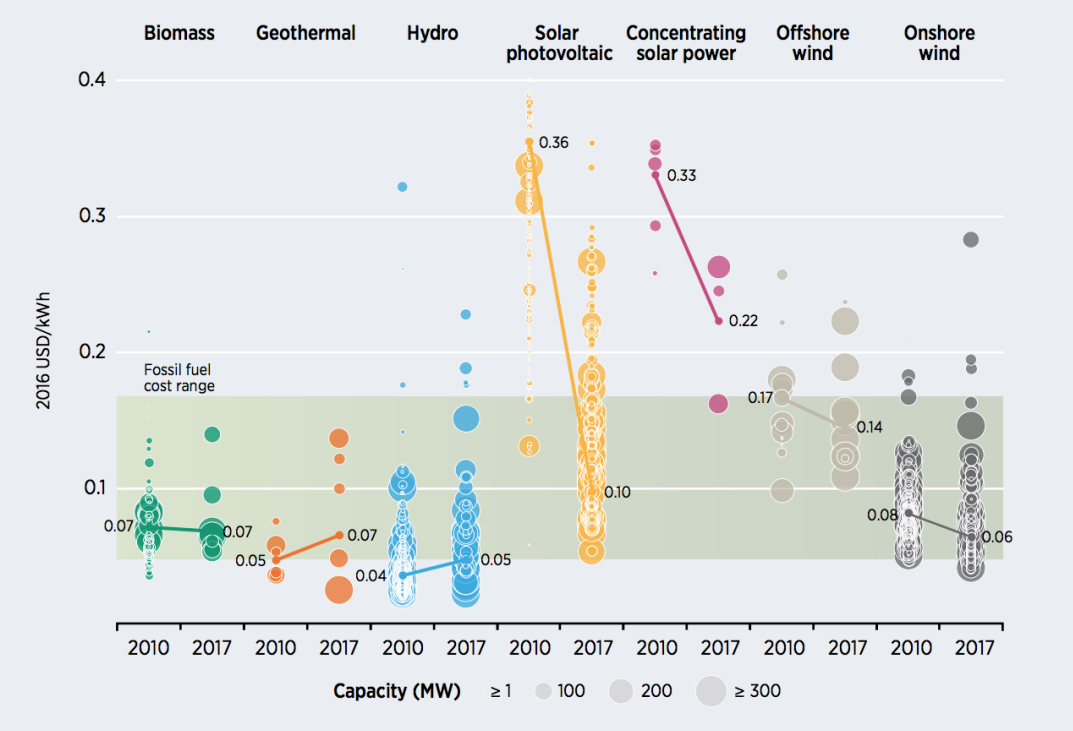
Figure 3.4- 3: United States Renewable Energy Production and Consumption by Source [U.S. Energy Information Administration, 2017].



Costs of Renewables

The decreasing prices in wind and solar energy have made these sources competitive options for electricity development and generation. The cost of solar power has dropped by 73% since 2010, making it cost-competitive with fossil fuels and other energy sources [IRENA, 2018]. Additionally, onshore wind prices have decreased 25% since 2010 [IRENA, 2018]. Figure 3.4-4 displays the changes in renewable energy prices and also shows the cost range for fossil fuels. The International Renewable Energy Agency predicts that renewable electricity sources will regularly be less expensive than fossil fuel sources by 2020 [IRENA, 2018].

Figure 3.4- 4: Global levelized cost of electricity from utility-scale renewable power generation technologies, 2010-2017
[IRENA, 2018].



Source: IRENA Renewable Cost Database.

Note: The diameter of the circle represents the size of the project, with its centre the value for the cost of each project on the Y axis. The thick lines are the global weighted average LCOE value for plants commissioned in each year. Real weighted average cost of capital is 7.5% for OECD countries and China and 10% for the rest of the world. The band represents the fossil fuel-fired power generation cost range.

Renewable Energy Opportunities in Utah

Utah is rich in renewable energy potential. Its unique landscape and geographic location provides incredible solar, wind, and geothermal energy potential. According to the U.S. Energy Information Administration, Utah has among the best geothermal potential in country [U.S. Energy Information Administration, 2019]. The NREL maps displayed in Figures 3.4-5, 3.4-6 and 3.4-7 portray the renewable energy resource potential for solar, wind, and geothermal energy in Utah.

Figure 3.4- 5: Utah Solar Resource Map
[NREL, 2018b].

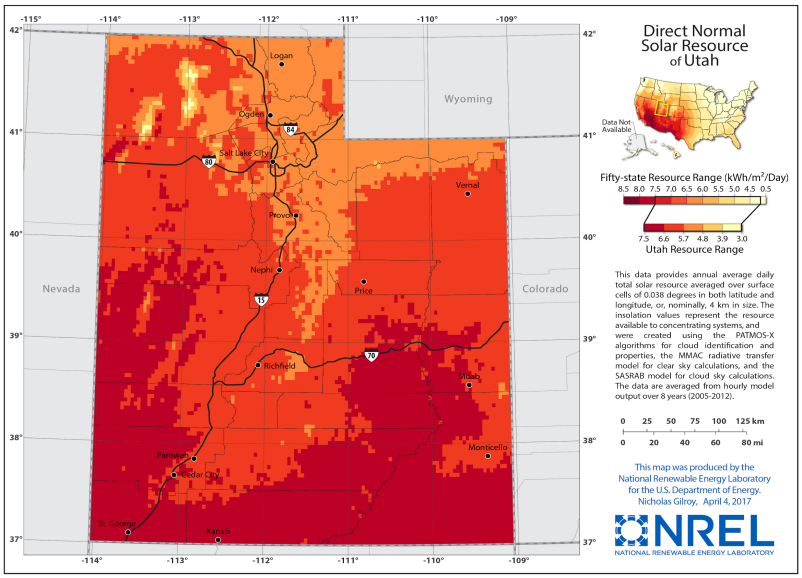


Figure 3.4- 6: Utah Total Wind Resource Map
[NREL, 2018c].

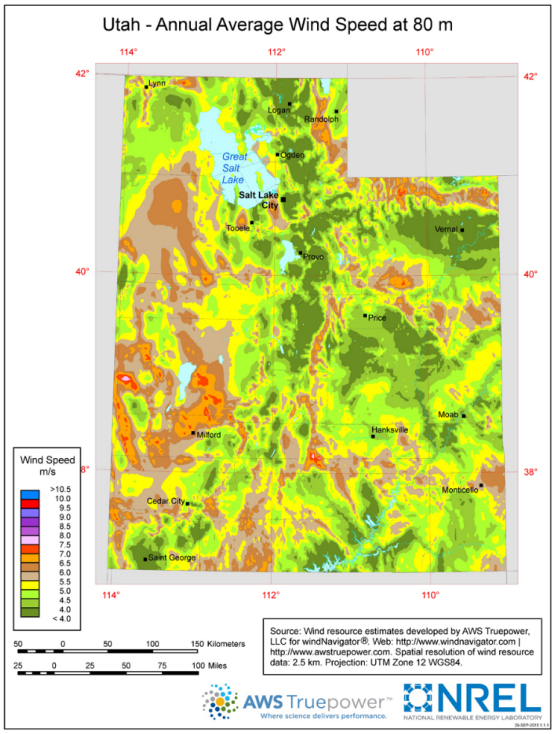
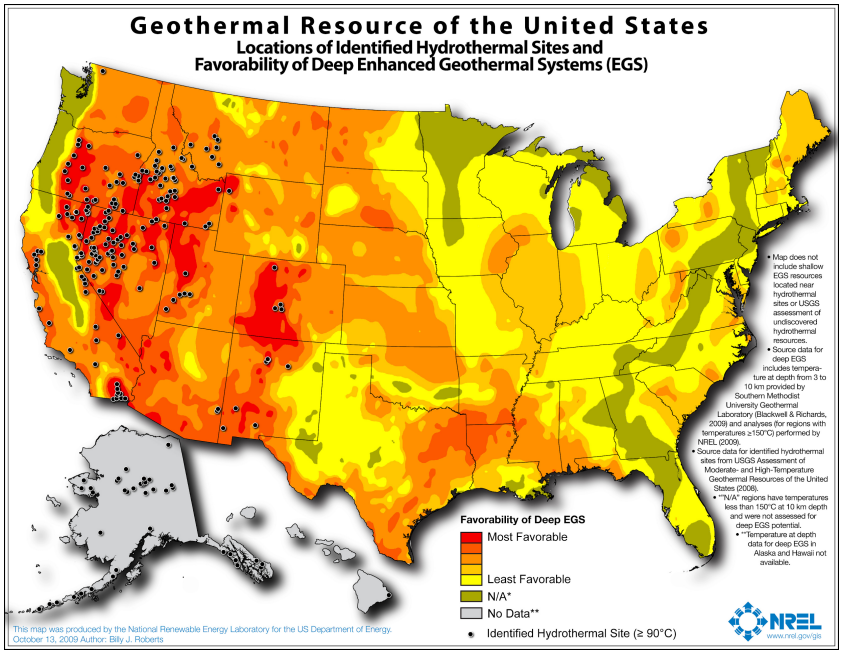


Figure 3.4- 7: United States Geothermal Resource Map
[NREL, 2018a**].**



Air Quality Benefits from Renewables

In addition to the benefits of energy security and energy independence that renewable sources provide, renewables can also help improve Utah's air quality. Poor air quality can pose a risk to health [Utah Department of Health, 2015].

While 48% of Utah's air pollution is attributed to vehicle emissions, 13% of the pollution comes from large manufacturing industries, and 39% from small industrial and commercial sources, known as area sources, such as home heating [Utah Department of Health, 2015]. Providing renewable energy options along with increased enhanced efficiency can enhance air quality outcomes.

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Section 4: Renewable Energy: Current and Emerging Technologies

4.1 Introduction

Renewable energy technologies, including wind, solar, and geothermal power, are expected to be an important part of the nation's energy portfolio. But energy supply usually does not coincide with energy demand, and energy storage technologies are also needed. This section reviews existing and emerging renewable energy and energy storage technologies.

Renewable energy facilities can have a negative impact on the mission of the military. The following is a partial list of such potential conflicts:

- ***Glint and glare.*** Glint and glare refer to the reflection of sunlight by reflective surfaces. Glint refers to momentary flashes, glare to continuous brightness. They can distract or temporarily blind aircraft or vehicle operators. They are of special concern with solar installations, but any structure with metal or glass surfaces may present glint and glare problems.

- ***Low-level flight obstructions.*** Wind turbines and other structures need to be sited away from runways, etc.

- ***Radar interference from wind turbines.*** The primary problem of wind turbines vis-à-vis the military is that they generate radar interference by "creating clutter, reducing detection sensitivity, obscuring potential targets, and scattering target returns." "These effects … tend to inhibit target detection, generate false targets, interfere with target tracking, and impede critical weather forecasts." [Sandia & MIT, 2014].

- ***Competition for water, land or other resources.*** Managing water resources is always a concern in the arid west. Planning is required so that renewable energy and military installations can both have access to water resources. Another problem is encroachment: For example, Camp Williams was established about a century ago in what was then a remote region, but recent population growth has made it necessary for the Camp to work closely with neighboring municipalities to avoid conflicts.

Below, we review existing and emerging technologies including innovations that can mitigate impacts on the military mission.

4.2 Wind Turbines

Two potential conflicts with wind turbines are low-level flight obstructions and radar interference. In many cases, these problems can be avoided by proper siting of wind facilities: They obviously should not be built near runways, and placing them in the line-of-sight of radars should be avoided if possible. In addition, a number of mitigation scenarios involving either

modifications to the turbines or to the radar system have been studied or proposed [Sandia & MIT, 2014; Gilman et al, 2016; McDonald et al, 2012]:

- ***Reduced Radar Cross Section (RCS) turbines***. This refers to the design of wind turbine blades: Either modifying the shape or the construction materials to reduce their radar reflectivity.

- ***Wind Farm Design.*** This scenario seeks to optimize against radar interference through design modifications such as the placement, number, orientation and size of individual turbines. This can also include placing wind farms out of the line-of-sight of existing radars.

- ***Radar Replacements.*** Existing radars could be replaced with more sophisticated "phased array radars with narrow 3D beams" and "advanced clutter mitigation" radars.

- ***Infill Radars***. These are smaller, high-resolution radars placed near the wind farm to compensate for the "blind spots" of existing radars.

- ***Radar Upgrades***. Software or circuitry used to process the signal or to integrate signals from several radars ("radar fusion") might be modified to improve radar performance in the presence of nearby wind farms.

A Sandia-MIT (2014) study tested both the infill and radar replacement technologies at three different radar sites, chosen because each was in the line-of-sight of a large number of wind turbines. Multiple flights both with and without activation of the infill or replacement radars, and with various aircraft designs, were flown near the wind farms, and radar operators had no advance knowledge of the flight paths, arrival times, or models of the test aircraft. The study found significant improvement from both technologies.

4.3 Solar Energy Technologies

There are three different technologies employed for solar energy conversion.

- ***Conventional photovoltaic***. This technology relies on photovoltaic materials that convert solar energy directly into electric current. Traditional materials are silicon and gallium arsenide (GaAs), but several new materials are under active research, see below. These semiconductor devices are designed with a "p-n junction," i.e., the interface between two sections with different levels of controlled impurities. The p-n junction generates electric current when struck by light. Conventional photovoltaic cells are "single junction," in that they incorporate one p-n junction.

- ***Concentrating*** or ***solar thermal***. In concentrating systems, mirrors or lenses concentrate or focus sunlight to heat molten salts. The heat from the molten salts is then transferred to water, which turns steam turbines.

- ***Concentrating photovoltaic***. This emerging technology also uses mirrors or lenses to focus light, but onto small "multi-junction" photovoltaic cells, so called because they combine several different materials to form two or more p-n junctions. The combination of concentrated light and several junctions boosts the efficiency beyond that of conventional, single-junction systems.

The solar cell efficiency or power conversion efficiency is defined as the fraction of solar energy that can be extracted as electrical energy. The theoretical limit for single-junction silicon cells is about 33%, and state-of-the-art silicon cells are approaching that limit [Rühle, 2016]. Multi-junction cells are able to exceed the 33% limit, and the world record (as of December 2014) of 46% was achieved with a four-junction concentrating photovoltaic cell [Fraunhofer, 2014]. Large conversion efficiencies are of course important, but other properties of photovoltaic materials, such as production cost, stability, durability, and environmental impact, must also be considered.

Three new classes of photovoltaic materials are an active area of research. The first class is comprised of ***perovskite materials***. They take their name from the mineral perovskite, or calcium titanate, because they have the same crystal structure. (However, they are ***not*** calcium titanate.) Most photovoltaic perovskite materials are hybrid organic-inorganic lead or tin halide-based materials, such as $(CH_3NH_3)\ PbI_3$ [Jacoby, 2018]. Solar energy conversion in small-scale laboratory experiments using single-junction perovskite materials was first reported in 2009 with an efficiency of 3.8%, but has grown to 23.3% in 2018 [Rong et al, 2018]. Two-junction photocells using perovskite and silicon were reported in 2018 with efficiencies of 27.3% [Jacoby, 2018].

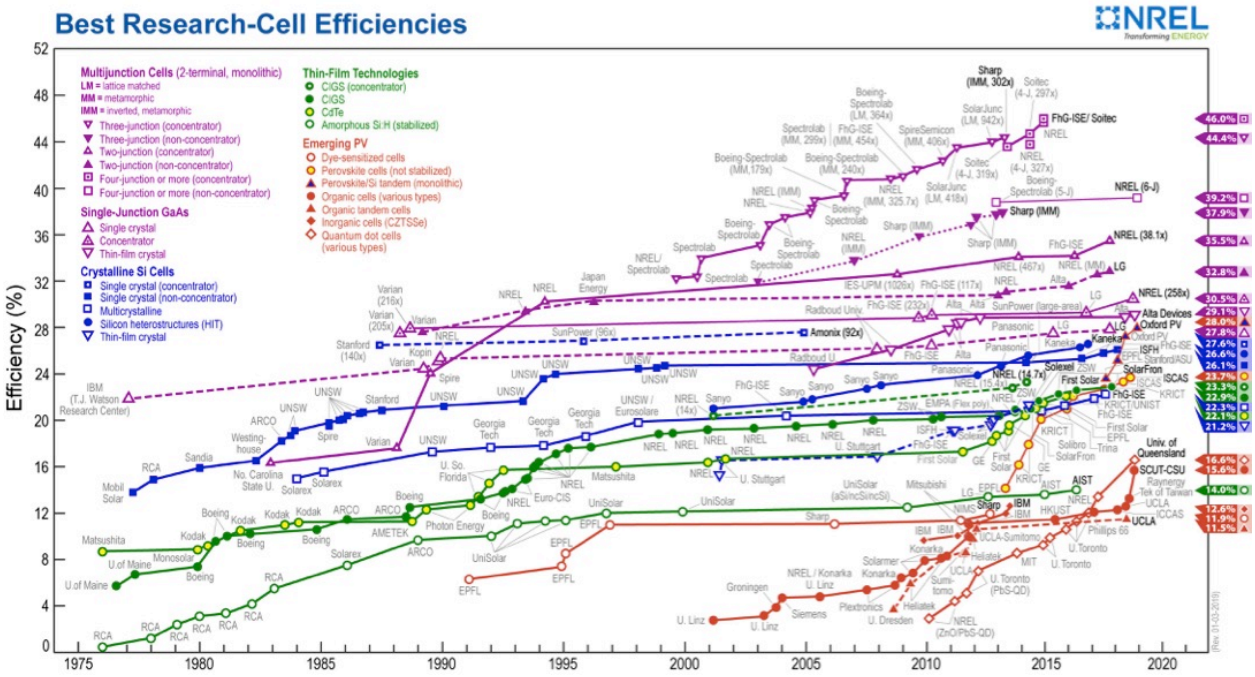
The second new class of photovoltaic materials is comprised of ***organic photovoltaics***. In these materials, the p-n junction is formed by joining a light-absorbing electron donor to an electron acceptor. A two-junction system reached an efficiency of 17.3% in 2018 [Meng et al, 2018; Jacoby, 2018]. In some formulations, the light-absorbing electron donor is polymeric, and for these the current record is 14.2% efficiency [Li et al, 2018].

