Utah Clean Energy Fund
An Analysis of Viability and Economic Impact
Reported to the Utah Legislature
February 2021
Prepared by the Sorenson Impact Center
With Support from the Coalition for Green Capital and a grant from the Park City Climate Fund of the Park City Community Foundation
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| Table 1: Measurements of Power |
|-------------------------------|---------------------------|
| Measurement                   | Abbreviation | Definition                                                                 |
| Kilowatt                      | KW           | a unit of power equal to one thousand watts                                |
| Kilowatt-hour                 | KWh          | the amount of electricity generated by a one kilowatt (KW) electric generator operating for one hour |
| Megawatt                      | MW           | a unit of power equal to one million watts                                 |
| Megawatt-hour                 | MWh          | the amount of electricity generated by a one megawatt (MW) electric generator operating for one hour |
| Gigawatt                      | GW           | a unit of power equal to one billion watts                                 |
| Gigawatt-hour                 | GWh          | the amount of electricity generated by a one gigawatt (GW) electric generator operating for one hour |
This study leverages the research performed by the Coalition for Green Capital, presented in the Nevada Green Bank Study (June 30, 2016). This study was reported to the Nevada Interim Legislative Committee on Energy for the 2015 session of the Nevada State Legislature and prepared for the Nevada Governor’s Office of Energy. We would like to thank the Coalition for Green Capital for providing this information and allowing us to present it to the Utah legislature.

Executive Summary

Introduction

Utah has a long history of being a source of energy for our state and the country. However, Utah has seen more than a 20% decrease in energy production since 2013 as a result of decreased profitability of Utah’s coal and natural gas resources with a corresponding loss of jobs in rural Utah. This loss of jobs and energy produced could be replaced by renewable energy sources with appropriate investment in these resources. In 2010, a study found that by increasing the proportion of Utah’s electricity mix that was sourced from renewables from 4% to 20%, over 7,000 jobs could be created.1 As of 2019, only 11% of Utah’s electricity mix is sourced from renewables, but these industries have already generated well over 7,000 jobs - not including the over 31k jobs in energy efficiency.2 Given these results, Utah could approximately double these 7,000 jobs by achieving the 20% goal. Based on data points such as historical MW installed versus jobs created, we can reasonably estimate future job growth of these industries. If investments are made, within 5 years Utah could create an additional 18k jobs, and within 10 years could create another 7k jobs. These clean energy sectors could also produce over 26mm MWh, or 90.9tn BTU, within those respective timeframes.

To enable the investment necessary to create these jobs and energy we could export, we are proposing the creation of the Utah Clean Energy Fund (“UCEF”). Many states in the U.S. have charted similar entities, with a variety of twists; the most recent funds were formed by Utah’s book-end states, Colorado and Nevada, and are structured similarly to the proposed legislation to enable the UCEF. UCEF is an innovative financial structure designed to attract private clean energy investment to increase the total amount of investment in clean energy markets. UCEF could also be a viable recipient of funds from the National Clean Energy and Sustainability Accelerator, which has been proposed via bills in both the U.S. House and U.S. Senate and is currently being considered.3 4 UCEF has the potential to animate markets, - providing capital in emerging, sustainable energy markets - drive private investment, and generate well-paying jobs. UCEF would capitalize on Utah’s natural competitive advantage in clean energy.

2 “Utah Electricity Profile 2019, Net Generation” EIA
3 “S.2057 National Clean Energy and Sustainability Accelerator” United States Congress
4 “H.R.5416 National Clean Energy and Sustainability Accelerator” United States Congress
The Opportunity

Long term and permanent changes are underway in the sourcing of energy to power transportation, industry, and commercial and residential properties. Starting with the Clean Air Act in 1963, the U.S. government and its citizens have sought to balance the need for economic efficiency and a healthy environment. This balancing act has been broadened to include the sourcing of energy that impacts the quality of our air and environment. Through a combination of government action, personal choice, and market innovation – the essential hallmarks of our free market economy - the mix of energy sources has continued to evolve in the ensuing six decades. While the specifics of how these factors interact is difficult to predict, the one clear result is a long-term shift away from carbon-based energy usage.

The investment and financial markets are increasingly aware of these shifts, and one of the most significant trends in the investing world is a surge of interest in capital allocations to clean energy, sustainable agriculture, and other “impact” investment strategies. These investors seek to earn a market rate of return while providing ancillary, qualitative benefits to environmental, governance, and/or social equity concerns. This pool of capital is growing rapidly as well as globally, and we believe their factors will become increasingly important to individuals and institutional investors.

The need to provide for a cleaner environment and the availability of capital to focus on this need, combined with the natural attributes of Utah’s economy and landscape, makes this a critical moment for the formation of a state-chartered clean energy fund.

Utah’s Energy Action Plan: Independent, Sustainable, and Strategic

Utah has a clear desire to support clean and sustainable energy. With a population that is set to nearly double by 2050, the Utah Governor’s Office of Energy Development’s “Utah’s Energy Action Plan” seeks to diversify its energy sources, maintain its energy independence, provide for clean air and water, and support rural business development.5 More broadly, the recently created Utah Climate & Clean Air Compact expresses the desire of a broad constituency of Utah leaders for the state to adopt the policies and goals expressed in “The Utah Roadmap: Positive Solutions on Climate and Air Quality” from the Kem C. Gardner Policy Institute.6 7 What’s needed now is to develop economically viable financing strategies to address these objectives by coordinating government action to access private capital. It is paramount that actions be taken presently, particularly as there are declining rates for clean energy programs, such as

6 “Utah Climate and Clean Air Compact” (2020)  
7 “The Utah Roadmap: Positive Solutions on Climate and Air Quality” Kem C. Gardner Policy Institute, David Eccles School of Business (2020, January 6)
net-metering and renewable energy rebates.\textsuperscript{8} 9 Utah’s ranking amongst states for adopting energy efficiency standards is also sliding.\textsuperscript{10} The current system of financial support for clean energy deployment is shifting from a government incentive system to a free market system. A UCEF could be an appropriate bridge to support this process. There is a clear need for clean energy policy to address this gap between economic aspirations and program support. UCEF is uniquely suited to fill this gap and support clean energy market growth in a cost-effective manner.