The third class consists of ***quantum dots*** [Barnham & Duggan, 1990; NREL, 2005]. In other technologies, the photovoltaic crystals have macroscopic dimensions. In quantum dot systems, individual crystals are shrunk to nanometer-scale "dots" and assembled into arrays. They are called "quantum" dots because different quantum mechanical laws apply with such small sizes. The energy absorbed by a single electron in a dot can be adjusted by varying the size of the dot. Additionally, the dots generate two or three electrons for each photon of light absorbed, whereas macroscopic semiconductors only generate one. The first laboratory tests of quantum dots in

2010 had efficiencies of only a few percent, but the efficiency has climbed to above 16% in 2019 [NREL, 2019].

Figure 4.3.1 is a chart developed by NREL [2019]. that plots the power conversion efficiency records obtained across time by a number of different solar cell technologies. The current record holder at about 46% is the multi-junction concentrated solar system mentioned above (purple traces and symbols). Single-junction silicon cell performance is plotted in blue. The three new technologies (perovskites, organic cells, and quantum dots) are plotted in orange. The newer technologies have yet to surpass the conventional ones, but are exciting because of the steepness of their growth curves.

Figure 4.3- 1: Best-record efficiencies obtained by various solar cell technologies [NREL, 2019].



One of the main advantages of the new materials is low cost. Disadvantages, at least at present, are low stability (many perovskites decompose on prolonged exposure to sunlight) and durability, and the fact that their efficiencies are still lower than traditional photovoltaic materials [Jacoby, 2018]. Other challenges to commercialization include scaling up from laboratory to industrial scale and recycling to address the toxicity of some components of some of the materials, such as lead in the perovskites [Rong et al, 2018]. Whether these materials can improve to the point that they enter the market still remains to be seen.

4.4 Glint and Glare from Solar Energy Systems

Glint and glare from solar energy systems can distract or temporarily blind aircraft and vehicle operators, and therefore pose a potential risk to the mission of the military. Sandia National Laboratories has developed software tools for analyzing reflected sunlight from concentrating or photovoltaic solar energy systems. The software is available for licensing directly from Sandia or through third parties [Sandia, 2019; ForgeSolar, 2019]. These sophisticated tools take into consideration the projected solar array orientation, tilt, shape and location and can be used to optimize the balance between glare mitigation and energy production.

4.5 Geothermal

Geothermal energy exists literally beneath our feet, but traditionally, has only been possible when natural permeability brings hot water near enough to the surface that it can be tapped as an energy source. Enhanced or engineered geothermal systems (EGS) seek to alter that scenario. In the existing version of EGS, cold water is pumped down in vertical injection wells, forced through hot porous rock or fracture networks by hydraulic pressure, and extracted through extraction wells. A few EGS systems based on this principle are in operation or under development, including two EGS plants in the Bas-Rhin department of France that together supply about 26 MW [Feder, 2018].

In a later, yet untested version of EGS, hydraulic fracturing ("fracking") and horizontal drilling techniques developed by the oil and natural gas extraction industry will be used to induce a fracture field in the rock. According to an estimate by the U.S. Department of Energy, this version of EGS has the potential to increase by 40-fold the net power-generating domestic capacity of geothermal systems and could be implemented almost anywhere [Feder, 2018; DOE, 2019].

But there are challenges: To reach high enough temperatures, EGS wells normally have to go deeper and into harder rock than petroleum wells. In 2014, the Department of Energy initiated the Frontier Observatory for Research in Geothermal Energy (FORGE) program to investigate the application of fracking and horizontal drilling, and in 2018, the University of Utah was selected to develop a FORGE test site near Milford, Utah. It is hoped that the Milford laboratory will advance EGS technology by addressing some of these challenges, including optimization of the fracturing technique given the existing geology, and building skill in horizontal drilling at the necessary temperatures and depths [Feder, 2018; Utah Forge, 2019].

A significant barrier to the development of EGS is the perceived or actual risk of induced seismicity. "Only a very small fraction of injection and extraction activities among the hundreds of thousands of energy development sites in the United States have induced seismicity at levels noticeable to the public," and induced seismicity has not resulted in any loss of life [NAS, 2012].

However, several studies clearly indicate a real risk of induced seismicity caused by injection of fluids, including injection for the purpose of EGS. [NAS, 2012; Candela et al, 2018; Hogarth and Holl, 2017; Feder, 2018; Grigoli et al, 2018; Kim et al, 2018]. Candela et al (2018) emphasize that the risk of induced seismicity is heightened by the presence of pre-existing faults that are close to their point of tectonic reactivation. Unfortunately, it is not always possible to identify such faults before the fact. Some researchers have even stated that "seismicity is an unavoidable part of a successful EGS stimulation" [Hogarth and Holl, 2017]. It remains to be seen whether real or perceived induced seismicity risk will prevent the widespread adoption of EGS.

4.6 Integrated Systems

Energy demand fluctuates daily and seasonally, while many renewable energy systems are intermittent, providing energy only when the sun shines or the wind blows. Integrated systems are being studied that would smooth over these fluctuations and intermittencies. The basic concept is to integrate two or more energy sources in the same plant. For example, a facility might integrate PV solar generation, fossil fuel generation and battery storage. When the supply of solar-generated energy falls below demand, the battery system and the fossil fuel source would be used to make up the difference. And when solar-generated energy exceeds demand, the excess would go to battery storage.

Energy sources under consideration for integrated systems include solar, wind, natural gas, diesel, hydrogen, heat pumps and nuclear power. Such facilities would also require energy storage systems, which are discussed in the following section.

Military bases have special energy resiliency needs, because critical military facilities must continue to operate when the external power grid crashes. One approach to meet such resiliency needs is for bases to operate internal integrated systems.

One design concept for integrated systems calls for decentralization into "microgrids" that "balance supply and demand locally through the use of distributed energy resources" [de Graaf, 2018]. See Fig. 3.1-1. Obviously, there is no single configuration that would fit all situations (we couldn't use solar power in Alaska) so such systems would need to be configured based on local resources and needs. There are probably significant technical, economic, political and legal factors preventing the wholesale adoption of this concept in the USA, but the idea is gaining traction in the EU [de Graaf, 2018]. However, a properly designed microgrid system could very well meet the need for resiliency at a military base.

4.7 Energy Storage

A significant challenge in renewable energy is matching supply and demand. Many energy demands follow daily or annual cycles, while supply from wind and solar power is intermittent.

We need effective technologies that can store energy when supply exceeds demand and then release it to the grid when needed. Important considerations are the energy densities of storage systems, the rates at which storage systems can be recharged and discharged, and their useful lifetime, which is limited by the number of recharging cycles they can perform before degrading.

Existing energy-storage systems include [Fu et al, 2018; Mohd et al, 2018].:

- ***Pumped hydro storage***. Water is pumped to an up-hill reservoir during times of low demand and then allowed to flow downhill to a second reservoir through hydroelectric turbines during times of high demand. Energy efficiencies are 70% to 80%, but there are obvious geographic requirements, namely a suitable site for the reservoirs.

- ***Compressed air energy storage (CAES).*** During low demand, energy is used to compress air. The energy is released later by allowing the compressed air to expand. Energy efficiencies are 40% to 55%. These systems also have specific geographic requirements such as large caverns to hold the compressed air.

- ***Molten salt thermal storage***. Because of the high operating temperatures, this technology is most commonly used in conjunction with concentrating solar power plants, see above. The advantage of molten salts is their high heat capacity.

- ***Batteries***. Currently, this technology is dominated by lithium-ion batteries, but lead-acid batteries, sodium-based batteries and vanadium flow batteries are also in use. Intense research aimed at improving battery performance is ongoing throughout the world.

A number of new or emerging energy-storage technologies are at the laboratory or start-up stage. However, because of maturity and market adoption, lithium-ion batteries are the benchmark standard against which these other technologies must compete. [Scott, 2018; Fu et al, 2018; Mohd et al, 2008].

- ***Redox-flow batteries.*** These battery systems operate using two liquid electrolytes stored in different tanks. The electrolytes are pumped through electrodes where they exchange electrons through external circuits. Scale-up is easy in principle: Just put in bigger tanks. The current market is dominated by vanadium batteries, which use vanadium salts as electrolytes, and by zinc-bromine systems. With government backing, Rongke Power in China is building a vanadium battery, which, when completed in 2020 will be the world's largest ("the size of an Ikea store") and provide 8% of the electricity demand for the city of Dalian, China. Current active research is aimed at developing electrolytes with faster charge-discharge times, capable of enduring more charging cycles, that are cheaper, or that are more environmentally benign. [Scott ,2018; Service, 2018].

- ***Other battery systems***. Rechargeable zinc-air batteries, molten-salt batteries, liquid metal batteries and manganese-hydrogen batteries are also being explored for grid-scale energy

storage. Many of these technologies are already used in small-scale battery systems. [Chen et al, 2018; Fu et al, 2018; Scott, 2018].

- ***Mechanical or kinetic energy***. 1. Flywheels are being spun by a start-up, Gyrotricity, in England. During charging, a motor is used to accelerate the flywheel. During discharging, the motor is converted to a generator. 2. A Swiss start-up, Energy Vault, is promoting a technology reminiscent of pumped hydro, using an automated crane that raises and lowers concrete blocks, and has built a test system expected to have an output of 10 to 35 MWh. They expect to be cost-effective because of the low cost of concrete. [Scott, 2018]. Such systems will probably be most useful in microgrid applications.

- ***Hydrogen***. These systems would store energy in the form of hydrogen fuel by cleaving water into hydrogen and oxygen and would recover the energy later in one of several ways: The hydrogen could be "burned" in a hydrogen fuel cell, burned as a transportation fuel, or reacted with carbon dioxide to make methane to be consumed like we now consume natural gas. The European Union is currently funding such research. These systems would require hydrogen storage, similar to the natural gas storage systems (underground caverns, salt domes, aquifers, etc.) currently in use [Scott, 2018; Mohd et al, 2018].

- ***Heat of hydration of salts***. A Dutch start-up is investigating using concentrated solar energy to dehydrate salts packed in drums. In winter, the salts would be rehydrated, and the resulting heat of hydration would be used for residential heating. [Scott, 2018].

- ***Superconducting Magnetic Energy Storage (SMES).*** Direct current flowing in superconducting coils generates a magnetic field which stores energy. These systems have quick response times and provide a constant, stable discharge. However, they are costly to operate, since, for example, the coils must be cryogenically chilled to superconducting temperatures. Therefore, they are best suited for very critical applications that can justify the cost [Mohd et al, 2018].

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Section 5: Introduction to Map and Regulatory Framework

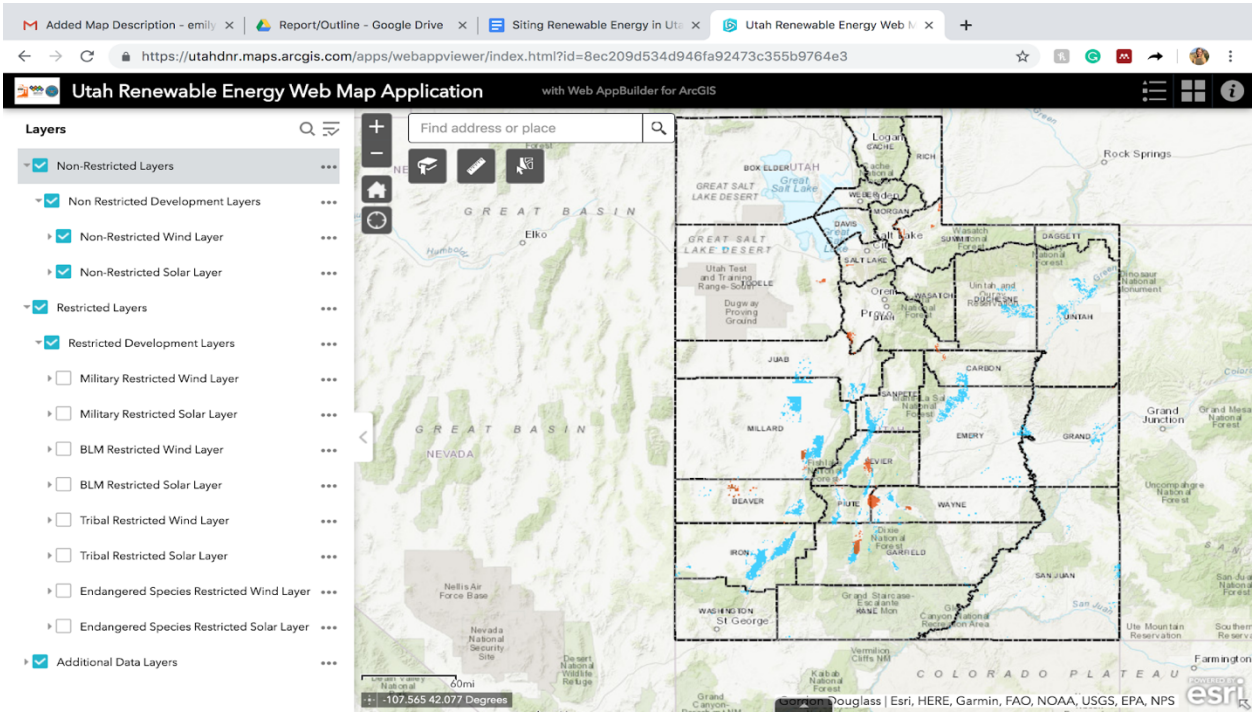
5.1 Online ArcGIS Map Description and Results for Wind and Solar Compatibility

Our team collected data from numerous stakeholders to develop a publicly available, online ArcGIS map that displays land that is suitable for wind and solar development in Utah and is also compatible with military operations, the BLM, tribal organizations, and the Endangered Species Act (ESA). The web map application was developed by the Utah Geological Survey (UGS) in cooperation with the Utah Governor's office of Energy Development and the United States Department of Defense. The map is available to the public and can be accessed by clicking here or typing the following link into an internet browser:

https://utahdnr.maps.arcgis.com/apps/webappviewer/index.html?id=8ec209d534d946fa92473c355b9764e3

The online GIS map displays three main groups of layers that can be toggled on and off: (1) Non-Restricted Layers, (2) Restricted Layers, and (3) Additional Data Layers.

Figure 5.1- 1: Online ArcGIS Map



1. Within the Non-Restricted Layers group, users can select the Non-Restricted Wind Layer and the Non-Restricted Solar Layer. These two layers display land with wind and solar potential that has no interference with the military, BLM, tribal organizations, and ESA. Our research suggests that the land identified within this layer group will be easier to develop due to its compatibility with these major entities.
    a. To generate the layers within this group we removed all of the land with wind and solar potential that existed within military, BLM, tribal lands, and ESA areas using the "Erase" tool in ArcGIS. The output that is created, shown in the Non-Restricted Wind Layer and the Non-Restricted Solar Layer, show all of the remaining wind and solar potential locations across Utah that have no overlap with any of those four entities.

2. The Restricted Layers group allows a user to identify additional land that has wind and solar potential across the state of Utah and *may* be developable, but development is dependent on further conversation with the restricting entity. We have organized this layer group to show which entity (military, BLM, tribal, ESA) is the limiting factor for wind and/or solar development in a given area. This created a total of eight layers labeled as the following: Military Restricted Wind Layer, Military Restricted Solar Layer, BLM Restricted Wind Layer, BLM Restricted Solar Layer, Tribal Restricted Wind Layer, Tribal Restricted Solar Layer, Endangered Species Restricted Wind Layer, and Endangered Species Restricted Layer. We have displayed data this way so that wind and solar developers can view locations that could be developed but are also aware of the development difficulty and know which entity to contact before pursuing that location.
    a. To compute these eight layers, we used the "Clip" tool in ArcGIS to identify all of the land with wind and solar potential that exists within the locations of the military, BLM, tribal lands, and ESA areas. To create the eight different layers, we did one entity at a time with data for one renewable energy resource, and then repeated the process for both wind and solar across all four entities to produce the eight layers that are viewed within the Restricted Layers group. Thus, the layers within the Restricted Layers group reveal all of the wind and solar potential areas that exist on land occupied by these entities.

3. The Additional Data Layers group gives users the ability to view the data sets that were used to compute the Non-Restricted Layers and Restricted Layers groups and a collection of additional data that may be of interest to the user and energy developers. This data group also provides users with information of geothermal potential across Utah.

5.2 Regulatory Roadmap for Siting Renewable Energy Projects and Transmission Lines: *Land Management and Ownership Entities in Utah*

This section of the report provides a brief summary and background on major land management/ownership entities in Utah. Sections 5.2 through 5.6 summarize regulatory requirements for renewable energy development -- primarily solar, wind, geothermal power and for transmission lines -- and can be used as a regulatory roadmap for project developers. This report additionally focuses on siting renewable energy projects compatible with military operations in Utah. An interactive web map supplements this report as a tool to enable users to view areas where military operations are ongoing and may require close collaboration and coordination with military representatives.

The first consideration, after deciding to proceed with a renewable energy project in Utah, is to determine regulatory requirements on the lands identified for the project. Lands managed by federal, state, tribal or private entities have different regulations. For example, the Bureau of Land Management (BLM) requires a rigorous land use planning process and an extensive environmental review prior to approving the siting of renewable energy projects. The regulatory process required by the United States Forest Service (USFS) is similar to the BLM. On the other hand, regulations for lands managed by the state government are less complex than the federal government.

Table 5.2-1 displays the important agencies, regulatory bodies and land stewards in the state. The mission and role of these agencies is described in the following paragraphs.

Table 5.2- 1: List of Land Ownership or Management Entity and Regulatory Agencies in the State of Utah.

Ownership/Management Entity	Agency
Federal	Department of Defense
	Bureau of Land Management
	U.S. Forest Service
Tribal	Bureau of Indian Affairs
	Department of Energy Tribal Energy Program
	Utah Division of Indian Affairs
State of Utah	School and Institutional Trust Lands Administration (SITLA)
	Utah Division of Forestry, Fire, and State Lands (FFSL)
Private Land and County	County Governments

FEDERAL GOVERNMENT

Department of Defense

Military Installations are focused on protecting the nation against threats from around the world. The current Department of Defense strategy focuses on responding to the changing character of war, emerging technologies, and identifying the needs of a military installation to prepare for training, testing and deployment of new and enhanced defense systems. Military leaders realize that focusing on military readiness is essential because they have seen erosion of the nation's technological advantage and the need to modernize its systems to maintain advantage. Readiness begins on installations, but the reality is that installations are not able to expand. Therefore, the military is seeking opportunities to develop partnerships with local leaders and citizens in communities where military installations exist.

The military develops land use planning through Joint Land Use Studies (JLUS) to collaborate with state and local governments, citizens and non-governmental organizations. JLUS are used to identify compatible land uses adjacent to military installations. They also seek solutions to protect compatible land uses, testing and training operations and preserve habitats around installations. Community and military partners working together can collaborate to identify barriers, advance solutions to ultimately connect ranges and create a joint environment. Whether it is a housing development or renewable energy infrastructure that might impede with military operations, the JLUS is an effective planning tool to bring together all stakeholders to better understand each other's priorities and develop solutions.

Bureau of Land Management (BLM)

The BLM is a federal agency within the U.S. Department of the Interior. The agency was established in 1946 and is responsible for managing 245 million surface acres and 700 million acres of subsurface minerals in the United States [BLM National, 2019]. In Utah, the BLM manages nearly 23 million acres of surface land and about 32 million acres of subsurface mineral estate [BLM Utah, 2019].

The BLM's mission is guided by the Federal Land Policy and Management Act (FLPMA) that requires multiple use and sustained yield of public lands. Under this law, the BLM is required to develop and implement Resource Management Plans (RMPs) that guide decisions for access and approval for a range of resource activities including renewable energy. Additionally, the BLM conducts environmental reviews as required by the National Environmental Policy Act (NEPA) and other federal laws.

Permitting and access to public lands will be determined by the planning process and prospective energy developers would benefit from understanding the overview of the agency's process.

Details of the planning process and regulations will be described in subsequent sections of this report.

U.S. Forest Service (USFS)

The U.S. Forest Service is a federal agency within the U.S. Department of Agriculture. Established in 1905, the USFS is charged with sustaining "the health, diversity, and productivity of the Nation's forests and grasslands…" The USFS manages 154 national forests and 20 grasslands across the nation and in Puerto Rico [USFS About, 2019].

In Utah, the USFS manages 8.2 million acres. Similar to the BLM, the USFS is guided by federal law, the National Forest Management Act (NFMA), for its land management planning decisions and is required to develop and implement Land Management Plans.[USFS Planning, 2019]. The USFS is also required to conduct environmental reviews as prescribed in NEPA.

The forest management plans are important to understanding where renewable energy projects will be permitted on forest managed lands. Specific detail of the regulations will be described in subsequent sections of this report.

TRIBAL GOVERNMENT

Table 5.2- 2: List of Tribal Nations with lands in the State of Utah.

Tribal Nations in Utah [UDIA, 2019].	
Paiute Indian Tribe of Utah	Cedar City, UT
San Juan Southern Paiute Tribe	Tuba City, AZ
Skull Valley Band of Goshute	Skull Valley, UT
Confederated Tribes of Goshute	Ibapah, UT
Northwestern Band of Shoshone Nation	Brigham City, UT
Ute Indian Tribe of the Uintah and Ouray Reservation	Fort Duchesne, UT
Ute Mountain Ute Tribe	Towaoc, CO
White Mesa Community	White Mesa, UT
Navajo Nation	Window Rock, AZ

Utah Division of Indian Affairs

The Utah Division of Indian Affairs was created in 1953 with the passage of the "Indian Affairs Act". The division carries out various responsibilities to include compliance with the Governor's

Executive Order on consultation. The Executive Order states that when a state agency is proposing to implement a state action that "has, or may have, substantial tribal implications, such as impacts…" on certain tribal practices, it should engage in the consultation process with Tribes on a government-to-government basis [USB, 2014]. The executive director of the Division of Indian Affairs is the principal liaison for coordinating consultation and for training state agencies and departments, as defined by the Executive Order, on requirements for consultation and communication.

Bureau of Indian Affairs (BIA)

The Bureau is an agency within the U.S. Department of the Interior and is primarily focused on ensuring the U.S. government meets its trust responsibility to American Indian and Alaska Native tribes that are federally recognized in accordance with established criteria. Approximately 2.45 million acres of trust lands are in Utah [E.I. Leydsman McGinty, 2009].

Within the BIA, the Division of Energy and Economic Development provides technical assistance to tribes that will enhance their opportunities to develop their energy resources including renewable energy. Technical assistance includes financial assistance to assess energy resource potential on trust lands, engineering, economic analysis, energy exploration analysis and advice on how to best negotiate agreements with potential partners and investors [BIA-DEMD, 2019]. The Bureau of Land Management is also important to leasing activities on certain minerals and resources on trust lands.

Department of Energy Tribal Energy Program

The U.S. Department of Energy's Tribal Energy Program does not manage lands but it is focused on providing technical and financial assistance to tribes that seek to develop their renewable energy resources and that wish to explore efficiency technologies. Education and online courses are provided to tribal leaders and their staff on a wide range of energy topics and on steps necessary for financing energy projects and project management [DoE Indian Energy, 2019]. While this office does not issue specific regulations for access and permitting of energy projects, their function is key to the support of increasing and expanding opportunities for renewable energy projects.

STATE OF UTAH

Utah School and Institutional Trust Lands Administration (SITLA)

SITLA was established in 1994 to manage 3.4 million acres of trust lands that remain from the original 7,475,297 acres of trust land granted to Utah when it became a state in 1894. Trust lands generate revenue from energy development, lumber production, livestock grazing, and other

activities. The revenue is for twelve beneficiaries that include public schools and institutions of higher education.

Unlike the BLM, SITLA is not bound to undertake land use planning nor is it required to comply with environmental review under NEPA. However, SITLA has its own environmental review process and coordinates with federal and state agencies on every lease application received to ensure the agency complies with all legal requirements. Additionally, SITLA is required to comply with State of Utah Code on cultural and archaeological resources. Effects on these resources within a proposed project area must be considered prior to authorization and approval of project lease applications [SITLA Renewable Energy Leases, 2019]. The regulatory roadmap for renewable energy will be discussed in subsequent sections of this report.

Utah Division of Forestry, Fire, and State Lands (FFSL)

Lands considered sovereign lands in Utah are managed by this division which is part of the Utah Department of Natural Resources. Nearly 1.5 million acres are managed by the FFSL and differ from those managed by SITLA. Lands managed by the FFSL are commonly referred to as "submerged" lands due to their location in river and lake beds. Some of the lands are available for leasing, primarily for oil and gas energy resources and other minerals such as coal, clay minerals and volcanic materials. The Division of Oil, Gas and Mining is responsible for the leasing of oil and gas. However, they have limited activity for renewable energy projects in general but currently manage one active geothermal lease on state lands.

Utah Public Lands Policy Coordinating Office (PLPCO)

Utah's Public Lands Policy Coordinating Office is part of the Governor's Office and is primarily responsible for preserving and defending the state's rights to access and use public lands in Utah. Specifically, the duties of the office are to work with the State's Attorney General on litigation pertaining to public lands, to oversee the coordination of the Resource Development Coordinating Committee (RDCC) which reviews applications for renewable energy projects, and to coordinate land use planning as required by the State of Utah Resource Management Plan passed by the Utah Legislature and signed into law by the Governor in 2015 [HB 323, 2015]. The statewide plan incorporates all Utah county land use plans and establishes priorities for land use such as energy including renewable energy resources. PLPCO is not responsible for managing lands but is vital in influencing and coordinating Utah land management policy.

PRIVATE AND COUNTY LANDS

Within the State of Utah there are approximately 11.4 million private acres or just more than 21 percent of surface area in the state. Activities on private lands should be consistent with state zoning laws. Appropriate permits for approval should be made to the county of jurisdiction and other governmental jurisdictions. The counties have just recently completed land use plans as part of the State Resource Management Plan. The first of its kind in the state and nationwide, the State's State Resource Management Plan will result in enhanced collaboration, cooperation and coordination between federal agencies, state and county governments. One of the requirements of the federal agencies' planning and environmental laws is to ensure their plans are consistent with state and county plans. Proper coordination and cooperation must be demonstrated in the preparation of federal planning activities [Utah RMP, 2018].

The counties require the submission of a Conditional Use Permit (CUP) for consideration of renewable energy projects regardless of land ownership. The regulatory steps for securing a CUP will be described in subsequent sections of this report.

5.3 Regulatory Roadmap for Siting Renewable Energy Projects and Transmission Lines: *Land Use Planning and Environmental Review*

In this section, the land use planning process and its distinction for each entity will be discussed. Additionally, the process for environmental review will be highlighted since this requirement is essential for most of the entities authorizing access to its land. It is important to have a basic understanding of the planning and environmental review processes for two reasons. One, to be able to identify appropriate areas in a particular land ownership area/region where renewable energy is permitted and second, to provide input to an area where a land use plan is being developed.

It is also important to understand the environmental review requirements. A recent decision by the Bureau of Land Management to deny the continuation of a wind project in Nevada was due in part to concerns about environmental issues and protected species. Subsequent sections of this report will elaborate on the details of this project decision but it is important to note here the basis for understanding the regulatory framework prior to advancing too far with project plans.

5.3a Land Use Planning

Bureau of Land Management

The federal land use planning process determines which lands are available for specific multiple uses of public lands including renewable energy. During the planning process, stipulations are also identified on how activities on leases and applications are to occur. The land use planning process differs slightly for each federal agency.

In 1976, Congress passed and the president of the United States signed into law the Federal Land Policy and Management Act (FLPMA). This landmark law changed the way federal lands are managed. Prior to this act, the federal government had moved a significant portion of its land and mineral holdings into state and private hands. FLPMA largely ended this practice and established a mission for the BLM of land management rather than land disposal. The new focus was management for multiple uses of federal land such as development, conservation, and/or recreation. FLPMA requires the BLM to engage in a formal land use planning process to ensure that land uses and land resource values are maintained and that changing conditions of the land and resources are accounted for periodically, usually every 15 to 20 years.

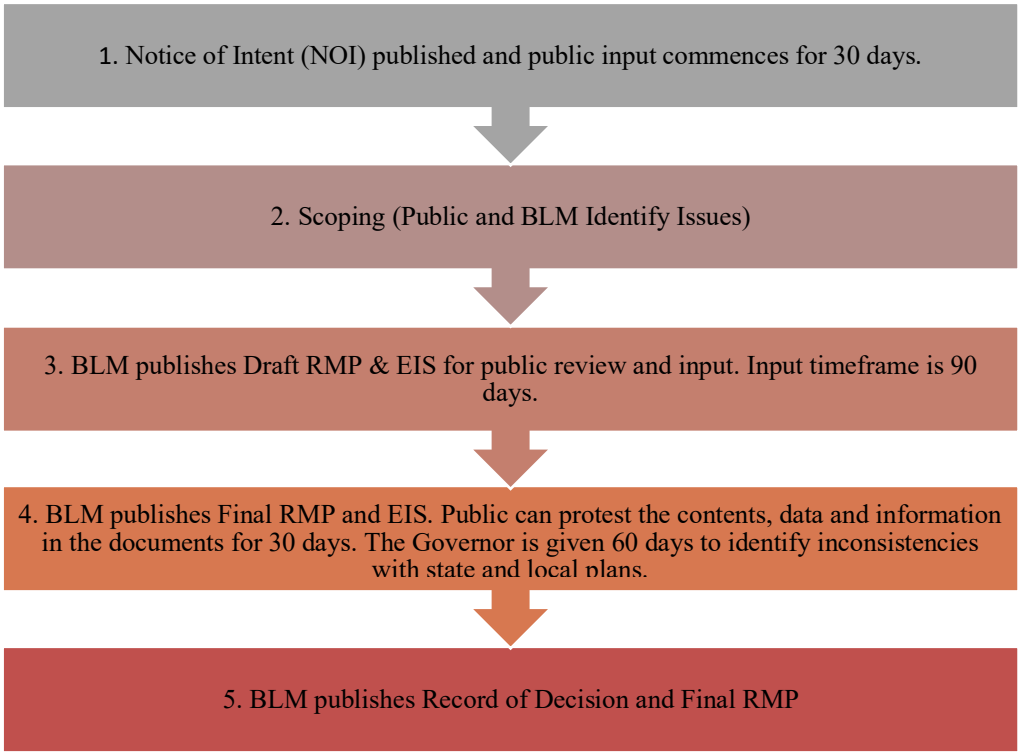
The land use planning process is a comprehensive review and inventory of land and resource values that responds to changing conditions and planning issues of a particular planning area for the BLM. The result of this process is a Resource Management Plan

(RMP) that outlines land management decisions for the planning area. The land use planning process can take several years. For example, RMPs completed by the BLM in Utah in 2008 took five to seven years to complete.

Land use planning is separate from the National Environmental Policy Act (NEPA). However, the NEPA process does support decisions in land use plans. As part of the land use planning process, agencies will prepare an environmental analysis according to NEPA. Typically, an Environmental Impact Statement (EIS) is prepared simultaneously due to the significance of the decisions proposed in an RMP.

One of the key components of land use planning is the involvement of the public, which includes the opportunity to comment and provide input throughout the development of the RMP. The diagram below highlights milestones in land use planning and identifies points in the process where the public may be involved. RMPs must be consistent with local, county and state planning documents. The figure below illustrates the steps of the BLM's RMP process.

Figure 5.3- 1: Key Steps for RMP Process
[BLM Public Involvement, 2019].



In steps one and two, the public is given the opportunity to identify land management issues that should be considered in the land use plan. It is important for the public to become involved at this point to shape priorities for land uses such as renewable energy projects. The agency will review the public's input and its own data and issues as the framework for the development of a range of alternatives for land management.

In step three, the draft RMP describes the purpose of and need for the land use plan, the affected environment, available alternatives for managing public lands within the planning area (including preferred alternative as determined by BLM), the environmental impacts of the available alternatives, and the consultation and coordination in which the BLM engaged during plan development. A companion document, the draft EIS, includes detailed environmental analyses of alternatives identified in the draft RMP.

The proposed RMP and final EIS include appropriate responses to public comments on the RMP and EIS drafts. The agency also corrects errors that were identified through public comment and internal BLM review. Individuals and entities have 30 days to file a protest with the BLM Director. The protest period cannot be extended. The BLM must resolve any protests of a proposed RMP/final EIS before issuing a record of decision. The Governor of the state where the land use plans are developed has 60 days to review the plan for any inconsistencies with state and local plans.

The final step is the Record of Decision (ROD). The ROD reflects the goals, objectives and actions for management with corrections to any errors or inconsistencies identified in the previous step. Prospective energy developers should review RMPs where potential projects are being considered to ensure access and requirements are met. The agency can amend a plan if the current document does not accommodate a land use such as renewable energy. However, if an amendment to the RMP is necessary to accommodate compliance with planning and environmental requirements, a similar process for the RMP is followed which would extend the time--two or three years--before approval can be considered.

US Forest Service (USFS)

Authorized by the National Forest Management Act (NFMA), the USFS conducts land use planning through its Land Resource Management Plan (LRMP). Similar to the BLM, the USFS requires specific steps with public input, review and analysis. There are three phases in the planning and adaptive management process. The first phase is assessment. The USFS brings partners together for input, assessment of the current conditions in a resource area, examine the monitoring results and develop the need for changes if necessary [USFS Citizens' Guide, 2016].

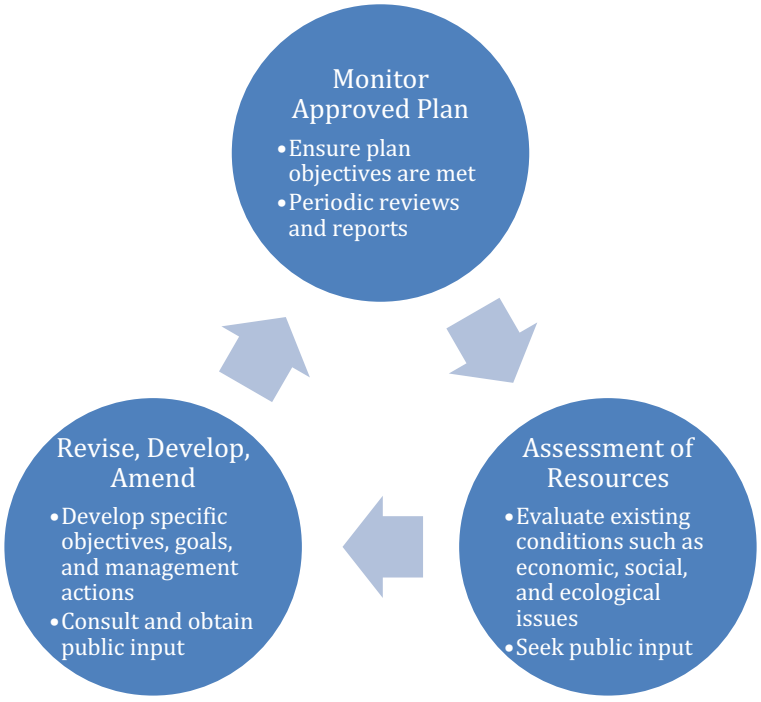
The second phase is plan development. In this phase, the agency continues to engage the partners for input, and develops the plan revision or plan amendment as necessary. The

agency will consider a number of components and issues for plan revisions or plan amendments to include lands suitable for wilderness designation, areas for potential special designation such as botanical or research natural areas, the maximum amount of timber that may be harvested, and the health of the various ecosystems on the land [USFS Citizens' Guide 2016].