Utah’s Clean Energy Economic Potential

Utah’s economically viable renewable energy potential is immense, and requires many billions of dollars of investment to fully realize the opportunity. The solar opportunity in Utah, for example, is exceptional; Utah receives the third most sun of any state in the country and solar power in Utah has the potential to provide all the electricity used in the United States.\textsuperscript{11} As of Q2 2020, Utah ranks as the 11th state in the nation in terms of total solar installed.\textsuperscript{12} $2.98bn has been invested in solar energy in the state, with over 100 solar companies that provide Utahns with over 7,000 jobs.\textsuperscript{13} Thus, while Utah has made significant progress developing its solar industry, it still has a significant opportunity on which it is yet to fully capitalize.

Utah has a number of features that support sustainable energy, including access to geothermal energy, salt domes for energy storage, and wind power capacity. Despite these opportunities, investments remain low, due to high upfront costs, short payback requirements, and lack of information. Without a tailored solution, investment opportunities and energy savings are left on the table. Markets are left underserved, potential jobs are not created, and new businesses are not drawn to the state.

UCEF: The Utah Clean Energy Fund  Solution

The best structure for UCEF is a non-profit corporation, created by the government. UCEF would be governed by a Board of Directors, composed of Utah officials and local leaders - such as the Director of the Office of Energy Development- to give proper oversight. With the stability and mandate provided by a public institution, private capital can be sourced to achieve the state’s energy and air objectives while generating employment and growing the market in a sustainable way, without booms and busts. UCEF will focus exclusively on delivering cost-effective solutions to customers and businesses that make Utah’s environment and air cleaner, and energy cheaper. Public-Private clean energy funds have been formed in 14 states around the U.S. and in

\begin{itemize}
\item \textsuperscript{8} “Docket No. 17-035-61: Application of Rocky Mountain Power to Establish Export Credits for Customer Generated Electricity” Utah Public Service Commission (2017, December 1)
\item \textsuperscript{9} Eric Wesoff “Utah PSC decides to lower export rate, impacting a recovering rooftop solar industry” PV Magazine (2020, October 30)
\item \textsuperscript{10} “2019 State Energy Efficiency Scorecard” American Council for an Energy Efficient Economy (2019, October 1)
\item \textsuperscript{11} “Average Peak Sun Hours by State” Renogy
\item \textsuperscript{12} “State Solar Spotlight: Utah” Solar Energy Industries Association (2020, September 10)
\item \textsuperscript{13} “Electric Power Monthly” EIA (2020, September)
\end{itemize}
many other countries. Since their respective inceptions, they have invested $25bn of their own capital, supporting over $70bn in clean energy investments globally.14 These funds offer loans rather than grants and these loans are priced to provide an economic return to investors while lowering costs to borrowers. The fund will also seek solutions that face financing obstacles and market development challenges to provide “proof of concept” to other commercial lenders.

UCEF should focus on priority markets. These include whole-home upgrades, whole-building upgrades for the commercial sector, low-to-moderate income households and communities, solar + storage applications, and more. Over time, UCEF will develop financing and market solutions to address each market sector. They are outlined in detail in this study, and include using tools such as credit enhancements, direct lending, PACE financing, innovative auction-licensing mechanisms, and alternative underwriting criteria. All of this financing activity will need to be paired with greater market transparency and consumer protection mechanisms, and will target investments in low-income communities as well as communities negatively impacted by the global shift in energy sourcing. By offering these solutions in concert with private lenders, contractors, and existing government/utility programs, UCEF can grow the clean energy economy of Utah while lowering energy costs for all Utahns.

Utah’s Clean Energy Future

Without a comprehensive, market-oriented approach to growing distributed generation and energy efficiency markets, Utah’s position as a creator of energy will diminish. UCEF is a comprehensive tool to ensure the state of Utah remains a leader in the energy industry, and help provide employment to Utahans. This will be accomplished by:

• Building a bridge to more private investment. Its objective is to grow the private market and increase private sector participation. The job is done when the UCEF can “walk away” from target markets, as other similar entities have done;
• Harmonizing programs across the state, ensuring ease of use for customers and industry;
• Acting as central source credible information; and
• Acting as a bridge between small distributed projects and large capital providers with money on the sidelines due to lack of track record and scale in target markets.

See figure on the following page for reference of how a UCEF would function in concert with other stakeholders.

Figure 1: Utah Clean Energy Fund

The time is ripe for new, market-oriented approaches that drive private sector engagement. UCEF is a relatively new concept, but others have demonstrated the efficacy of the approach. UCEF has been designed to draw upon these lessons but adapt the model to the state’s needs. This is an opportunity for Utah to affirm its position as a clean energy leader, pioneer new solutions, and increase jobs and investment in the state.
Chapter 1 - Current Utah Landscape

Utah Economic & Energy Landscape

Utah’s diverse economy has several major industries and is one of the fastest growing in the U.S. The largest sector of this growing economy is the financial services industry, which is responsible for 20% of Utah’s GDP.\(^\text{15}\) The information technology sector is one of Utah’s fastest growing sectors as tech companies continue to expand around the Salt Lake City metropolitan area. Utah also has an important mining and energy extraction industry that, while not one of the top ten industrial sectors in the state, is an important source of employment in many rural areas.\(^\text{16}\) The state is also very well known for its tourism industry, which attracts visitors year round with five National Parks and world-renowned ski resorts. This sector ranks as one of the top ten industries in the state, supports one in eleven Utah jobs, and contributes ~$10bn to the economy via visitor spending.\(^\text{17}\)

Historically, Utah has produced and exported more energy than it consumed and Utah currently supplies some neighboring states with energy. Since 1980, Utah produces on average 26% more energy than is consumed within the state.\(^\text{18}\) The majority of excess energy produced in Utah is in the form of exported natural gas and coal. Exported electricity is produced from both fossil fuels and renewable energy sources.\(^\text{19}\) The chart on the following page shows Utah’s total energy consumption steadily growing as Utah’s total energy production exceeds consumption regardless of secular decline in coal production.

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\(^{15}\) “October 2020 Economic Summary,” Gardner Policy Institute, 2020


\(^{17}\) Leaver, Jennifer “The State of Utah’s Travel and Tourism Industry 2019” Kem C. Gardner Policy Institute (2020, September)

\(^{18}\) Michael D. Vanden Berg “Utah’s Energy Landscape,” Utah Geological Survey

\(^{19}\) Michael D. Vanden Berg “Utah’s Energy Landscape,” Utah Geological Survey
Electricity generation in Utah is predominantly from burning fossil fuels such as coal and natural gas. 66% of electricity generated in Utah comes from the burning of coal, however this is a substantial decrease from 81% just five years ago. In 2018, Utah’s coal production hit a 33 year low as older mines became less profitable and demand for coal decreased substantially. 24% of Utah’s electricity comes from natural gas, and the remaining production primarily comes from renewable sources, with solar accounting for the largest share of electricity from renewables. While natural gas is still a substantial component of Utah’s electricity mix, it has been declining since 2012 after having risen steadily since the 1980’s.
In 2008, Utah enacted a renewable energy goal that seeks to have 20% of its adjusted retail sales of electricity to come from renewable sources by 2025. As of 2018, approximately 18% of electricity is sourced from renewables, and renewables account for 11% of the state’s utility-scale generation. Solar accounted for more than half of renewable utility-scale

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24 “Renewable Portfolio Goal,” Database of State Incentives for Renewables & Efficiency
25 “Utah Profile Analysis,” US Energy Information Association (2020)
generation - solar generation was 26 times higher in 2018 than it was in 2015 - and hydropower accounted for the second largest share at 21%.  

Figure 4: Electric Grid Mix in Utah

![Electric Grid Mix in Utah](image)


Domestic Energy Production

Utah’s diverse landscape and climate would provide a potential market opportunity for renewable energy technologies including wind, geothermal, and solar. However, coal and natural gas have historically dominated Utah’s energy production. In 2018, Utah produced a total of 879 trillion BTU of energy. Fossil fuels comprise 94% of Utah's total energy production, while renewable sources account for 6% of Utah’s production portfolio.

Energy Sources

Since 1980, Utah has been, and continues to be, a net-exporter of energy by producing 26% more energy - across sources such as natural gas and coal - than is used in-state. Utah exported a total of 32 trillion BTU of electricity in 2018, resulting in a net total consumption of 851 trillion BTU. The following year, 83% of the state’s produced coal powered Utah's electricity grids for in-state use. Utah’s annual crude oil production in 2018 increased to the highest level in three years. However, Utah remains reliant on Canada and other states to satisfy its demand for crude oil and petroleum products. Utah imports approximately 72% of crude oil.

26 “Utah Profile Analysis,” US Energy Information Association (2020)
27 “Electricity Data Browser, Net generation for all sectors,” US Energy Information Association
28 Michael D. Vanden Berg “Utah’s Energy Landscape” Utah Geological Survey
31 Stephanie Mills, Andrew Rupke, Michael Vanden Berg, Taylor Boden “Utah Mining 2019,” Utah Geological Survey
that is processed within the state.\textsuperscript{32} Historically, Utah’s crude oil and coal consumption has been stable due to favorable low prices and growth in foreign export market. However, there is a slight reduction of demand as solar and other renewable sources provide alternative energy generation. Utah will remain reliant on other states and countries to satisfy its demand for crude oil and petroleum products.

Energy Prices

As of November 2020, Utah’s rate per kWh for residential electricity is 11.32¢.\textsuperscript{33} Since 2017, Utah’s rate has hovered around 10-11¢ kWh, and residential energy costs have been declining over the last few years.\textsuperscript{34, 35, 36} Utah’s current rate is approximately 15% lower than the national average of 13.31¢ and ranks it as the 11th lowest electricity rate in the nation.\textsuperscript{37} In the Mountain West region, the average residential electricity rate is 11.84¢, 4.6% higher than Utah’s rate.\textsuperscript{38} For additional details, see table below.

| Average Residential Electricity Rates (¢/kWh) November 2020 |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| UT              | 11.32           | NV              | 10.79           | NM              | 13.97           | CO              | 12.84           |
| AZ              | 12.37           | OR              | 11.28           | ID              | 10.39           | WY              | 11.72           |
|                 |                 |                 |                 |                 |                 |                 |                 |
| Avg. Mountain West | 11.84       |                 |                 |                 |                 |                 |                 |

\textsuperscript{32} Michael D. Vanden Berg “Utah’s Energy Landscape,” Utah Geological Survey
\textsuperscript{33} “Electricity Rates by State” ChooseEnergy (2020, November 2)
\textsuperscript{34} “Electric Rates by State” ElectricChoice (2020, October)
\textsuperscript{35} “Average Price of Electricity to Ultimate Customers by End-Use Sector” EIA (2020, September)
\textsuperscript{36} “PacifiCorp Rate Changes 1992-2020; Average Residential Customer Using 700kWh/Month” Utah.gov (2020, June 1)
\textsuperscript{37} “Electricity Rates by State” ChooseEnergy (2020, November 2)
\textsuperscript{38} “Electricity Rates by State” ChooseEnergy (2020, November 2)
As of 2019, Utah's natural gas prices were on the low end of the nation at $7.82/thousand cubic feet.³⁹ See chart below for comparison.