Generally, the process for land use planning in the forest system is similar to the process for the BLM. It includes public participation, resource assessment, changing conditions for improvement, environmental review, and social and economic objectives.

The diagram below provides the path for planning as revised by the planning rule in 2012 and continues to be the guiding principle. Prospective energy developers should review USFS plans where potential projects are being considered to ensure proper access and permitting requirements.

Figure 5.3- 2: Planning Steps for USFS
[USFS Citizens' Guide 2016].



Department of Defense (Planning for Military Installations)

Military Installations conduct Joint Land Use Studies (JLUS) to "identify compatible land uses and growth management guidelines within, and adjacent to, active military installations…" [Camp Williams JLUS, 2019]. JLUS focus on engaging local citizens and community leaders to enhance collaboration, cooperation and discuss military operational and training priorities, community growth and economic development. The value of this planning effort is to identify issues and concerns and develop solutions that minimize conflicts and incompatible uses with military operations.

The Utah Army National Guard's training camp, Camp Williams, completed its JLUS process in 2012. Camp Williams provides training facilities for the Utah Army and Air National Guard, the U.S. Army and Army Reserves, U.S. Marine Corps and Marine Reserves, U.S. Air Force and Air Force Reserve, the Reserve Officers Training Corps and various federal, state and local law enforcement agencies. The final JLUS reflects priorities and mission-related activities. The plan also identifies stakeholders who have interests near and around the boundaries of the training camp. Their priorities and issues are identified in the plan.

Hill Air Force Base in Utah is in the early stage of developing its JLUS. It will follow similar steps to reflect mission priority and community interests. One of the tools the military has developed is the Readiness and Environmental Protection Integration Program (REPI). This program allows the military to enter into cost-sharing agreements with conservation organizations and state/local governments to protect compatible land uses and habitats around the installation.

State and Local Governments

In March 2015, the Utah Governor signed into law the State of Utah Resource Management Plan which includes specific priorities for county resource management plans and sets the basis for coordinating with federal government agencies. The Governor's Public Lands Policy Coordinating Office (PLPCO) was tasked to oversee the planning effort. The Utah Resource Management Plan was completed in 2018 and it incorporates all county land use plans [Utah RMP, 2018].

One of the main objectives for this planning effort is to ensure substantive coordination between the State of Utah and federal agencies when federal agencies develop land use plans. Federal agencies are required to achieve consistency requirements with the state's objectives and public land use requirements. Another requirement for federal agencies is to grant state and local governments Cooperating Agency status when requested. This designation differs from coordination. Cooperating Agency status is part of the National Environmental Policy Act (NEPA) process, which will be discussed in subsequent

sections. This requirement allows state and local agencies to have substantive input on federal land use plans from the start of the planning process until the plan is finalized.

Among the many issues addressed in the State and county plans is energy. The state encourages development of renewable and non-renewable sources of energy. The state of Utah has significant potential for renewable sources, including geothermal, solar, wind and hydropower. The state plan outlines the potential for energy, areas where the energy resources exist and the importance of resource development. Since this planning effort was just completed, prospective developers should consult with the state plan and with each county plan appropriate for project consideration.

State Land Use Planning and Management Program § 63J-8-104 [Utah RMP, 2018].

According to Utah state code, the statements in Table 5.3-1 guide the process for the BLM and Forest Service land use plans to achieve consistency and ensure multiple use and sustained yield management.

Table 5.3- 1: Utah Planning Policy Statements

Planning Policy Statements	
A.	Achieve and maintain in perpetuity a high-level annual or regular periodic output of agricultural, mineral, and various other resources for subject lands;
B.	Support valid existing transportation, mineral, and grazing privileges in the subject lands at the highest reasonably sustainable levels;
C.	Produce and maintain the desired vegetation for watersheds, timber, food, fiber, livestock forage, wildlife forage, and minerals that are necessary to meet present needs and future economic growth and community expansion in each county where the subject lands are situated without permanent impairment of the productivity of the land;
D.	Meet the recreational needs and the personal and business-related transportation needs of the citizens of each county where the subject lands are situated by providing access throughout each such county;
E.	Meet the needs of wildlife, provided that the respective forage needs of wildlife and livestock are balanced according to the provisions of Subsection 63J-4-401(6)(m);
F.	Protect against adverse effects to historic properties, as defined by 36 C.F.R. Sec. 800;
G.	Meet the needs of community economic growth and development;
H.	Provide for the protection of existing water rights and the reasonable development of additional water rights; and
I.	Provide for reasonable and responsible development of electrical transmission and energy pipeline infrastructure on the subject lands.

School Institutional Trust Lands Administration (SITLA)

SITLA has the discretion to participate in joint planning with other land management agencies if the director of the agency determines that their trust management responsibilities will benefit from the planning effort. Under Rule R850-100, SITLA is given the discretion for planning, however, the agency complies with legal requirements for protection of threatened and endangered species and cultural resources as required by federal laws.

Division of Forestry, Fire, and State Lands

The state management planning objectives for permitting of renewable resources where applicable guide the access to any potential mineral and energy resources. Geothermal leasing exists on these lands on a limited basis and any other mineral or renewable energy permitting will be discussed in subsequent sections of the report.

5.3b Environmental Review

BLM and USFS

Federal agencies are required to comply with one of the major procedural statutes, the National Environmental Policy Act (NEPA) that requires federal agencies (except Congress, the President and the federal courts) to identify and consider impacts to the human environment and identify a range of alternatives to a proposed activity on federally managed lands. Unless state agencies receive federal funding for a particular project, state agencies are exempt from this statute. This section of the report will discuss the legal requirements and steps for compliance with NEPA. It is important to understand the NEPA process for renewable energy projects because this process will impact timelines, budget and cost of mitigation should the agency determine the feasibility of a project and whether there is a need to minimize impacts.

NEPA was signed into law in 1970 and is considered a benchmark for environmental policies. It serves to identify impacts to the quality of the human environment. The statute serves as the basis for the decision-maker to make an informed decision based on the analysis resulting from the NEPA process.

The NEPA process can occur at various levels of access and authorization. For example, the previous section on land use planning discusses NEPA for land use plan development. If a land use plan is already in place, the NEPA process will occur when the proposed project is being considered on a site-specific basis. Even though the NEPA process has occurred at the planning level, impacts from specific projects must be considered.

The Council on Environmental Quality (CEQ) oversees NEPA implementation and ensures that federal agencies meet the obligations under NEPA. Federal agencies are given discretion to develop regulations to accommodate their individual missions but still must follow the general framework required by NEPA. The Environmental Protection Agency (EPA) is responsible for reviewing major NEPA documents such as the Environmental Impact Statements (EISs) and some Environmental Assessments (EAs) issued by federal agencies. The EPA provides comments and is responsible for publishing the documents in the Federal Register as the main vehicle that notifies the public that NEPA documents are available for review.

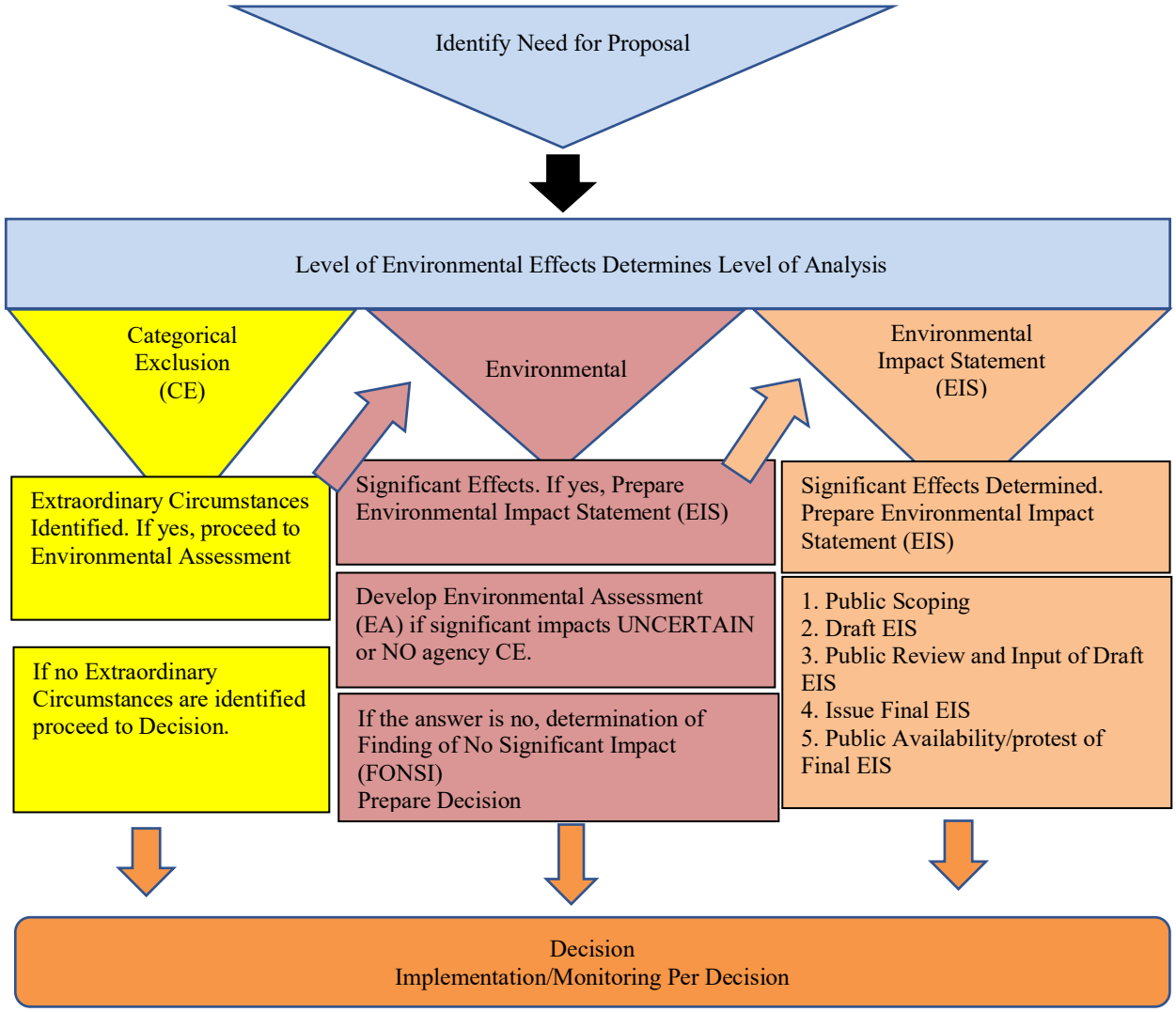
Generally, the NEPA process on federally managed lands can be cumbersome, repetitive and lengthy. However, in 2017, the Department of the Interior issued Executive Order 3355 to streamline the NEPA process [EO 3355, 2017]. on BLM managed lands. For purposes of this report, the focus will be on BLM's regulatory steps but similarly the USFS is required to comply with the general requirements of NEPA.

Figure 5.3-3 provides an overview of the steps required under the NEPA process and the three major levels of analysis for each step.

Categorical Exclusion (CX or CE)

A Categorical Exclusion allows the agency to make the determination that a proposed action will not significantly impact the quality of the human environment individually or cumulatively and therefore an EA or EIS is not required. The CE is used when the agency has conducted an analysis previously on the same type of action being proposed, and no significant impact was identified. If the agency official determines that the previous analysis is legally defensible and remains sufficient to make an informed decision without conducting further analysis, then approval of the action can occur without further analysis. This step minimizes duplication of information and provides an efficient approach for final decisions when there are negligible environmental impacts. The Energy Policy Act of 2005 added five circumstances where CX would apply.

Figure 5.3- 3: The NEPA Process



Environmental Assessment (EA)

An EA is prepared when the significance of the environmental impacts of a project proposal is uncertain. An EA briefly discusses a project's need and environmental impact, considers alternative actions and their impacts. The information assists in determining whether a Finding of No Significant Impact (FONSI) is issued or a more extensive and detailed analysis is required. An Environmental Impact Statement is required should the EA determine greater potential impacts. In the former, it is determined that the proposed action will not result in significant impacts to the quality of

the human environment.

An EA can be finalized in a matter of months; however, depending on the complexity and opposition to the proposed action, the final decision can take years and often results in litigation**.**

Environmental Impact Statement (EIS)

An EIS is a detailed document required when a proposed action has been determined to significantly affect the quality of the environment. The EIS describes the environmental effects of a proposed action and contains alternative actions that may be chosen, including the decision not to proceed with the proposed action. An EIS allows for extensive input from the public and is designed to involve cooperating agency partners, e.g., local, state and federal officials. Executive Order 3355 provides a target of one year to complete the Final EIS (from the time a Notice of Intent to prepare the EIS has been published). Timelines exceeding the target by more than three months must be approved by the Assistant Secretary who has the responsibility for the matter of the document.

Levels of NEPA Analysis for Programmatic and Site-Specific Analyses

A programmatic analysis will cover a broad geographic area and assess potential cumulative environmental effects of proposed actions such as the locations of transmission lines or solar energy zones. At this level, multiple objectives and alternatives are evaluated and generic mitigation measures identified to address impacts.

In contrast, site-specific analysis is conducted when a specific activity is proposed such as a wind, solar or geothermal project. The project would comply with stipulations outlined in the broader NEPA document prepared for the land use plan and mitigation measures identified to minimize impacts would be specific to the area where the project is located or the area identified with impacts as a result of the project.

Streamlining the NEPA Process

As noted previously, the Department of the Interior issued an Executive Order to streamline the NEPA process. The objectives are to reduce the timelines for completing the analysis, issuing the final decision and reducing the number of pages in the decision and analysis documents.[EO 3355, 2017]. The streamlining tools created in major part by the Department of the Interior are in Table 5.3-2 [NEPA Streamlining, 2019].

Table 5.3- 2: DOI Strategy for Streamlining NEPA

NEPA Strategy	
Ask Tough Questions, Make Tougher Choices	Consider whether NEPA is necessary, the level of NEPA, CE, EA, EIS. Can a previous NEPA document be referenced and still be adequate?
Pages and Time	Before issuing an intent to start a NEPA document, plan timeline and document strategy.
Get Everyone on Board	Management at all levels should understand the objectives of project, their roles etc. Create Project Management.
Engage Stakeholders	Identify cooperating agencies, contractors and address legal, policy and contractual requirements.
Recruit Team Leader(s)	Appoint a leader(s) who will keep team on schedule and focused.
Focus	Maintain a clear purpose and need statement and exclude extraneous background discussions.
Unleash the Power of Scoping	Internal and external scoping should begin well in advance of formal public scoping. Use scoping to help determine significant issues.
Picture It	Use illustration rather than text to help communicate important points and issues. Maps, charts, graphics, and figures are effective tools.
Convey Bottom Line	Chapter to convey comparison of alternatives is important so ensure clarity and important explanations are made in this section of the document.
Document Details Elsewhere	Document processes and detailed analyses in Decision file. Prepare online reports, etc. rather than appendices.

Other major environmental legal requirements include: Endangered Species Act (ESA), Native American Graves Protection and Repatriation Act, National Historic Preservation Act, Clean Air and Clean Water Acts.

The Endangered Species Act (ESA) requires government, non-government and private property owners to comply with the act. ESA requires agencies to consult with the two federal agencies responsible for its compliance to ensure that potential effects of actions authorized and funded are not likely to jeopardize the continued existence of species (plant or animal) listed as threatened and/or endangered. The two federal agencies are the U.S. Fish and Wildlife Service (FWS) at the U.S. Department of the Interior and the National Marine Fisheries Service (NMFS) at the U.S. Department of Commerce.

The consultation process will result in a biological opinion (BO) from the oversight agency. The BO will assess the proposed activity and will make a jeopardy determination to any potential endangered species or its critical habitat. Depending on the jeopardy determination, the agency proposing to approve an activity will offer reasonable and prudent alternatives to minimize jeopardy to the species in question. When species are listed, the oversight agency will also designate critical habitat for conservation of the species. Activities on critical habitat are likely subject to restrictions for the protection of the critical habitat.

The military and the USFWS work closely to address challenges with the management of endangered species on military lands [Military ESA, 2001]. The DoD and each of the military

service areas have specific guidance for compliance and implementation requirements. The consultation process and requirements to address species and critical habitat designations under the ESA are addressed in the Integrated Natural Resources Management Plans (INRMPs). As noted prior, the DoD has the Readiness and Environmental Protection Integration Program (REPI) that allows the military to engage in conservation and mitigation activities with non-DoD partners.