Figure 5: U.S. Average Annual Residential Natural Gas Prices by State, 2019

³⁹ “Natural Gas Prices” U.S. Energy Information Administration
Utah Clean Energy Programs & Policies

Utah currently has a carbon emissions reduction requirement of 20% by 2025.\textsuperscript{40} Utah’s renewable portfolio standard is not compulsory, but has a 25% voluntary renewable portfolio goal.\textsuperscript{41} As of June 2019, Utah was one of 21 states without an enforceable renewable portfolio standard, and one of 8 states with a renewable portfolio goal.\textsuperscript{42}

\textbf{Figure 6: U.S. Renewable Portfolio Stands & Goals, 2019}

In 2016, Utah passed SB 115, the Sustainable Transportation and Energy Plan Act which authorized the Public Service Commission to approve utility pilot programs for emerging technologies such as battery storage, a key component of a clean energy economy.\textsuperscript{43}

Increasingly common among many Fortune 100 and 500 companies are climate goals or commitments to purchase renewable energy. From 2014 to 2018, over 9 GW of renewable energy contracts were announced by corporate entities.\textsuperscript{44} In order to better facilitate these goals, Utah passed legislation in 2016 which requires public utilities to develop a Voluntary

\textsuperscript{40} Utah Clean Energy's 2020 Legislative Priorities (2020, January 30)
\textsuperscript{41} “Midmarket Solar Policies in the United States: Utah” National Renewable Energy Laboratory
\textsuperscript{42} “Renewable Energy Explained: Portfolio Standards” EIA
\textsuperscript{43} “State Brief: Utah” Center for the New Energy Economy (2018)
\textsuperscript{44} “State Brief: Utah” Center for the New Energy Economy (2018)
Clean Energy Choice Program. This allows corporate entities to purchase renewable energy credits, own shares in community renewable energy projects, and more.

In 2019, the Utah legislature passed HB 411, the Community Renewable Energy Act. This allowed counties and municipalities (that are serviced by Rocky Mountain Power) that would commit by December 31st, 2019 to a 100% net-renewable energy portfolio by 2030 to be supported in achieving such goal. HB 411 requires Rocky Mountain Power to replace fossil fuel generation with renewable energy sources to meet new commitments. In 2020, Rocky Mountain Power was required to issue a filing with the Public Service Commission, conduct a year-long demand study, and begin the process of setting new electricity rates for participants. 23 Utah cities and counties representing 37% of Utah’s electricity load adopted a 100% net-renewable electricity goal (via sources including solar, wind, and geothermal) through this bill.

The table on the following page summarizes existing clean energy policies and incentives in Utah, compiled in the Database of State Incentives for Renewable and Efficiency by the NC Clean Energy Technology Center.

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47 “Community Renewable Energy Act” State of Utah, 2019 General Session
48 “Utah moves closer toward renewable energy goal” Industrial Safety & Hygiene News (2019, October 31)
49 “Analysis: Utah cities pursue 100% net-renewable electricity” Utah Policy (2020, November 1)
Table 3: Existing Utah Clean Energy Policies and Incentives

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Chapter 2 - Utah’s Clean Energy Market Potential

The state of Utah has some of the highest potential for clean energy industries in the country, largely thanks to its geography and geological make up. Because of these characteristics, Utah has very promising potential to be a leader in clean energy, although little of the total potential has been exploited to date. This chapter outlines the current market trends and market potential for five major areas of clean energy - energy efficiency, solar photovoltaic (PV), wind, geothermal, and hydrogen - within Utah. The purpose of this chapter is to provide a solid background of the state of these various markets within Utah, and highlight the economically-viable potential of each. Our analysis has found that Utah can produce an estimated 18,000 jobs within 5 years through investing in energy efficiency and solar, and an additional 7,000 jobs within 10 years by investing in geothermal and wind. In addition, the state could increase its energy production by over 26mm MWh, or 90.9tn BTU.

Energy Efficiency

As of 2017, $51mm had been invested in Utah’s energy efficiency sector, generating more than 31k jobs and resulting in 255 GWh in incremental savings.\(^\text{50}\) Even with these promising achievements, Utah’s commercial and residential buildings still have great potential for energy efficiency improvements. Research has found that cost-effective energy efficiency improvements in single-family Utah homes could save 17% of energy and provide $231.3mm in annual utility bill savings. This would also save 8.6tn BTU per year in gas, propane, and fuel oil, as well as 1.2bn KWh in electricity savings, resulting in the pollution reduction equivalent of removing almost 300k cars from the road.\(^\text{51}\)

Weatherization retrofits for homes have been found to reduce energy and gas costs for residents by 35%, as seen by the Weatherization Assistance Program. This program helps low-income families - those below 200% of the federal poverty line - retrofit their homes and reduce energy costs, allowing these families to direct those funds to other important areas.\(^\text{52}\) A study conducted by the Western Rural Development center found that clients of Utah’s Weatherization Assistance Program have “reported an average 35% reduction in heating and gas expenses after weatherization improvements were made to their home”. Annually, this equates to an average of $583 in savings per household”.\(^\text{53}\) With 1,133,521 homes in Utah,

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\(^{50}\) “Spending Savings Table Database” ACEEE (2017)
\(^{51}\) “Residential Energy Efficiency Potential” NREL, U.S. Department of Energy
\(^{52}\) “Weatherization Assistance Program” Utah Department of Workforce Services, Housing and Community Development
\(^{53}\) “Boosting Rural Economies with Home Weatherization” Western Rural Development Center (2021, January)
residents of the state could benefit from $660mm in savings annually if these same conservative savings were achieved unilaterally.\textsuperscript{54}

In addition to cost savings, energy efficiency programs are accompanied by noteworthy job creation. In Carbon and Emery counties, a study conducted by Utah State University found that if just 20\% of older homes - homes built before 1970 - were upgraded for weatherization to reduce carbon emissions by 25-30\% annually, the total annual cost savings would exceed $500k and create 114 jobs within five years. In an ambitious scenario in which 100\% of older homes in these counties were retrofitted, annual savings would exceed $2.5mm and create 571 jobs within five years.\textsuperscript{55} These two counties account for only 4.41\% of all rural homes in Utah. The study also shows that approximately 42\% of homes in Carbon and Emery counties were built before 1970. Applying these findings to rural counties throughout Utah infers the potential to create approximately 4,800 new jobs over a five year period. A limitation to this calculation is that it assumes the percentage of homes built before 1970 in Carbon and Emery counties holds true for all rural counties throughout the state. However, this analysis does provide a reasonable baseline estimate. These findings demonstrate that investments in energy efficiency can be economically stimulating and cost saving for consumers.