The Clean Air and Water Acts have limited impact on renewable energy projects. Should there be any applicability, the Utah State Department of Environmental Quality determines environmental regulations within the state to include Clean Air and Water laws subject to the Environmental Protection Agency (EPA) overall authority. The land use planning process will include analysis on potential impact from various activities. Should any renewable energy projects be deemed to have impacts, specifically geothermal, a site-specific analysis would be conducted.

National Historic Preservation Act (NHPA) was enacted in 1966 and mandated that federal agencies consider historic properties and impacts from proposed actions on such properties. The regulations require consultation commonly known as Section 106 consultation whereby federal agencies consult with State and Tribal historic preservation officers (SHPO and THPO) about proposed actions on areas that may have historic properties or places and identify potential mitigation measures to avoid, minimize or mitigate effects on these properties or places. Consultation occurs during the development of the land use planning process and during the NEPA process. The federal Advisory Council on Historic Preservation (ACHP) is the entity responsible for providing guidance on the consultation process.

However, SHPO/THPO have a programmatic agreement in place which authorizes SHPO to consult within the state to meet compliance requirements of Section 106. Table 5.3-3 is taken from the ACHP handbook to illustrate the steps for the Section 106 consultation process [NEPA & NHPA, 2013].

Table 5.3- 3: National Historic Preservation Act Section 106 Process

Section 106 Process	
1. Initiate the process ● Determine undertaking ● Coordinate with other reviews ● Notify SHPO/THPO ● Identify Tribes and other parties ● Involve the public	1. Undertaking has potential to cause effects? If yes, go to step 2. If no, the process is complete.
2. Identify historic properties ● Determine area of potential effect ● Identify historic properties ● Consult with SHPO/THPO, tribes, etc. ● Involve public	2. Historic properties at site are affected? If yes, go to step 3. If no, the process is complete.
3. Assess adverse effects ● Apply criteria of adverse effect ● Consult with SHPO/THPO, tribes, etc. ● Involve public	3. Historic properties adversely affected? If yes, go to step 4. If no, the process is complete.
4. Resolve adverse effects ● Avoid, minimize or mitigate adverse effects ● Notify ACHP ● Consult with SHPO/THPO, tribes, etc. ● Involve public	4. Agreement (Memorandum of Agreement/Programmatic Agreement) or Council Comment. The process is complete.

Native American Graves Protection and Repatriation Act (NAGPRA)

The Native American Graves Protection and Repatriation Act specifically addresses the protection of Native American cultural artifacts. NAGPRA requires federal agencies and any entity receiving federal funds to ensure Native American cultural items found on the federal land or area where activities are occurring, to return such items to the tribes affiliated with the items which can include human remains, sacred objects and objects of cultural patrimony.

As previously noted, SITLA is required to comply with State of Utah Code on cultural and archaeological resources.

5.4 Regulatory Framework for Permitting Electrical Transmission Lines in Utah

As previously noted, identifying land management/ownership areas is vital to understanding the regulatory process for approval of proposed renewable energy projects or any proposed activity associated with such projects. One important component associated with the delivery of renewable energy is electrical transmission lines and associated infrastructure. Apart from outlining land management/ownership regulations for access and siting approval, the jurisdiction for transmission of energy (generation and delivery), infrastructure reliability and pricing/rates is

worth noting. There are independent federal and state regulatory agencies that govern public utilities (monopoly in nature) and the service/business associated with these entities. The following is a brief overview of organizations involved in the regulatory, planning and infrastructure within a state and across state lines.

At the federal level, the Federal Energy Regulatory Commission (FERC) is responsible for regulating interstate transmission of electricity and other sources of energy except for certain intrastate regulatory authorities which is left to a state Public Utility/Service Commission. FERC also oversees not-for-profit organizations such as the North American Electric Reliability Corporation (NERC) which has regulatory authority to assess and reduce risks to the grid and ensure reliability of the Bulk Electric System (BES). The BES includes transmission elements operated at 100kV or higher (defined transformers, generators, etc.) [NERC, 2014]. Its jurisdiction covers those who use, own or operate the bulk power system that serves nearly 335 million people across the United States, northern Baja California, Mexico and Canada. Under NERC, there are regional entities responsible for compliance and monitoring. Utah is within the Western Electricity Coordinating Council (WECC). In accordance with the standards developed by NERC, the WECC ensures reliability and safety in the Western Interconnection region. WECC also conducts studies and assessments for long term planning of energy demand and infrastructure needs. The role of the Utah Public Service Commission is ‘to promote and protect the public interest by ensuring that public utility service is adequate in quality and reliability and is available to everyone at just and reasonable prices” [PSC, 2018].

Regarding approval and construction, state governments are part of the coordination with federal and not-for-profit entities. Through a Memorandum of Understanding signed in 2005, the governors of California, Nevada, Utah and Wyoming created a coordinating committee to focus on proper planning for transmission capacity and infrastructure development. Similarly, the federal government developed a team model to bring all appropriate agencies together with designated lead or co-lead parties. The federal response teams serve to improve coordination, collaboration and efficiency in approving environmental reviews and approval for complex transmission siting proposals.

To begin the process and upon completion of internal studies and planning, the transmission line project proponent must first file an application for a Right-of-Way (ROW) grant and a Conditional Use Permit (CUP) prior to consideration for approval and access to the area(s) proposed. In the example outlined in the case study for the company TransWest Express, LLC (TWE), the ROW application was initially filed with the BLM. It was determined that the size and scope of the project was a major federal action. Therefore, an EIS was required for analysis to include land use planning amendments to existing land use plans along the proposed route. The Table 5.4-1 is a simplified chart outlining steps for approval for a major federal action. CUPs are required by counties prior to access and approval at the county level.

Table 5.4- 1: Outline of steps needed for approval

Right-Of Way Application and Utah County requirement for Conditional Use Permit	Federal Agencies - Depending on Management and Regulatory Jurisdiction	State, County, Private landowners	Tribal
Proposed Route Impact	BLM, USFS and USDA, National Park Service (NPS), Federal Aviation Administration (FAA), DoD, BOR, US Army Corp of Engineers (USACE), Federal Highways Administration (FHWA)	SITLA, Public Lands Policy Coordination Office (PLPCO), Resource Development Coordinating Council (RDCC), SHPO, FFSL, County, private lands	BIA, Tribes, THPO
NEPA Determination	CX, EA or EIS	No NEPA required unless state agency has received federal funds for the project	NEPA if BIA trust responsibility applies
Land Use Planning- Refer to resources plans to ensure proper access and location permitted.	Federal land management agencies provide areas for access in resource plans. FAA and DoD have separate regulations for airport and military mission requirements.	State of Utah and Utah counties have implemented individual county plans that have been incorporated to State Plan. Areas outlined for approved access.	Consult with individual tribes for access. Consult with BIA for process and application
Cultural, Archeology and historic properties impact	Section 106 consultation required.	State requires cultural and archeology studies	Section 106 consultation and tribal consultation
Threatened and Endangered Species	USFWS-Provides biological opinion (BO)	USFWS and Utah Division of Wildlife Services consultation and BO	USFWS BO and tribal consultation
Water Quality and Wetlands	Environmental Protection Agency (EPA), USACE, BOR	Utah Division of Environmental Quality (DEQ)	Tribal and BIA consultation
Impacts to Federal Highways and airports	FHWA will evaluate impacts and process for crossing highways. FAA will review impacts to airport traffic	Utah Division of Transportation will evaluate impacts to crossing of Utah roads and highways	
Impact to Farmland, agriculture	Obtain permit from USDA's Natural Resources Conservation Service and Farm Services Agency		
Permits Required	Federal Agencies issue individual permits for specific regulatory requirements prior to final approval of ROW grant/special use permit. Permits required may include, USACE Section 10 permits if there is dredging. A section 404 permit is for ensuring the physical, biological and chemical quality of the water is protected so as not to permit unregulated discharges of dredged or fill material.	State Agencies require permits, i.e., water quality, Paleontology and archeological surveys. Counties will issue a Conditional Use Permit subject to analysis and approval of regulatory requirements. Private Landowners and Company must reach agreement for access on private land.	BIA and tribes will grant approval subject to consultation and regulatory requirements
Plan of Development	After approval of NEPA, permits approved, project proponent submits POD to ensure compliance with ROD	Consistent with permits and agreements made to secure approval. Bonding, reclamation etc.	
Fees, costs to agencies	Rental Fees, associated processing fees. (Note: if project is approved, monitoring fees will be assessed for construction and operations for the life of the ROW)	Rental fees, certain administrative costs	
Rate Filing for business and operational transmission line	FERC	Utah Public Service Commission if within jurisdiction	

More specific description of steps required to obtain a Utah County Conditional Use Permit (CUP) will be discussed in the renewable energy resources regulatory framework below.

TWE, LLC, A Case Study for NEPA and Electric Transmission Lines

As noted above, the TWE transmission project is an appropriate example that illustrates the steps and process involved in a large development project to meet regulatory requirements and obtain permitting approval.

The proposed route for this transmission project crosses four states and multiple federally managed lands including the BLM, USFS, U.S. Bureau of Reclamation and the Utah Reclamation Mitigation Conservation Commission. This project will supplement energy to the Desert Southwest region from major wind power generated in Wyoming.

The project was initiated in 2005 by Arizona Public Service following a study that provided insight to project benefits to the western United States. One of the key considerations for TWE was WECC's planning efforts that confirmed the high quality of Wyoming's wind resources and its potential economic benefit to consumers and the project's reliability and enhancement to the grid. Several follow-up studies were conducted to include various technical data and input from stakeholders such as PacifiCorp. Additional details on specific reports are located in the project's website [TWE, 2019]. .

Under the model of collaboration and coordination established by the federal government, Western Area Power Administration (WAPA), an agency under the Department of Energy, and the Department of Interior's Bureau of Land Management (BLM) were selected as co-lead agencies for the EIS. The purpose for WAPA's engagement is due to its mandate to authorize the borrowing of federal funds to construct, finance, plan, operate and maintain electric power lines and related facilities within its jurisdiction and would involve the delivery of power from renewable energy resources. The purpose for BLM's engagement derives from its mandate under the Federal Land Policy and Management Act to manage lands under multiple use such as electric transmission siting.

The analysis and process for approval would involve 49 agencies including 11 federal agencies and 24 counties. Following internal review of issues identified for analysis by all cooperating agencies, the public was notified through a Federal Register Notice of the opportunity to identify additional issues to consider. There were nearly 25 public scoping meetings held throughout the proposed route of the project. Issues to consider included, fish, wildlife and habitat impacts, cultural resources, conflicts with future land uses along the proposed route, impacts to special management areas such as Wilderness Study Areas (WSAs), National Historic Trails, and state and federal parks. These and other issues were superimposed with the transmission line design, construction operation, and maintenance and route proposal of the project. The project facilities included the high voltage power line of about 725 miles across four states with a right-of-way of

at least 250 feet, two terminal stations, access routes on new or existing public and private roads, two ground electrode facilities, and a network of up to 15 fiber optic communication and regeneration sites at each terminal.

In BLM's environmental impact statement, the route was divided into four regions with each containing at least four alternatives for siting. The division into separate regions would facilitate comparison and analysis of issues specific to the region. In general, the following major issues were considered and analyzed prior to the Record of Decision [ES-TWE-EIS, 2015]. In reference to the issues listed in the Table 5.4-2, the agencies in the table above would have jurisdiction for review and approval when major issues would present a concern or a proper method for mitigating impacts to concerns was identified.

Table 5.4- 2: List of issues and summary of impacts and analysis

Issue	Summary of Impacts and Analysis
1. Air Quality	Increases in fugitive dust emissions, emissions of hazardous air pollutants and greenhouse gas emissions but not contribute to any violation of state or federal ambient air quality standard.
2. Geological, Paleontological, and Mineral Resources	Low to potentially active faults along the route, Low incidence of landslides, minimal or no impediments to mineral resources, fossil bearing formation impact potential but best management practices would minimize of eliminate impact. Other best management practices identified to minimize possible damage to lines should there be unexpected ground instability or precipitation.
3. Soils	Potential erosion due to water, wind compaction, sinkholes, piping subsidence. Best management practices identified to mitigate erosion concerns.
4. Water Resources	During construction phase, potentially impact to the various waterway crossings along the route. Impact could be channel instability and increased sediment from activities. TWE was required to develop a management plan to avoid, reduce and or minimize adverse impacts to streams and related areas.
5. Vegetation	Various vegetation communities and Forest and woodlands are in the path of the project. Potential habitat fragmentation and noxious weed invasion due to ground disturbance during project construction. Changes in vegetation could increase the risk of accidental fires. Vegetation Management identified during Plan of Development.
6. Special Status Plant Species	Nearly 300 special status plant species exist along the project route but limited to less according to specific region. Design features, best management practices identified to reduce impacts.
7. Wildlife	Impacts would generally be in the area of habitat loss and fragmentation as well as wildlife mortalities. Large and small game impacted. TWE committed to seasonal timing restrictions for nesting birds and commit to design features to minimize bird perching, avian collisions.
8. Special Status Wildlife Species	Threatened and endangered species identified. Habitat potentially impacted through construction and maintenance phases. Proper mitigation measures required to address impacts.
9. Aquatic Biological Resources	Crossing streams or springs could impact fish and other aquatic species. Use of best management practices, design features would lead to minimal impacts.

10. Special Status Aquatic Species	There are seven federally listed fish species along the route. An effect determination would be completed after water sources are identified for construction. Best management practices would be similar to #9.
11. Cultural Resources	As stipulated in the Programmatic Agreement, an intensive Class III inventory (walk along the designated areas) would be required. If an area containing historic property is potentially affected adversely, mitigation measures would be imposed.
12. Visual Resources	Indirect impacts from new structures and changes to existing characteristic landscapes would need to be mitigated in accordance with BLM Visual Resource Management Class II and USFS Scenic Integrity Objectives or Visual Quality Objectives Retention management objectives.
13. Recreation Resources	Dispersed recreation to include motorized and non-motorized activities (fishing, hunting, camping, horseback riding, snowmobiling, off-highway vehicle trail riding) would be impacted. Impacts would be generally temporary during construction phase.
14. Land Use	Three quarters of the impacted area is on federally managed land, BLM, NPS, USFS) military operations areas are included. Compliance with land use plans, county zoning ordinances and other regulatory requirements.
15. Special Designation Areas	Areas such as wilderness study areas, wild and scenic rivers, national monuments, national conservation areas, etc.
16. Transportation	Impacts to airports, military operations would be addressed and minimize to maintain safety of airport operations and maintaining military operations without impediments. New roads for construction and access are necessary. Best management practices in place to road closure for new roads not in use after construction phase.
17. Social and Economic Resources	No high adverse effects on human health or environmental resources identified. Initial employment during construction phase but reduced after.
18. Human Health and Safety	Health and safety limited to mostly construction workers. Mitigation to excessive noise levels, collision hazards, electrical shock, electric and magnetic fields, stray and induced voltage, would be mitigated through best management practices and other safety related training programs.
19. Wild Horses	Potential impact to BLM's horse gathering efforts in the nine wild horse herd management areas.
20. Lands with Wilderness Characteristics	Only one area could be impacted in Utah. The land use plan includes requirements to maintain, protect and preserve the characteristics if impacted.
21. Wildland Fire	Unpredictable but disturbance identified during construction may increase the risk. Best management practices and vegetation management would be required.
22. Migratory Birds	Impacts on migratory birds and their habitat would be minimized through the use of best management practices and proposed mitigation measures. The company developed the Avian Protection Plan to ensure proper management and safety tools.

The BLM issued the Record of Decision in 2016, WAPA, BOR and the USFS issued their individual Records of Decision in 2017. Non-trust lands from the Ute Indian Tribe of the Uintah and Ouray Reservation are within the construction route of the project. As a result, TWE and the tribe signed agreements related to employment of tribal members, job training, and economic opportunities for qualified subcontracting business owned by tribal members. The tribe was among the 49 agencies cooperating with the BLM and WAPA.

TWE was required to submit a Plan of Development (POD) to document the agreements and requirements made during the NEPA process, i.e. mitigation for wildlife, surface disturbance,

redesign, and road rehabilitation. A ROW grant was issued following the submission of POD and the NEPA Record of Decision (ROD).[BLM ROW, 2017]. The grant includes the terms and conditions such as the timeframe for land occupation and rental fees.

As noted in the project timeline, it took approximately 12 years to approve the project from the time it was decided to proceed to the process required for federal lands. The coordination between stakeholders and government agencies at all levels was vital to ensure proper compliance with the regulatory roadmap for such a project. The company must secure county and private land owner approvals before construction begins.

Next Steps

TWE is in the process of obtaining conditional use permits from counties along the route. Regulations differ from state to state. For example, TWE must obtain a permit from the Wyoming Industrial Siting Council. TWE is also seeking approval for conditional use permits from various counties in the states along the route. In Utah, Carbon County has given its approval to TWE for the CUP. TWE is also seeking agreements from private land owners along the route. The Moffat County Commission is considering TWE's conditional use permit application at this time, however, issues concerning the decisions in BLM's ROD are creating some concern for the commissioners. Until TWE secures all the permits required, construction will not begin.

The Argonne National Laboratory issued a resource document in 2007 that details design, construction and operation of high-voltage electricity transmission technologies. The reference to this report is to provide the reader with technical information about the infrastructure for generation and distribution of electricity [Molburg et al., 2007].

5.5 Regulatory Roadmap for Solar and Wind Energy Access and Approval

This section will focus on the regulatory roadmap for solar and wind energy projects at the various levels of land management and land ownership. BLM, SITLA, USFS, and counties in Utah have separate regulatory processes in place. BLM is the largest federal land management agency in Utah, and therefore the regulatory framework for permitting solar and wind projects will be highlighted in this section. Further, the rules for BLM ROW grants or leases are the same for wind and solar projects and therefore the section is combined to minimize duplicative details. The regulatory roadmap for the Utah School and Institutional Trust Lands Administration (SITLA) and the steps required for obtaining a Conditional Use Permit from Utah counties are also similar for wind and solar.

Projects on tribal lands vary from one tribal government to another and should be coordinated with individual tribes and if applicable with the Bureau of Indian Affairs. The key points to consider with tribal interests are cultural and historic properties which was outlined in the land use planning and environmental review section.

Federal

Department of Defense

The interactive map associated with this report will provide valuable insight to potential issues with existing military operations and renewable energy projects. At the same time, the map will assist in highlighting opportunities for renewable energy projects in Utah. Upon a review of the map and other materials in this report, contacting the military to discuss details of a proposed project will eliminate time consuming steps and additional costs if conflicts are identified. Additionally, the Federal Aviation Administration (FAA) should also be consulted if the project is near airports. It will provide a determination for the safety and design of the project.

BLM and the Department of Defense have a Wind Energy Protocol in place to facilitate compatible uses of public land for wind energy projects and military operations. Such an agreement/protocol can enhance communication and collaboration between both federal agencies in reviewing proposed ROWs for wind energy prior to approval. Any potential concerns can be addressed early on in the process of permitting the project. There are also discussions to include solar power and perhaps other technologies, but no updated protocol has been issued.

Solar and Wind Energy Projects and Approval on BLM Managed Lands

Resource Management Plans (RMPs) are important documents to ensure proposed locations are permitted for solar and wind energy projects and to understand specific stipulations required for project development. Other documents to review are the 2012 Programmatic Environmental Impact Statement (PEIS) that amended RMPs in six Western States including Utah. The ROD provides the establishment of BLM's Solar Energy Program in this region.

The other document is the Programmatic EIS (PEIS) for wind energy which was completed in 2005 and amended RMPs across BLM lands to accommodate environmental analysis for wind projects. The PEIS included policy guidance for mitigating impacts from wind energy projects to birds, wildlife and other resources.

In 2016, the BLM issued the Solar and Wind Energy Rule that changed the terms and conditions of a ROW grant (noncompetitive unless otherwise indicated) and/or lease (competitive) particularly in the areas where competitive leasing has been determined, financial incentives, application processing fees, monitoring construction, operation, maintenance, and termination fees, and rental fees, bonding costs, and fees to ensure fair market value of power pricing. The changes in the rule and the analysis for resources on public lands in the Programmatic

Environmental Impact Statements for solar and wind power set the stage for current siting projects on public lands.

The rules for utility scale projects requiring a ROW grant or lease for solar and wind power are the same and are in 43 CFR parts 2800 and 2880 and the Federal Land Policy and Management Act (FLPMA) [FLPMA, 2019]. However, the regions and names for each are different. The definition for a ROW grant and lease is as follows. Short term testing activities not to exceed three years are authorized with a short-term ROW grant (not competitive unless noted otherwise) or the specific activity is outside known competitive leasing designation. A lease will authorize solar and wind energy development facilities inside DLAs when issued under a competitive process. The term of the lease is for 30 years. Development facilities located outside Designated Leasing Areas (DLAs) and certain facilities inside DLAs are authorized with a right-of-way grant issued for up to 30 years.

Solar Power

There are three major land designations where solar projects are either prohibited or allowed. These designations are;

1. Excluded from utility-scale production.
2. Lands with some variance for production.
3. Solar Energy Zones (SEZs).

Variance Areas

Variance Areas are defined as those lands that have potential for utility-scale solar production, but are outside of the SEZs or Designated Lease Areas (DLA) and are not in the areas identified as exclusion areas. Right-of-Way grants are issued once applicants comply with all requirements. If there is interest from multiple applicants in non-DLAs, BLM may likely proceed with a competitive bid process. Competitive bidding/leasing is considered in a SEZ section since it is a DLA. The competitive process will be described following the discussion on variance areas.

The process is the same for wind energy projects. If there is interest by more than one person in a non-DLA wind energy area for a ROW grant, BLM may choose to offer a bidding/competitive lease sale. In a DLA, the BLM will hold a competitive lease sale.

Prospective applicants in variance areas (non-DLA) will first have an opportunity to meet with BLM officials to discuss possible access to public lands. Table 5.5-1 summarizes the steps necessary prior to proceeding with the NEPA process and other applicable requirements.

Table 5.5- 1: Solar Projects in Variance Areas

Steps	Action
1. Meetings with BLM	Two meetings with the applicant and BLM prior and upon submission of an application for ROW. Topics for discussion are: Status of Land Use planning; potential siting constraints; National Park Service, US Fish and Wildlife Service sensitive resource information; costs; application requirements; public involvement requirements; and timeline for the approval process. The second meeting is to ensure coordination with all federal agencies including the Department of Defense, Park Service and all State and local government agencies and Tribal Governments. Outcome of these meetings may result in preliminary indication of success or failure to secure approval for siting.
2. Application	Form SF-299 is the ROW application to be completed by the applicant [GSA SF299, 2019]. The applicant will also file a Plan of Development with information that describes proposed technology to be used, proposed location of solar panels or reflectors, buildings, transmission lines and roads. A cost recovery agreement will also be part of the submission package. The agreement will outline associated costs such as the agency's costs for processing the application, environmental review, inventories for resources, i.e. cultural, visual, and special status species.
3. Documentation of Factors	At least 25 requirements for documentation to include: financial and technical capability of the applicant, the project's conformance with land use planning decisions and the programmatic features in the Solar PEIS ROD, capacity of existing and new transmission infrastructure to avoid duplication of existing facilities; road access, coordination with all applicable government agencies, impacts to groundwater [BLM factors, 2019].
4. Outreach	At least one public meeting will be held prior to initiating environmental review to allow public the opportunity to identify issues. This is similar to a public scoping opportunity.
5. Coordination	The application will be reviewed by all appropriate federal agencies, Department of Defense, US Army Corp of Engineers, Environmental Protection Agency, NPS, USFWS, FAA if near airport, State and regional planning entities (Western Governors' Association, Western Electricity Coordinating Council, State energy offices and transmission system operators, private land owners, etc [BLM coordination, 2019].
6. Determinations	After evaluating information gathered in steps one through five, the agency may make a determination to deny the application from further consideration and without completing the formal NEPA process. The agency should demonstrate public interest with support of a reasoned analysis and information in the administrative record if the application is denied. If the agency determines to continue processing the application, the agency will proceed with applicable NEPA and other steps outlined in the application.
7. Permits	Along with final NEPA decision, secure all necessary permits including county Conditional Use Permit (CUP) and required studies and plans, i.e., cultural, tribal, wildlife.

Solar Energy Zones (SEZs)

SEZs are designated zones where the potential for utility-scale solar production is high. Utah has three designated SEZs, Escalante Valley, Milford Flats South and Wah Wah Valley. Leasing in these areas is on a competitive basis. Pending applications prior to June 30, 2009 in SEZs are processed under the land use decisions in place before new rules and the ROD for the Solar PEIS were issued.

The most recent Environmental Assessment (EA) conducted for three parcels in the Milford Flats South will be the basis for illustrating BLM's regulatory roadmap for solar energy projects in a SEZ. The analysis and details in the EA will be used to demonstrate a potential scenario for prospective bidders. The EA also includes items that the successful bidder will be required to

comply following a lease sale. Additional detail can be found in the Code of Federal Regulations Title 43 Part 2800 for ROW grants [FLMPA, 2019].

In July, 2018, the Utah BLM office issued a ROD for the EA for a possible competitive lease sale for three parcels totaling nearly 5,000 acres in the Milford Flats South Solar Energy Zone. The ROD includes the terms, conditions and stipulations for the parcels that will be offered for leasing. Prior to the lease sale, prospective bidders will understand the requirements for the design features of a project and the scope of what should be incorporated into the Plan of Development (POD) prior to BLM's Notice to Proceed (NTP) with construction [BLM MFSSEZ, 2018].

In addition, prospective bidders can analyze the scope of compliance with the following list of plans that will be required when the successful bidder submits the POD [BLM MFSSEZ, 2018].

Table 5.5- 2: BLM Compliance Requirements

Plan for Design Compliance	
1.	Worker Education and Awareness Plan
2.	Bird and Bat Conservation Strategy
3.	Decommissioning and Site Reclamation Plan
4.	Dust Abatement Plan
5.	Spill Prevention and Emergency Response Plan
6.	Hazardous Materials and Waste Management Plan
7.	Health and Safety Program
8.	Groundwater Monitoring and Reporting Plan
9.	Fire Management Plan
10.	Lighting Management Plan
11.	Integrated Weed Management Plan
12.	Raven Management Plan
13.	Site Rehabilitation and Restoration Plan
14.	Storm water Pollution Prevention Plan
15.	Site Drainage Plan
16.	Traffic Management Plan
17.	Surface Water Quality Management Plan

In addition to these requirements, the ROD notes that the successful bidder will have to comply with regulations governing cultural resources. A Class III survey must be completed prior to construction. If any historic properties are identified, a plan for avoidance and/or mitigation must be submitted along with an agreement from the State Historic Preservation Office (SHPO). As mentioned previously, the SHPO will outline specific mitigation measures if the project is likely to have adverse effects on historic properties. The terms would be outlined in a Memorandum of Agreement.

The ROD also notes that if the solar project negatively impacts livestock grazing in the project area, mitigation for impacts and compensation to any livestock permittees in the project area will be required. Depending on the degree of impact, compensation could be for range improvements previously made by the livestock permittee, new range improvements to ensure livestock are kept separate from the solar project. A reasonable amount of notification must be given to livestock permittees impacted by the project and who may want to make alternative business and management arrangements due to the presence of the solar project. Therefore, upon acceptance of a POD that will likely adversely affect current livestock grazing operations, the BLM authorized officer will send a certified letter to the permittee/lessee to serve as the 2-year notification of the BLM's potential decision affecting the status of the grazing permit as required by 43 CFR 4110.4-2(b).

Stipulations to accommodate sensitive species are also mandated for the project area. There are eleven sensitive species that will require mitigation. Table 5.5-3 provides the specific mandates per sensitive species [BLM MFSSEZ, 2018].

Table 5.5- 3: Stipulations for Sensitive Species

Species	Stipulation/Mitigation
Dark Kangaroo Mouse	Avoid occupied habitat by 330 feet year round, or mitigate impacts.
Kit Fox	Avoid occupied burrows by 330 feet year round, or mitigate impacts.
Pygmy Rabbit	Avoid occupied habitat by 330 feet year round, or mitigate impacts
Bald Eagle	1.0 mile nest buffer. January 1 through August 31
Brewer's Sparrow	100 foot nest buffer, April 1 through July 31
Burrowing Owl	0.25 mile nest buffer March 1 through August 31
Ferruginous Hawk	0.25 mile nest buffer March 1 through August 31
Golden Eagle	0.5 mile nest buffer March 1 through August 31
Long-billed Curlew	100 foot nest buffer April 1 through July 31
Sage Thrasher	100 foot nest buffer April 1 through July 31
Short-eared Owl	0.25 mile nest buffer March 1 through August 1

Competitive Lease Sale

When BLM decides to hold the lease sale, it will notify the public 30 days in advance with a Call for Nominations through various public sources including the *Federal Register*. The call for nominations will detail the method of the lease auction, i.e., internet, oral auction, sealed bids, etc. The notice will provide the public with details of date, time, location and the map/legal descriptions of the parcels to be offered. The notice will also include the items that would be required upon submission of nominations [FR, 2016]. The following is a summary of the items to be submitted with nominations.

Individuals must submit a nomination in writing with name and personal/business address. The nomination must include a **nomination fee** per acre, the legal description of the parcel(s) and map of the lands for nomination. Bid submissions must include a **minimum bid** which is the cost incurred by the federal agencies in preparing for the lease sale and environmental reviews and an amount determined by the agency for potential value of the parcel such as megawatt capacity fee and acreage rent (only successful bidders will eventually pay the minimum bid). In addition to the nomination fee and minimum bid, individuals must submit 20 percent of the **bonus bid**, the amount offered at the discretion of an individual bidder and the amount the agency will use to determine which bidder has offered the highest bid for the parcel(s). The highest total bid will be selected as the successful submission. Upon notification and acceptance

of a successful bid, the bidder has 15 calendar days to submit full payment of the bonus bid.

If the agency rejects the highest bid due to regulatory non-compliance, the agency may select the next highest bid. In case of a tie, the agency may elect to re-offer the parcels either to the tying bidders or to the entire group of bidders. If no bids are received during the auction, the agency may re-offer the parcels at another date or may make the lands available for lease under non-competitive rules established by the agency.

In addition to environmental, cultural, wildlife, livestock and other issues previously discussed, the successful bidder will be required to pay fees determined by the agency. Various fees include cost recovery of studies, administrative costs for processing applications, annual rental fees, performance and reclamation bonds. The fees are calculated according to the scope of work for reimbursement to agencies, size of the leased parcel, and other factors. A typical lease will be issued for 30 years but performance on the lease must be demonstrated to maintain the length of the term.

In general, wind energy projects will have similar requirements as those in tables 5.5-2 and 5.4-3 but will differ according to the species and habitat in wind energy project areas. Fees are also different for solar and wind. Table 5.5-4 outlines the differences for each resource.

Table 5.5- 4: Fees for solar and wind projects

Fee	Solar	Wind
Rents & Fees for ROW Grants, Leases	Annual acreage rent and a phased-in megawatt capacity fee. Based on National Agricultural Statistics Service (NASS) data. State specific reduction varies by state. Based on encumbrance factor and varies by county (100%). Depending on option chosen (standard or scheduled), fair market value rents vary as well as other factors. CFR includes detailed formula.	Grants -Annual per acre zone rate from the wind energy acreage schedule multiplied by the per acre zone rate from the wind energy acreage rent schedule. Detailed formula is included in CFR. Leases- Per acre zone rate; assignment of counties; acreage rent payment. Formula is dependent on option chosen (standard or scheduled) 10% encumbrance factor
Application Fee	$15 per acre outside DLA; $5 per acre inside a DLA	same
Minimum Bond under Grant	Minimum Bond and Reclamation Cost Estimate (RCE) required; $10,000 per acre	$10,000 per wind turbine less than 1 MW or $20,000 per wind turbine equal or greater than 1 MW
Standard Bond under Lease	No Reclamation Cost Estimate Required. But bond amount is same	No Reclamation Cost Estimate required but rates per turbine remain the same

As noted in previous sections, early collaboration with the military and regulatory agencies across all government levels is essential. Late last year, the BLM rejected a massive wind energy project along the Nevada/California state line. The project known as the Crescent Peak Wind Project ran against several issues including impacts to scenic values from wind towers, radio interference from rotating blades, potential interference with Clark County's expansion plans for a nearby airport, impacts to Native American sites, impacts to wilderness and various sensitive species. The nearly 250 wind turbine projects would have generated 500 megawatts of electricity and would have been located on nearly 33,000 acres of land. The amount of electricity generated from this wind farm would have been enough to power approximately 125,000 to 150,000 homes.

The objection to the project came from local residents, environmental groups, and Native Americans and was potentially outside the scope of BLM's RMP for the area. While the latter issue had been raised early on, BLM proceeded with its review and public input process. Without amending the RMP, the project proponent would have a difficult time getting such a project approved.

SITLA

The School and Institutional Trust Lands Administration leases trust lands for renewable energy projects and other energy and mineral resources. The process for solar and wind energy projects is the same under SITLA. A prospective applicant can fill out a two-page Special Use Lease application form and submit the form with a non-refundable application fee of $250. The agency will first review the application. The agency will notify the public and other agencies that an application has been received by sending notification to the Resource Development Coordinating Committee (RDCC). The RDCC is part of the Governor's Public Lands Policy Coordination Office (PLPCO). The agency also notifies adjacent land owners, county governments, and potential competitors when there is interest from other parties. The agency will consider a competitive bid process, but it rarely receives multiple interest on the applications.

Once the notice is determined to be complete, the agency performs an analysis on the application. Meetings are held between the agency and applicant to ensure accurate data and expectations for the lease. Following internal review, including any comments submitted from the RDCC notification, SITLA can issue a lease to the lessee.

The RDCC supports the state planning coordinator in the review and coordination of technical and policy issues, particularly where state resources are impacted. The RDCC includes representatives with state land management responsibilities. SITLA submits applications for renewable energy projects to the RDCC to ensure compliance with federal and state legal requirements. The RDCC has a Project Management System where projects and applications are available for public comment and coordination [PLPCO, 2019]. While SITLA is exempted from NEPA, it must comply with cultural and archeological requirements, water and air quality, and state and federal wildlife resources.

SITLA requires a construction bond and reclamation bond as needed to protect the interests of their beneficiaries. These bonds are similar to the bonds required by BLM. Fees on a SITLA renewable energy project are based on the energy produced by the project (production rent) or lease acreage rent. Pre-development rents are also charged based on acreage leased until energy production begins. Leases on SITLA are generally for 25 to 30 years with options for two 5-year extensions thereafter.

County Conditional Use Permits (CUP)

In accordance with Utah state law, counties are required to develop rules for the approval of permitted uses in defined zoning areas. Renewable energy projects and transmission line siting must obtain a Conditional Use Permit from the county prior to construction regardless of an approval from the cognizant federal or state agency. Each county has rules in place but all follow from the state code for zoning requirements. For purposes of this report, Iron County rules will be the example for a typical regulatory roadmap for obtaining a CUP.