Solar Photovoltaic (PV)

Solar power in Utah has the potential to provide all the electricity used in the United States, and is one of seven states with the best potential for solar power.\textsuperscript{56} In 2019, the U.S. used approximately 3.9mm GWhs of electricity.\textsuperscript{58} Utah’s total estimated technical potential for rural and urban utility scale solar is 5.18mm GWh and .03mm GWh respectively.\textsuperscript{59} Measured in GW, the state’s urban and rural potential for utility scale solar is 14 GW and 2,390 GW respectively. Utah has installed 1.9 GW to date, a significant increase from .248 GW in 2015 but still only a fraction of its potential.\textsuperscript{60} With the 1.9 GW of solar currently installed, Utah has enough solar energy to power 350k homes.\textsuperscript{61} As of Q2 2020, Utah ranks as the 11th state in the nation in terms of total solar installed.\textsuperscript{62}

\textsuperscript{54}“Housing Units Report” United States Census Bureau (2019, July)
\textsuperscript{55}“Boosting Rural Economies with Home Weatherization: A study of potential savings and economic benefits in Carbon and Emery Counties, Utah” Western Rural Development Center, Utah State University (2021, January)
\textsuperscript{56}“US Renewable Energy Potentials: A GIS-Based Analysis” NREL (2012)
\textsuperscript{57}“Global Horizontal Solar Irradiance, National Solar Radiation Database Physical Solar Model” NREL (2018, February 22)
\textsuperscript{58}“Electricity Explained, Use of Electricity” U.S. Energy Information Administration
\textsuperscript{59}“US Renewable Energy Potentials: A GIS-Based Analysis” NREL (2012)
\textsuperscript{60}“The Economic Impact of Solar; Utah Ranks 6th in the Nation” Economic Development Corporation of Utah (2017, March 1)
\textsuperscript{61}“State Solar Spotlight: Utah” Solar Energy Industries Association (2020, September 10)
The vast majority of Utah’s solar installations have been in the form of utility-scale projects. Some examples of major installations include:63

- Ulta Red Hills Renewable Energy Park: a photovoltaic project with the capacity to generate 104 MW, or power 20,419 Utah homes.
- Granite Mountain Solar East: completed in 2016, this is a 100 MW plant located outside of Cedar City.
- Buckhorn Solar Plant: located in Paragonah, this 3 MW plant has the electric capacity to power more than 589 homes.

![Figure 7: Utah Annual Solar Installations](image)

Currently under construction is a 100 MW solar power plant, Hunter Solar, located in Emery County. This project is expected to create over 300 jobs during construction and will generate significant tax revenue for the county over the project life.64 Another major project is also in development: Elektron Solar. This solar project developed by D. E. Shaw Renewable Investments in Tooele County and contracted by Rocky Mountain Power will be online by 2023, and has already executed contracts to fulfill its entire 80 MW capacity. The construction of the project is expected to generate approximately 100 jobs, and will provide substantial revenue to Tooele County as well as the State of Utah’s School and Institutional Land Trusts Administration.65

In 2012, the Bureau of Land Management identified 17 “Solar Energy Zones” with the best potential for solar development. Two additional zones were designated in 2013. Projects in

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64 “DESRI Acquires 100MW Utah Solar Project from Community Energy” NS Energy (2020, June 3)
65 “Rocky Mountain Power contracts to deliver renewable energy for six large customers” Rocky Mountain Power (2020, November 24)
these zones “could produce as much as 27,000 MW, enough to power 8 million homes.”\textsuperscript{66} Three of these are located in Utah: Escalante Valley, Milford Flats South, and Wah Wah Valley. Together, these three zones have the potential to provide 3,071 MW of energy.\textsuperscript{67}

$2.98bn has so far been invested in solar energy in Utah, with over 100 solar companies (20 manufacturers, 70 installers/developers, and 50 others) that provide Utahns with more than 7,000 jobs.\textsuperscript{68} Utah is also home to one of the largest solar installation companies in the nation, Vivint Solar, which was acquired by Sunrun for $3.2bn in 2020.\textsuperscript{69}

In 2019, the state gained over 1,000 solar jobs, driven by investment in utility scale solar. Future support for residential and large-scale solar would support additional job growth.\textsuperscript{70} Given that the vast majority of Utah solar jobs are in installation, we can make reasonable estimates for future job gains based on growth in solar capacity. 81% of Utah solar jobs are in installation. Over the next 5 years, Utah is expected to install an additional 1,489 MW (\textasciitilde1.5 GW).\textsuperscript{71} In 2019, the state gained 1,070 installation jobs and installed 120.36 MW, creating approximately 8.9 jobs per MW installed.\textsuperscript{72} If investments in solar are made and future growth follows a similar pattern, this could create an estimated 13k jobs.

Over the last 5 years, prices for solar have fallen 45% to a current average solar panel cost of $2.97/W.\textsuperscript{73,74} While decreasing prices have attracted additional solar installations, especially as 2020 has brought events encouraging Utahns to be energy independent such as the earthquake in March and major windstorm in September, other changes may discourage consumers from purchasing solar. Solar customers in Utah currently enjoy a state tax credit which allows them to deduct $1,600 from solar installations, however this credit will begin to be reduced by $400 per year in 2021, and will be completely phased out in 2023.\textsuperscript{75} However, the Federal Solar Tax Credit (ITC), which currently covers 26% of solar installation costs, will continue to stay at 26% for the next two years, as determined in the 2020 year end omnibus spending bill.\textsuperscript{75} Previously, the ITC was scheduled to decrease to 22% in 2021, 10% in 2022, and then be completely withdrawn after 2022.\textsuperscript{77}

\textsuperscript{66} “Solar Energy” Bureau of Land Management  
\textsuperscript{67} “Solar Energy Development” PEIS Information Center  
\textsuperscript{68} “Electric Power Monthly” EIA (2020, September)  
\textsuperscript{69} Jonathan Shieber “Sunrun’s $3.2bn Vivint Solar Bid Challenges Tesla’s Energy Ambitions” TechCrunch (2020, July 7)  
\textsuperscript{70} “Utah State Solar Jobs Census 2019” The Solar Foundation  
\textsuperscript{71} “State Solar Spotlight: Utah” Solar Energy Industries Association (2020, September 10)  
\textsuperscript{72} “Utah State Solar Jobs Census 2019” The Solar Foundation  
\textsuperscript{73} “Solar Panel Cost in Utah” EnergySage (2020, November 28)  
\textsuperscript{74} “State Solar Spotlight: Utah” Solar Energy Industries Association (2020, September 10)  
\textsuperscript{75} “2020 Utah Solar Trends” GoSolar (2020, March 25)  
\textsuperscript{76} Marks, Allen “Big Stimulus For Clean Energy: Covid Relief Bill To Include Bipartisan Support For Green Tax Credits” Forbes (2020, December 21)  
Utah has very strong potential to be a major player in the solar industry given its fortunate geography. Already, the solar industry has contributed significantly to job growth in the state, and has the potential to continue this trend, especially in areas that are being heavily affected by the transition away from carbon extraction industries.
Wind Power

The U.S. produces 7.2% of all electricity generation through wind with an annual production of 295mm MWh.\(^7^8\) \(^7^9\) Wind energy requires a few seemingly contradictory features to be viable. Namely, high wind speeds (which tend to be better at higher altitudes), air density (better at lower altitudes) and smooth air flow (best in wide-open spaces with little vegetation). While Utah lacks large areas of sustained winds, it does have unique geological characteristics which allow wind energy to be viable. The intersection of mountains, valleys, and canyons create optimal conditions for wind power, and long canyons descending from high mountains create significant wind flows at night as cold air plunges and is channeled through them.\(^8^0\)

Utah ranks 27th out of all states in current wind power capacity.\(^8^1\) Wind power in Utah has steadily grown since 2000 to produce 2.0% of all electricity generation - or 819 GWh - in the state in 2019. The state currently has five utility-scale wind production sites through a total of $900mm in capital investment. These five sites have a capacity of 391 MW with 205 turbines.\(^8^2\) Most of these sites are located in the central or southwest regions of the state. The table below provides details regarding existing wind farms in Utah. As of January 2021, there are no new wind power projects under known development or construction.

<table>
<thead>
<tr>
<th>Project Name</th>
<th>No. of Turbines</th>
<th>Capacity (MW)</th>
<th>Year Online</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latigo</td>
<td>27</td>
<td>62</td>
<td>2016</td>
</tr>
<tr>
<td>Millford Phase 1</td>
<td>97</td>
<td>204</td>
<td>2009</td>
</tr>
<tr>
<td>Millford Phase 2</td>
<td>68</td>
<td>102</td>
<td>2011</td>
</tr>
<tr>
<td>Camp Williams</td>
<td>2</td>
<td>0.7</td>
<td>2000</td>
</tr>
<tr>
<td>Spanish Fork</td>
<td>9</td>
<td>18.9</td>
<td>2008</td>
</tr>
<tr>
<td>Tooele Army Depot 1</td>
<td>1</td>
<td>1.5</td>
<td>2009</td>
</tr>
<tr>
<td>Tooele Army Depot 2</td>
<td>1</td>
<td>1.8</td>
<td>2016</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>205</strong></td>
<td><strong>391</strong></td>
<td></td>
</tr>
</tbody>
</table>

\(^7^8\) “Wind Power America Annual Report 2019” American Wind Energy Association (Accessed 2021, January 5)
\(^7^9\) “What is U.S. electricity generation by energy source?” U.S. Energy Information Administration (2020, November 12)
\(^8^0\) Powlick, Phillip “Energy News: The Status of Wind Energy Development in Utah” Utah Geological Survey, Department of Natural Resources
\(^8^1\) “Wind Power America Annual Report 2019” American Wind Energy Association (Accessed 2021, January 5)
\(^8^3\) “Wind Energy in Utah” American Wind Energy Association (2020)
The U.S. Department of Energy estimates that Utah has the total potential installation capacity of 278k MW. At this capacity, the state could generate 576k GWh. This amount of electricity is over three times the total current electricity consumption for the state.

Wind power can potentially be economically and socially beneficial as there is price stability. The cost of wind power to utility companies remains consistent and predictable primarily because wind power does not rely on price-volatile fuels which have historically experienced pronounced boom and bust cycles.

The expansion of wind power is also expected to create many jobs; the American Wind Energy Association estimates a need for 80,000 new “highly trained” wind technicians by 2030 as demand for wind power grows. Many of these wind technician jobs will be supporting rural communities where turbines are located. Additionally, many jobs are expected to be produced along the supply chain given approximately 8,000 components are required for wind turbines. Current wind investment provides $2mm in annual tax revenue to the state of Utah with an additional $2.7mm in lease payments to landowners.

As of 2019, 434 Utahans are employed in wind electric generation. The U.S. has a total potential capacity for wind energy of 10.6mm MW. At Utah’s total potential of 278k MW, this is 2.6% of the total U.S. capacity. Given 80,000 new jobs required in the industry by 2030, and applying the 2.6%, Utah could create an approximate 2,090 additional jobs. This would be at an installed capacity of 236k MW by 2030 in the U.S, which using the same 2.6% would be 6.2k MW in Utah. These potential job numbers assume that growth in wind follows the proportion of states’ capacities to total U.S. capacity which is likely not realistic, but does provide a reasonable estimate.

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85 “Utah End-use energy consumption 2018, estimates” Energy Information Administration
86 “Wind Power in Utah” Utah State University Extension Sustainability (2013, May)
87 “Wind Power in Utah” Utah State University Extension Sustainability (2013, May)
88 “Utah State Fact Sheet” American Wind Energy Association
90 “How Much U.S. Electricity Will Come From Renewables in 2030?” The Motley Fool, NREL
Geothermal

The State of Utah ranks 3rd in the U.S. in geothermal energy production and contributes 2.8% to the nation’s total geothermal electricity production.\textsuperscript{91} Utah falls in 5th for the most installed geothermal power generation in the country with over 150 MW of geothermal capacity.\textsuperscript{92} Currently, there are three major geothermal facilities that generate up to only 75 MW of their total 150 MW capacity, which represents about 5tn BTU and less than 1% of Utah’s total energy production.\textsuperscript{93} In Utah, renewable energy sources have primarily been dominated by hydroelectric and solar power, but the geothermal market has expanded significantly over the past twenty years.

\begin{itemize}
  \item \textsuperscript{91} “Geothermal Electricity Generation” EPA
  \item \textsuperscript{92} Benjamin Matek “2016 Annual U.S. & Global Geothermal Power Production Report” Geothermal Energy Association (2016)
  \item \textsuperscript{93} “Economic Impacts of Utah’s Energy Industry” Kem C. Gardner Policy Institute
\end{itemize}
In 2008, the U.S. Geological Survey (USGS) assessed geothermal resources in Utah and other states. Data shows Utah has substantial geothermal resources to utilize based on heat-flow data, thermal spring and well temperatures, and fluid chemistries. The Great Basin carbonate and aquifer system of western Utah is potentially suitable for hosting both conduction- and convection-dominated geothermal systems.