Specific rules for CUPs are in the Iron County Code of Ordinances [ICCO, 2019]., see Chapter 17.28 for general rules, Chapter 17.33 for solar projects and Chapter 17.34 for wind projects. Project proponents must submit an application provided by the county which includes similar level of detail as the federal and state forms, including site plan, location and any permits that have been approved. The proposed action must conform to the county land management code. Once the criteria are deemed in compliance, the county may grant a CUP based on the application and on other information from the public hearing on the application.

Table 5.5-5 provides specific items that must be met in general prior to a CUP for a specific use.

Table 5.5- 5: Iron County Rules for application and approval for renewable energy projects

Iron County Criteria for Approval – Application and Public Hearing [ICCO, 2019].	
1.	The proposed use at the proposed location will not be unduly detrimental or injurious to property or improvements in the vicinity and will not be detrimental to the public health, safety or general welfare.
2.	The proposed use will be located and conducted in compliance with the goals and policies of the Iron County general plan and the purposes of this title and the land management code.
3.	The property on which the use, building or other structure is proposed is of adequate size and dimensions to permit the conduct of the use in such a manner that will not be materially detrimental to adjoining and surrounding properties.
4.	Does not propose any construction on any critical lands as defined in Section 17.36.020 of this title.

The county may also impose stipulations and conditions as part of the general operational use of the area where the proposed use will be located, indicated in Table 5.5-6.

Table 5.5- 6: Iron County Conditions & Stipulations for renewable energy projects.

Iron County Stipulations, Conditions and Restrictions Upon Approval [ICCO, 2019].	
1.	The site will be suitably landscaped and maintained and that the design, setbacks, fences, walls and buffers of all buildings and other structures are adequate to protect property and preserve and/or enhance the appearance and character of the area;
2.	All buildings or other structures are designed to add to the quality of the area;
3.	Provision of parking facilities, including vehicular ingress and egress, loading and unloading areas and the surfacing of parking areas and driveways to specified standards;
4.	Provision of required street and highway dedication and improvements and adequate water supply, sewage disposal and fire protection;
	Mitigation of nuisance factors, such as noise, vibrations, smoke, dust, dirt, odors, gases, noxious matter, heat, glare, electro-magnetic disturbances and radiation;
5.	Regulation of operating hours for activities affecting normal schedules and functions;
6.	Regulation of signs;
7.	Provision of a reasonable guarantee, bond or other surety, as determined by the planning commission, that the proposed conditional use will be maintained and operated in compliance with all conditions and requirements;
8.	Identifying a time for regular review and monitoring as determined necessary by the planning commission to ensure the use continues to operate in compliance with all conditions and requirements of approval;
9.	Such other conditions determined necessary by the planning commission to allow the establishment and operation of the proposed conditional use in an orderly and efficient manner and in compliance with all elements of the general plan and the intent and purposes of the land management code.

Specific to utility scale solar energy projects and power plants, Iron County requires specific rules for design and if possible other permit applications for substations or transmission lines that will be considered as part of the proposed power plant project. Table 5.5-7 includes the county's standards for design of solar power plants.

Table 5.5- 7: Iron County solar design standards

Iron County Solar Power Plant Design Standards [ICCO, 2019].
Minimum Lot Size. No concentrated solar thermal power plant shall be erected on any lot less than forty acres in size. No photovoltaic solar power plant shall be erected on any lot less than five acres in size.
Maximum Height. The maximum height for all structures shall be established through the conditional use permit process, provided a structure height of thirty feet or less shall always be permitted.
Setbacks. Solar power plant structures shall be set back from all property lines and public road rights-of-way at least thirty feet, or one and one-half times the height of the structure, whichever is greater. In addition, solar power plant structures must be located at least one hundred feet from all residentially zoned lots and existing residences. Additional setbacks may be required to mitigate noise and glare impacts, or to provide for designated road or utility corridors, as identified through the review process.
An appropriate **security/livestock fence** (height and material to be established through the conditional use permit process) shall be placed around the perimeter of the solar power plant. Knox boxes and keys shall be provided at locked entrances for emergency personnel access. b. Appropriate warning signage shall be placed at the entrance and perimeter of the solar power plant project.
Noise. No operating solar power plant shall produce noise that exceeds any of the following limitations. Adequate setbacks shall be provided to comply with these limitations. a. Fifty dBA, as measured at the property line of any neighboring residentially-zoned lot; b. Forty-five dBA, as measured at any existing neighboring residence between the hours of nine p.m. and seven a.m. c. Sixty dBA, as measured at the property lines of the project boundary, unless the owner of the affected property and the planning commission agree to a higher noise level as specified in the rules. This requires an agreement with neighboring property owner and the agreement must be filed with the County Recorder upon CUP grant.
Visual Appearance. a. Solar power plant buildings and accessory structures shall, to the extent reasonably possible, use materials, colors, and textures that will blend the facility into the existing environment. b. Appropriate landscaping and/or screening materials may be required to help screen the solar power plant and accessory structures from major roads and neighboring residences. c. No solar power plant tower or other tall structure associated with a solar power plant shall be lighted unless required by the Federal Aviation Administration (FAA). When lighting is required by FAA, it shall be the red, intermittent, glowing-style, rather than the white, strobe-style, unless disclosed and justified through the application review process. Aircraft sensor systems to turn the lights on only when low-flying aircraft are in the area may be required. d. Lighting of the solar power plant and accessory structures shall be limited to the minimum necessary and full cut-off lighting (e.g., dark sky compliant) may be required when determined necessary to mitigate visual impacts. e. No solar power plant shall produce glare that would constitute a nuisance to occupants of neighboring properties or persons traveling neighboring roads.
Electrical Interconnections. All electrical interconnection and distribution lines within the project boundary shall be underground, unless determined otherwise by the planning commission because of severe environmental constraints (e.g. wetlands, cliffs, hard bedrock), and except for power lines that leave the project or are within the substation. All electrical interconnections and distribution components must comply with all applicable codes and public utility requirements.
Fire Protection. All solar power plants shall have a defensible space for fire protection in accordance with the Iron County Wildland-Urban Interface Code.

Local, State and Federal Permits. A solar power plant shall be required to obtain all necessary permits from the Utah Department of Environmental Quality, including the Utah Division of Air Quality and the Utah Division of Water Quality, applicable permits required by Iron County, and applicable Federal permits.
Agreements/Easements. If the land on which the project is proposed is to be leased, rather than owned, by the solar energy development company, all property within the project boundary must be included in a recorded easement(s), lease(s), or consent agreement(s) specifying the applicable uses for the duration of the project. All necessary leases, easements, or other agreements between the solar development company and the affected parties must be in place prior to commencing construction, unless specified otherwise by the conditional use permit.

In general, Iron County requires the proponent to provide:

1. A rationale for the project to include construction schedule, anticipated life of the project, customers and markets where the energy will be sold;
2. Siting considerations that would avoid areas of concern such as wildlife habitat, wilderness study areas, soils, water quality, cultural, historic and archeological resources;
3. Site development plans;
4. Economic benefit analysis for the local area;
5. Visual Impacts and Scenic view to include possible Zone of Theoretical Visibility/Zone of Visual Impact analysis;
6. Wildlife habitat and migration areas considerations to include information specific to threatened and endangered species;
7. Environmental analysis that may not be part of a federal or state process to ensure consideration of potential impacts to the environment;
8. Solid waste or hazardous waste mitigation plans;
9. Federal Aviation Administration review of height restrictions and ensure potential hazards to navigation operations do not exist or are addressed in the final review;
10. Construction of new roads if applicable and use of existing transportation systems;
11. Public safety and plan to address potential safety to communities, adjacent properties, roadways;
12. Noise and compliance with noise limitations;
13. Rehabilitation plan upon the termination of the project. Revegetation and reclamation of the affected areas; and
14. Other areas of impact that may have been identified during the review process [ICCO, 2019]. Application fees and taxes will be determined according to the county's current rate schedule.

The final approval of a CUP is made by the zoning board and the board of County Commissioners.

Wind Power

The county establishes minimum requirements for small, commercial and wind metering towers and equipment [ICCO, 2019]. Like solar power, Iron County zoning designations for wind

projects are listed in their code, Chapter 17.34. A brief overview of their requirements include location, design standards and permit applications for small, commercial and metering towers.

For purposes of this report, Table 5.5.8 will outline the requirements for a commercial-scale wind energy project.

Table 5.5- 8: Iron County Commercial Wind Project Standards

Locations: County Zoning Ordinances will apply, and location permitted accordingly.
Design Standards: Pole or Tower Design, Minimum Blade Height, Safety and Access, Setbacks, Spacing etc.
Noise: dBA rating requirements. Setback and Noise Waivers between landowner(s) and wind project developer.
Visual Appearance: Color requirements, lighting if only Federal Aviation Administration (FAA) requires, no advertising signs permitted, accessory buildings and facilities to the extent possible should blend with entire project, shadow flicker (changes in light intensity caused by blade movement casting shadows on an object such as a window) analysis required, landscaping, view-shed analysis and potential mitigation from view-shed impact.
Electrical Interconnections: Require all electrical interconnection and distribution lines underground unless specified for environmental reasons. Transmission lines (33 and half kV lines would be above ground.
Signal Interference: Avoid blocking or reflecting television and other communication signals.
Fire Protection: Require a defensible space for fire protection.
Permit Application: Must include a complete description of the project, documentation to demonstrate capability and satisfying compliance with all requirements outlined in relevant sections for wind energy.

Consideration for approving the CUP will be based on the rationale for the project, compliance with standards listed in table 5.4.7; siting considerations, development plans, economic benefits, visual impacts, mitigation plans for wildlife habitat and migration patterns, environmental review (cultural, historic and archaeological resources, soil erosion, land use authority), solid and hazardous waste prevention and disposal, FAA review and compliance, noise limitations, etc.

These examples are provided to summarize typical and actual requirements. However, applicants must always confirm with each entity the current requirements for siting any renewable project and to confirm potential conflicts with military or other uses of land anticipated for a project. The interactive map and the regulatory roadmap are helpful tools for planning purposes.

5.6 Regulatory Roadmap for Geothermal Energy in Utah

This section will summarize the regulatory roadmap for geothermal renewable resources in Utah. Unlike wind and solar energy regulations, geothermal energy is similar to oil and gas exploration, drilling, development and production. As in oil and gas, the Bureau of Land Management has the delegated authority to lease on public lands including those within the U.S. Forest Service system provided the Forest Service land use plans allow access to the resource and gives consent to the BLM for parcel(s) to be included in an anticipated lease sale.

As a result of new regulations issued by the BLM in 2007, lands where geothermal resources exist are leased mainly on a competitive basis. Similar to solar and wind, the BLM issued a ROD for a Programmatic EIS (PEIS) to amend RMPs across the BLM with 111 million acres designated as open for geothermal leasing on lands managed by the BLM. The USFS estimates there are about 79 million acres under its jurisdiction in the western United States that have potential for geothermal resource.

There are two geothermal electrical generation power plants in southern and central Utah. Increased interest in geothermal energy is resulting in new research to increase efficient access to geothermal resources. The U.S. Department of Energy established a partnership between universities, national laboratories, federal, state and private industry to develop innovative Enhanced Geothermal Systems (EGS) technologies, see Section 4.5. The field laboratory is located in Beaver County and the lead research group is from the University of Utah at the Energy & Geoscience Institute in Salt Lake City [Utah Forge, 2019].

The regulations for federal leasing of geothermal resources can be found in 43 CFR Part 3200. Like solar and wind energy resources, key documents to review include land use plans and environmental review from government land ownership/management agencies such as the BLM, SITLA, Forest Service and the tribes. The PEIS authorizing geothermal on BLM lands will provide more specific detail about locations and potential stipulations that would be required on a geothermal lease.

Tables 5.6-1-4 outline the steps for leasing, fees, permitting, exploration and development of geothermal systems on BLM land.

Table 5.6- 1: BLM Geothermal Leasing Steps

Leasing Steps	
Call for nominations	Industry can nominate parcel(s) ranging from 640 acres and not to exceed more than 5,120 acres unless stated circumstances apply. BLM can also identify parcel(s) for nomination in a lease sale. At least 45 days prior to the lease sale, BLM will notify the public that will hold a lease sale. The notice will include the time, date, place, list of parcels available for leasing including stipulations attached to each parcel.
NEPA	BLM conducts environmental analysis prior to lease sale. Any stipulations or other pertinent information to the parcels offered for sale will be provided in the NEPA document and on the call for nominations.
Day of Lease sale **15 calendar days after lease sale**	Prospective developers offer bonus bid. Highest bid wins parcel. Winning bid must submit 20 percent of the bonus bid, the total amount of first year's rental fee, processing fee for competitive lease application. Winning bid submits the balance of the bonus bid. Failure to submit all payments required will cancel bid and BLM retains any fees submitted prior.
Leases offered but not sold	After the lease sale, BLM has the option to offer any geothermal leases not sold beginning the day following the lease sale for the next two years. The leases will be offered on a noncompetitive basis.
Lease Awarded	BLM will award the lease once the successful bidder has paid required fees, accepts the stipulations for the lease and complies with maximum limit on acreage holdings. A person may not hold more than 51200 acres in any one state.
Terms of the Lease	Primary term is ten years, with an initial extension of five years, and another 5 year extension following. A drilling extension of five years. Production extension of 35 years and a renewal of up to 55 years. To obtain extensions, BLM requires a certain minimum amount of activity and money spent on the lease.

Table 5.6- 2: BLM Geothermal Fees

Fees	
Non Competitive Lease application	$425
Competitive Lease Application	$165
Lease Consolidation, Name change, Lease Reinstatement	$470 (Consolidation) $225 (Name change) $85 (Reinstatement)
Nomination of lands	$120 plus 0.12 per acre
Bonus Bid	Amount at the discretion of bidder that determines highest amount to win parcel(s)
Annual Rental Fee from a competitive sale	$2 per acre for the first year and $3 per acre from year 2nd to 10th. After 10th year, the fee is $5 per acre. Once the lease is producing in commercial quantities, the lease holder will pay royalties.
Annual Rental Fee from noncompetitive process	$1 per acre annually for the first ten years.
Royalty	Electricity generated from the geothermal lease in commercial quantity will be subject to a 1.75 percent royalty rate for the first ten years and 3.5 percent thereafter. The rate is applied on the gross proceeds from the sale of electricity. Other factors may apply that will affect the rate.
Bond	The amount varies depending on the purpose of the bond. Bonding may be for exploration operations, drilling and utilization if the change of work to be performed is not in a previous permit.

Table 5.6- 3: BLM Permitting Requirements

Permitting	
County CUP	County of jurisdiction will issue CUP based on the requirements of local zoning regulations and policies.
Clean Water and Clean Air	Utah Department of Environmental Quality

Table 5.6- 4: BLM Exploration and Development Rules

Exploration and Development Rules	
Notice of Intent to Conduct Geothermal Resource Exploration Operations	Lease holder provides BLM notice when plans are made for geophysical operations, drilling temperature gradient wells, drilling holes for seismic exploration, core drilling.
Approved plans	Ensure leaseholder has been given approval for activity plans, permits, conditions of approval etc., prior to surface disturbance activities.
Environmental consideration during exploration operations	Protect quality of surface, water, air, soil, vegetation, wildlife, cultural, scenic and recreational resources. Where appropriate, use pits, tanks when drilling for temperature gradient wells
Drilling temperature gradient well	Depths approved in the permit but cannot include a flow test or perform an injection test during this exploration phase. Once complete and no longer in use, regulations provide for well abandonment and reclamation.
Well Completion	Required to submit well history, copy of all logs, directional surveys, all mechanical, flow, reservoir and other test data.
Record Keeping for each well completed	Drilling log, water or steam analyses, hydrologic or heat flows, directional surveys, well completion activities such as cementing, perforating, etc.
BLM inspection	All federal drilling and activity operations, well logs, maps, books, accounts. Regulations for noncompliance apply should BLM find adverse conditions, actions, etc.

SITLA

Current activity from geothermal leases on SITLA lands include two operations in south central Utah. One operation is a binary geothermal power plant with an electrical generating capacity of 10.3 megawatts employing nine full-time employees and generating a total of nearly $840,000 in royalties. The second operation is a geothermal plant owned and operated by PacifiCorp Energy employing 23 full time employees and generating an electrical capacity of 34 megawatts. The royalties generated to date are nearly $1.5 million.

Rules guiding the leasing of geothermal resources on state trust lands are in R850-24, R850-25 and R850-27. As previously noted, SITLA does not require a land use planning process unless it chooses to participate in other ongoing efforts. However, there are several requirements

applicants must meet prior to obtaining a permit or lease and during exploration and development phases. Prior to acquiring a permit or lease, an applicant will be required to comply with the following [UAC R850-25, 2019].

- Obtain insurance coverage and post a bond to ensure the applicant pays for any reclamation or damage to trust lands.
- Submit payment for annual rental fees and royalties once lease is in production.
- Submit a plan of operations prior to conducting any surface disturbance activities on trust lands. The plan must include a completed survey of cultural, paleontological and biological survey.
- Provide an action plan for any potential mitigation from project impacts.
- A negotiated surface use agreement and/or right-of-way agreement.
- Agree to comply with surface disturbance limitations such as for pits, roads, etc.

Lease Application

A lease can be issued competitively or non-competitively or can be issued as part of a joint venture/business arrangement. The lease is issued for not less than a quarter-quarter section and no more than 640 acres. The term on the primary lease will not exceed ten years but can be extended as long as the lease is producing in paying quantities, activity on the lease demonstrates diligent operations, and annual minimum royalties are paid.

The lease holder may modify the initial lease with approval from the agency if the lease will be part of a unit, cooperative or plans of development with other lands. The stipulations for production may change however, when the lease is modified.