**Figure 10: Geothermal Resources of the United States**

Source: NREL
The table below provides a comparison between USGS and the Utah Renewable Energy Zone (UREZ) summary analysis of potential geothermal generation and corresponding investment needs.

Table 5: Summary of Geothermal Power Potential in Utah

<table>
<thead>
<tr>
<th>Source</th>
<th>Potential Type</th>
<th>Capacity (MW)</th>
<th>Estimated Investment Needed (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USGS</td>
<td>Conventional, identified</td>
<td>184</td>
<td>$460</td>
</tr>
<tr>
<td>UREZ</td>
<td>Conventional, identified</td>
<td>754</td>
<td>$1,885</td>
</tr>
<tr>
<td>USGS</td>
<td>Conventional, undiscovered</td>
<td>1,464</td>
<td>$3,660</td>
</tr>
<tr>
<td>UREZ</td>
<td>Conventional, undiscovered</td>
<td>1,413</td>
<td>$3,533</td>
</tr>
<tr>
<td>UREZ</td>
<td>Conventional, Total</td>
<td>2,167</td>
<td>$5,418</td>
</tr>
<tr>
<td>USGS</td>
<td>Unconventional (EGS)</td>
<td>47,200</td>
<td>$118,000</td>
</tr>
</tbody>
</table>

Source: USGS Assessment of Moderate- and High-Temperature Geothermal Resources of the United States; Utah Renewable Energy Zones Task Force Phase I Report

The market potential of identified and undiscovered geothermal resources indicates an approximate 180 to 750 MW of identified geothermal capacity. The UREZ assessment provides a greater in-depth analysis of Utah’s geothermal electricity generating potential. The analysis identifies thermal areas in Beaver and Iron County to hold 645 MW of geothermal potential which creates the deficit between USGS and UREZ reports. However, both assessments report 1,400 MW of undiscovered geothermal capacity resulting in a total conventional geothermal capacity of 2,100 MW. The estimated initial investment for the field and power plant within the “high and low” capacity range is between $460mm and $5.4bn dollars.

An increase in Utah’s geothermal capacity from its current 150 MW to 750 MW would reach the state’s potential capacity of identified geothermal resources using conventional technology. The 600 MW capacity increase would require approximately 12 geothermal plants (a typical plant has a 50 MW capacity). Each plant could create approximately 400 new jobs - based on current employment of 25,000 individuals across approximately 58 plants - in operations and in supporting roles, resulting in 5,200 total additional jobs.

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97 Geothermal Industry: more than 25,000 employed nationwide at 2,550 to 3,300 MW (average 58 plants)
In hopes to capitalize on Utah’s potential geothermal resources, the U.S. Department of Energy established the Frontier Observatory for Research in Geothermal Energy (FORGE). FORGE is a dedicated field laboratory which is essential in developing and testing Enhanced Geothermal System (EGS) technologies in locations that allow deeper drilling and infrastructure to build geothermal power plants. FORGE is a highly innovative program located in Milford, Utah performing this important research.

Hydrogen

Hydrogen power functions as a kind of a “secondary” power source and can be a beneficial component of a clean energy future. Hydrogen power is created through a process called electrolysis in which hydrogen fuels cells combine hydrogen and oxygen to produce electricity, water, and small amounts of heat. These fuel cells utilize energy from other sources including natural gas, biogas, fossil fuels, and renewables, and the hydrogen that is produced can then be stored. When fuel cells use renewable energy to produce hydrogen, they are considered a clean source of energy as the only byproduct is small amounts of water.

A major challenge for the future of renewable energy is storage capacity. Lithium batteries are currently the primary source of storage for wind and solar energy, as large-scale battery storage systems - over 90% of which are based on lithium-ion chemistry - provided 87 GW of storage capacity in 2019. This is expected to grow to 17 GWs by 2050. The U.S. also has 22 GWs of storage from pumped hydropower. It is estimated that the country will need 120 GWs of storage by 2050 in a scenario where 80% of electricity is derived from renewable sources (which was achievable as of 2012 given existing deployed technologies at the time, and is even more so at present day). Given that hydrogen fuel cells are relatively inefficient compared to electric batteries - 20-60% versus up to 99% - its primary promise is in its storage ability. Battery storage is progressively becoming more affordable for short durations of time, but in the Western U.S. a combination of lower temperatures, ample sunlight, snowmelt, and forceful winds leads to large energy surpluses that go unused, often totaling hundreds of thousands of megawatt hours. This highlights the critical need for storage solutions. Increasing hydrogen

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98 “Hydrogen Explained: Use of Hydrogen” EIA
101 “Declining Renewable Costs Drive Focus on Energy Storage” NREL (2020, January 2)
102 “Renewable Electricity Futures Study” NREL (2012)
103 “Realising the hydrogen economy” PowerTechnology (2019, October 11)
104 “BU-104a: Comparing the Battery with Other Power Sources” Battery University (2019, March 28)
105 Jason Compton “In Utah, Hydrogen and a Massive Salt Dome are Winning the West for Renewable Energy” Forbes (2020, March 13)
storage and generation supports intermittent renewable power generators where electricity storage is not adequate to cover demand.\textsuperscript{106}