Rental rates are set by the agency director, but the rate cannot be less than $1.00 per acre per year and the minimum annual rental is $500. Rental costs are paid annually and credit toward rental costs can be achieved when production royalties under prescribed scenarios.

Royalty rates are set by the director of the agency, but the production royalty rate is not less than 10 percent.

In a non-competitive lease application, the application is filed with the agency during office hours or by mail. If multiple applicants file for same parcels/area with same bid, the agency may either award the lease by public drawing or oral bidding.

In a competitive lease scenario, the minimum bid accepted is at least equal to the rental rate for the first year of the lease. The public notice for the parcels offered in a competitive bid filing will be posted for 15 days after the initial posting. Applications must be submitted in sealed envelopes with appropriate notation, “competitive bid” on the envelope. The lease is awarded to

the highest qualifying bid application.

Following notification of the lease award, the lease holder must submit a plan of operations to include specific surface disturbance activity, drilling operations, required land and cultural surveys, as noted previously. The plan must be approved by the agency prior to any construction or surface disturbance on the lease.

County Conditional Use Permit

As noted above, Iron County is the example utilized in this report to outline a typical regulatory roadmap for siting and approving renewable energy projects. The Iron County process for geothermal power plants is as follows.

County zoning ordinances will dictate locations permissible for permitting a geothermal power plant. In addition, the following requirements must be met.

- The county rules require that a power plant be located in an area greater than 20 acres.
- The total height of the tallest cooling tower cannot be taller than 50 feet.
- Setback requirements from public buildings (churches, parks, hospital, schools, playgrounds) and from property lines, public road ROWs.
- Safety and access measures required.
- Noise limitations from a power plant cannot exceed 65 dBA from a property line or 50 dBA from the nearest building.
- Visual appearance must be designed to the extent possible to blend with local landscape and natural settings. Mitigation for visual impact may be required.
- Defensible space for fire protection as required by the Wildland-Urban Interface Code.
- Permits from The Utah Divisions of Water Quality and Air Quality must be approved as well as permits required by federal agencies and county.
- Compliance with all public utility and applicable codes for electrical interconnection and distribution lines.

Factors for Consideration of a CUP

The County will review a number of factors when reviewing and considering the approval of CUP. The list below summarizes the factors.

- The applicant must provide a rationale for the project to include time frames, expected life of the project, markets anticipated for energy use/purchase, potential expansion.
- Location of facilities and proper consideration for mitigating or avoiding areas with certain restrictions, i.e. wilderness, sensitive species and habitat, etc.
- Plans and map of project facilities, location, ancillary equipment/structures.

- Economic analysis to include property taxes, sales taxes, and any other economic benefits projected in the area.
- Lighting and FAA height restrictions
- Reclamation
- Factors will also include those noted above.

In addition to these requirements, applications must include elevations of the site to scale showing height, design and configuration of the plant and all associated structures, electrical lines and property lines. The application must also include the soil conditions of the site, the type, size rated power output, performance, safety and noise characteristics of the system. The applicant must provide evidence of the intent to install an interconnected electricity generator if connecting to electrical grid and if applicable must provide evidence of a net metering interconnection application or work order from the utility company [ICCO, 2019].

These examples are provided to summarize typical and actual requirements. However, applicants must always confirm with each entity the current requirements for siting any renewable project and to confirm potential conflicts with military or other uses of land anticipated for a project. The interactive map and the regulatory roadmap are helpful tools for planning purposes.

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Section 6: Best Practices and Opportunities to Enhance Collaboration and Address Data/Process Gaps (Team)

6.1 Process Improvements

During the interview process, stakeholders expressed several issues, opportunities and challenges with developing renewable energy projects in Utah. Some of the concerns are outside the scope of this report but nonetheless can be noted in brief as the group maintains ongoing collaboration and communication beyond the duration of the grant. The opinions expressed here are those of individual stakeholders and do not necessarily reflect those of the Department of Defense, The Utah Governor's Energy Office, Utah Geological Survey, or Utah State University.

Communication and Collaboration

One of the suggestions was concerned with increasing communication and collaboration among stakeholders, particularly between developers and military officials. This project provides tools to enhance communication and information exchange on areas where renewable energy projects can be developed efficiently, and the interactive map indicates activities with the potential to interfere with military operations. Exchanges between developers and the military can determine the extent of any conflicts and whether those conflicts can be mitigated through adjustments in location and project design, thereby maintaining the ability to site the project.

Tools such as protocol agreements or formal memoranda of understanding can be beneficial. The BLM and the military have a Protocol Agreement on wind projects. The document establishes a process to ensure communication and collaboration as well as exploring mitigation measures necessary to minimize impacts from wind projects on military operations. Such agreements might be expanded to include other renewable energy projects like solar power and include other land management agencies.

Infrastructure and Grid access

One challenge is focused on access to the electrical grid and the process for gaining access, and would require external consultation and collaboration. The OASIS website has been identified as the portal for developers to get queued up for access to the grid when transmission line capacity becomes available. There is an opportunity for developers and the major electrical utility to discuss streamlining the OASIS process. Discussions can focus on the length of time for access and on predictable outcomes. The issue is timely because demand for renewable energy is expected to increase. There are private citizens and companies that have expressed the desire to obtain 100% of their electrical power from renewable energy sources, as exemplified, for example, by RMP's Blue Sky program. Additionally, counties in southern Utah have established marketing efforts to include renewable energy. As the demand and interest increases for more renewable energy, strategies to resolve this challenge may be found.

The private sector and the military expressed the desire to store energy generated from renewable projects so as to maintain a reliable source of energy without depending on third-party infrastructure. Micro-grids employing multiple energy sources and effective energy storage technology, and operating at military installations, should be an especially effective method to keep critical military operations from dependence on the external power grid, which may be a target of malicious or hostile action. As mentioned above, battery or other storage technologies are critical for the use of renewable energy. The issue of effective energy storage is an active research area throughout the world.

Financing

Incentives provided by State Government are an area of interest to stakeholders. The federal tax credit for renewable energy was extended but will decrease next year by 4%, by another 4% the following year, and in 2022 will decrease to 10%.[CGB, 2017]. Other states, such as Connecticut have a green bank, a financial model with the ultimate goal of increasing opportunities for more renewable energy projects in the state at lower rates for the consumer. The program has been in existence since 2011.

Access to Land for Renewable Energy Projects

Most developers indicated that privately-owned or state-managed lands are preferable to federal lands for the development of renewable energy projects, mainly because of the length of time required to obtain approval due to complex regulations. However, there are ongoing efforts to reduce or eliminate some of the more complex or redundant regulations and encourage greater collaboration among agencies for major projects.

6.2. Process Improvements by Stakeholder Group

The following is a summary of the input received from stakeholders during interviews for this project. The comments are separated according to categories of interest in the stakeholder group. The opinions expressed here are those of individual stakeholders and do not necessarily reflect those of the Department of Defense, The Utah Governor's Energy Office, Utah Geological Survey, or Utah State University.

Military

- Renewable energy projects are necessary so long as they are not within critical areas of military operations. The interactive map and early collaboration between the military and developers are key.
- Reliable energy sources are needed to sustain operations particularly in times of short- and long-term interruptions.

a. Self-sustaining and independent of the electrical grid for energy security purposes and to avoid mission interruptions due to energy loss.
b. They are exploring renewable energy and micro-grids for the above reasons.

- There needs to be a process in place to identify renewable energy project needs at military installations, i.e. RFP, Army Corp of Engineers, solicitation of energy savings performance contracts for renewable energy projects.
- Areas of concern related to renewable energy projects, including physical obstructions, spectral interference (light, low-frequency transmissions, magnetic disturbance, Wi-Fi transmitters), radar interference from wind turbines, glint and glare from solar installations, and environmental issues such as habitat and species protection, all need to be addressed early on in the process.

Industry

- Transmission is the main impediment to renewable energy development. There are only so many lines to carry energy load to the Salt Lake metro area. The best areas where transmission is still available are Mona to Logan and west of Tooele and north.
- When transmission access is available, they still need to get on the queue, which takes a long time. It is a highly regulated system where renewable energy and conventional energy sources compete.
- Solar power is more economical to develop than wind power. Wind resources in Utah are not as high in value as in Wyoming. But there are still some opportunities for wind projects in Utah.
- Issues between independent renewable energy operators and the major utility.
- Some companies coming to Utah are demanding renewable energy. (RMP's Blue Sky program is the currently existing mechanism to allow this.)
- The federal government has excessive regulatory requirements to site renewable energy projects.
- Renewables are on the increase. We are likely to see battery storage connected with solar systems in the future so as to deploy energy at a level rate. In 20 years, could see a completely different energy regime with emerging technology.
- Green banks in other states provide loans for renewable energy projects. We can encourage the utility to provide low rate structure.
- It would be helpful if accurate information from utilities on transmission line gaps, interval data were available.
- The Federal Tax Credit will expire, local tax credits will step down with residential zoning, changes in rate structures will affect renewable energy in the next 5-10 yrs.

Utilities

- RMP provides transmission and distribution to the military. It is looking to building solar capability at HAFB that will not flow onto the grid but stay and be utilized on base. RMP's Blue Sky Program may also be considered.

- Grid connections are made through three types of agreements: Interconnection, Power Purchase and Transmission Service.
- An Impact Study indicates transmission capacity. If there is insufficient capacity, the customer is informed of the required equipment cost in order to connect and transmit. If new transmission benefits customers then initial cost is recovered eventually. If not, then cost is the responsibility of the owner of the generation resource.
- The OASIS website is the site used to get on the queue until transmission line capacity becomes available.
- Infrastructure improvements are planned or projected, including a solar pilot project in Panguitch, they will address voltage issues at the transmission lines.
- Battery backup with photovoltaic solar generation is attractive to military as a means towards energy resilience, since battery storage can be used to stabilize the grid.
- Biogas and solar programs are top priorities for development in Utah.

Federal, State, County Regulators and Administrators

- On Federal lands, solar and wind power applications are mostly competitive although some are by application (with no competitive process), geothermal power is mostly competitive.
- Wind and solar projects are coordinated through the DoD Clearinghouse which reviews impacts between development and military test and training operations. Initial coordination with bases and with the Clearinghouse are important, so that projects with any risk of cancellation are identified before developers have invested lots of time or capital.
- The State Preservation Office looks at project impacts to cultural and archeological resources. Consultation is required for a determination.
- Solar and wind access on SITLA land is through application and allows for competition. Prior to final approval, the application goes through the RDCC.
- The RDCC is the entity for coordination between involved parties, with the military involved in coordination of land exchanges.
- County processes are consistent with Utah lands and zoning requirements. Conditional Use Permits are the primary application process for being granted approval for projects.
- Beaver County is promoting potential technology for geothermal projects. $130 million grant from DOE has been awarded (the FORGE laboratory) to test prove technology.
- Transmission capacity is constraining additional development. It is open to renewable energy of all sources.
- Except for their construction, renewable energy facilities generally do not create many jobs, because they are operated by a relatively small staff. But they certainly contribute positively to the county.
- Iron County has 19 utility-scale solar projects and a few smaller ones. Most developers avoid federal land in favor of county or private lands due to the efficiency of the county processes.

- The Millard County process is similar to other counties. They are open to renewable energy projects and some areas have been rezoned to accommodate renewable energy. The Intermountain Power Plant (a coal-fired plant scheduled for conversion to natural gas) is located in the county and interest in more renewable energy projects is growing due to the plant's presence.

6.3. Lessons Learned and Going Forward

1. Early communication and collaboration with all appropriate entities will lead to efficient and productive steps toward renewable energy projects in Utah while maintaining ongoing and vital military operations.
2. All stakeholders should continue to explore solutions for grid access and expansion.
3. Efforts should be undertaken to resolve challenges that may exist on metering and accounting of renewable energy utilized by customers.
4. It would be helpful to facilitate ongoing stakeholder meetings, either annually or semi-annually.

Reference to Section 6

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Appendix A. Additional Information

Multiple federal agencies are tasked with management of public lands and/or have regulatory authority for various activities associated with siting of renewable energy projects. The following websites and publications give additional detailed data and information necessary for the approval and siting of proposed projects. It is imperative to check with these agencies to ensure the approval process is efficient, timely and without unnecessary bureaucratic steps.

In addition, there are several other entities in Utah that can support data and information for energy projects. These sites and associated links also give additional support for project research and siting.

Department of Defense
https://www.acq.osd.mil/dodsc/
"The DoD Siting Clearinghouse works with industry to overcome risks to national security while promoting compatible domestic energy development."

Bureau of Land Management
https://www.blm.gov/programs/planning-and-nepa
https://www.blm.gov/programs/energy-and-minerals/renewable-energy/laws
https://www.blm.gov/programs/energy-and-minerals/renewable-energy
http://solarmapper.anl.gov/
https://www.blm.gov/programs/energy-and-minerals/renewable-energy/wind-energy
https://www.blm.gov/programs/energy-and-minerals/renewable-energy/geothermal-energy
https://www.blm.gov/programs/energy-and-minerals/renewable-energy/data
https://openei.org/wiki/RAPID/Geothermal
https://openei.org/wiki/RAPID/Solar
https://openei.org/wiki/RAPID/BulkTransmission

US Department of Energy
https://energy.gov/science-innovation/clean-energy
https://energy.gov/energy-economy/state-local-government

Western Area Power Administration
https://www.wapa.gov/Pages/Western.aspx

School and Institutional Trust Lands Administration
https://trustlands.utah.gov/business-groups/surface/special-use-leases/renewable-energy-facility-leases/
https://trustlands.utah.gov/policy/monitoring/resource-department-coordinating-committee/

Western Electricity Coordinating Council (WECC)
https://westernenergyboard.org/reliability/western-electricity-coordinating-council-wecc/

State of Utah County Planning
http://publiclands.utah.gov/rdcc/
https://drive.google.com/drive/folders/1syywC9lLy4RooLeTCI_ZPs4sN8QCazXg

Military Operations in Utah
http://gardner.utah.edu/wp-content/uploads/DefenseReportFinal.pdf
https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-19436.pdf

To contact tribes in Utah
https://heritage.utah.gov/utah-indian-affairs/utah-tribes

Camp Williams Joint Land Use Study
https://www.saratogaspringscity.com/851/Joint-Land-Use-Study

Land Use Academy of Utah (LUAU)
https://luau.utah.gov/about-us/

> "LUAU was created by a grant from the Utah State Legislature in 2014. Spearheaded by the Utah League of Cities and Towns LUAU is made up of a consortium of Utah interest groups who support training and education in land use for our local elected and appointed officials.
>
> "Our goal is to create the first statewide uniform and comprehensive online land use website resource to train, inform and educate elected and appointed officials and the general public in statutory land issues and best planning practices. The site is housed and managed by the Utah League of Cities and Towns working with a review board for content and oversight direction."

Office of the Property Rights Ombudsman -- Utah Department of Commerce
https://propertyrights.utah.gov/land-use-and-development/

> "As part of its mandate from the Utah Legislature, The Office of the Property Rights Ombudsman provides free training on a variety of topics including land use and development and eminent domain and takings law.
>
> "This training is ideal for citizens' groups, planning commissions, local officials, etc. The Ombudsman can meet any time during the day or evening and can travel anywhere in Utah to conduct training sessions. Attorneys in our office can tailor training to the particular needs of the audience and are prepared to answer questions individually if desired.

"The attorneys in the Ombudsman Office can provide training to private citizens, civic groups, planning commissions and city/county councils, government entities, and other interested parties upon request. Potential training topics include the following:

"The purpose and function of the OPRO and how the OPRO might assist you:
– Alternative forms of dispute resolution;
– Avoiding land use-related lawsuits: best practices for county and municipal governments;
– Recent legislative changes in the area of land use or eminent domain law;
– Land use laws and practice;
– Eminent domain laws and practice;
– Takings laws and practice;
– Exactions;
– Conditional uses and variances; and
– Appeals procedures for land use decisions.

"The Ombudsman can provide training on other topics if helpful to you.

"The Office of the Property Rights Ombudsman is committed to making relevant legal information accessible to citizens, property owners, and government officials."

The Utah Land Use Institute

https://utahlanduse.org/

"The Utah Land Use Institute was created in 2007. Its mission is to raise the professionalism of those involved in the land use arena, including planning and legal professionals, civic leaders, and citizens. We sponsor an annual fall conference, periodic seminars on various topics, and offer publications both electronically and in print through this website.

"Key Supporters of the Utah Land Use Institute:

- The S. J. & Jessie E. Quinney Foundation
- Real Property Section, Utah State Bar
- Utah League of Cities and Towns
- Utah Association of Realtors
- Salt Lake Association of Realtors
- Utah Chapter, American Planning Association"

Utah League of Cities and Towns

http://www.ulct.org/3-free/land-use-training/

> "2016 Training: We are working with the Utah Chapter of American Planning Association, the Private Property Rights Ombudsman Office and the Utah Counties Indemnity Pool to provide 4 annual training session in Land Use. Stay tuned for details and in the meantime head to our new land use resource site at Land Use Academy of Utah
>
> "Land Use Planning 101: A Training Session for Land Use Authorities in Utah
> Topics covered in this basic training session include:
> • Statutory Powers and Duties of the Land Use Authority and Appeal Authority
> • Review of Land use planning tools, general plan and ordinances
> • General overview of meeting procedures and required public hearings and notice
> • Open Meetings Training
> • State Ethics review
> Who should attend? City/town council members, planning commissioners, members of the appeal authority and staff. Generally, any person who deals with land use issues in your municipality. Specialized training is available for Appeal Authorities in a separate 2-hour training."

Appendix B. Stakeholder Contact List

Stakeholder Contact List

Important to maintain dialogue and collaboration

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