Utah is a state uniquely suited to store hydrogen due to its geological make up. Salt domes are ideal storage locations for power as they are significantly less expensive than aboveground tanks and hard rock mines. When water is injected into the salt domes, the salt dissolves and the brine is extracted, providing large caverns. These caverns are also favorable for storage as they are suitable for high hydrogen injection rates and withdrawal cycles.\textsuperscript{107} While other storage options for hydrogen such as compression systems, chemical production systems, and nano-material based storage are possible, according to the U.S. Department of Energy, geological storage of hydrogen is the best option for large-scale and long-term storage.\textsuperscript{108}

Utah is already a leader in the hydrogen space, with multiple projects underway. The Advanced Clean Energy Storage (ACES) project, which will invest approximately $1bn, aims to build the world’s first utility-scale renewable hydrogen creation, storage, and transmission project.\textsuperscript{109} Located in Delta, Utah, this will be the world’s largest facility for energy storage at 1,000 MWs or 150,000 MWh (150 GWh).\textsuperscript{110} 40,000 shipping containers of batteries would be required to store the equivalent amount of energy.\textsuperscript{111} This project alone would double the current storage available from lithium batteries and will help meet the energy needs of the U.S. This 1 GW capacity is also based on just one cavern, and the salt dome in Delta could potentially house as many as 100 storage caverns.\textsuperscript{112}

The ACES project will also work in tandem with another project: Intermountain Power Agency’s new generation facility. This facility is initially expected to run on a mix of natural gas and hydrogen, 70% and 30% respectively, but will continuously phase out natural gas until it runs entirely on hydrogen power by 2045. This project is expected to be operational in 2025. The Los Angeles Department of Water and Power (the largest customer of the Delta power plant) plans to use this facility to help meet California’s 2045 decarbonization target.\textsuperscript{113}

\begin{footnotes}
\item[107] Emiliano Bellini “Hydrogen Storage in Salt Caverns” PV Magazine (2020, June 16)
\item[109] Jason Compton “In Utah, Hydrogen and a Massive Salt Dome are Winning the West for Renewable Energy” Forbes (2020, March 13)
\item[110] Jeff St. John “How to Build a Green Hydrogen Economy for the US West” GreenTechMedia (2020, November 17)
\item[111] Tim Hornyak “An $11trillion global hydrogen energy boom is coming. Here’s what could trigger it” CNBC (2020, November 1)
\item[112] Jason Compton “In Utah, Hydrogen and a Massive Salt Dome are Winning the West for Renewable Energy” Forbes (2020, March 13)
\item[113] “Green Hydrogen Project Underway” Utah Governor’s Office of Energy Development
\end{footnotes}
Big Navajo Energy is also pursuing a method of producing hydrogen from reclaimed excess methane gas from petroleum drilling sites in Southern Utah. This project aims to capture 80,000 cubic feet of methane daily which would otherwise be vented or flared.\textsuperscript{114}

By 2030, the hydrogen market in the U.S. is expected to reach $140bn and produce 700k jobs. By 2050, this market is expected to grow to $740bn and produce a total of 3.4mm jobs, while also fulfilling 14% of the U.S. total energy demand.\textsuperscript{115} Utah is uniquely positioned to capitalize on this growing market, and multiple projects within the state have already begun to lay the groundwork. Many of Utah’s neighboring states have made significant commitments to increase the proportion of energy they source from renewables. Utah has the opportunity to become a major exporter to these states which would not only help these states achieve their commitments, but would also be highly beneficial for the Utah economy. For example, California will need 25 GWs in renewable energy capacity, including 8.9 GWs of storage by 2030, and the ACES project in Utah could help the state meet those targets.\textsuperscript{116} According to one of the leaders of the ACES project, “one of our caverns has the capacity to store the entire state of California’s monthly curtailed energy.”\textsuperscript{117}

Key Takeaways

In 2010, a study found that by increasing the proportion of Utah’s electricity mix that was sourced from renewables from 4% to 20%, over 7,000 jobs could be created.\textsuperscript{118} As of 2019, only 11% of Utah’s electricity mix is sourced from renewables, but these industries have already generated well over 7,000 jobs - not including the over 31k jobs in energy efficiency. Given these results, Utah could approximately double these 7,000 jobs by achieving the 20% goal. If investments are made, within 5 years Utah could create an additional 18k jobs, and within 10 years could create another 7k jobs. These clean energy sectors could also produce over 26mm MWh, or 90.9tn Btu, within those respective timeframes.\textsuperscript{119} For a summary of potential job creation and energy generation across different sectors for which we could reasonably estimate please see table below. Please note these figures are estimates based on data points such as MW installed versus jobs created, and are not definitive.

| Table 6: Summary of Potential Job & Energy Creation in Utah |

| Potential Job & Energy Creation |

\textsuperscript{114} “Between the Coasts: Utah” Fuel Cell & Hydrogen Energy Association (2020, August 10)
\textsuperscript{115} “Roadmap to a US Hydrogen Economy” McKinsey & Company (2020)
\textsuperscript{116} “Tim Hornyak “How salt caverns may trigger an $11 trillion hydrogen energy boom” CNBC (2020, November 1)
\textsuperscript{117} Jason Compton “In Utah, Hydrogen and a Massive Salt Dome are Winning the West for Renewable Energy” Forbes (2020, March 13)
\textsuperscript{119} “Utah Electricity Profile 2019, Net Generation” EIA
Chapter 3 - Market Gaps & Opportunities

The previous chapter outlined the current state of and trends in clean energy markets within Utah as well as their market potentials. This chapter seeks to highlight market gaps and areas of opportunity for the Utah Clean Energy Fund.

Energy Efficiency

The residential sector accounts for 21% of energy consumption in the state of Utah. While existing energy efficiency practices provide simple solutions to reduce consumption, there currently exist financing gaps to provide this opportunity to all Utahans.

According to a study by ACEEE, residential home retrofits can provide energy savings of 10% to nearly 80%, ranging from light efficiency to deep efficiency retrofits.\(^\text{120}\) Light retrofits provide the least in energy savings, but are also the most cost effective. A light retrofit includes adjustments like sealing air leaks and installing energy efficient LED lighting and low-flow shower heads. In the case study used by ACEEE, it was concluded that a light retrofit costs ~$1,000 and produces annual savings of $185, or an 18.5% return. It is worth noting that in Utah, 53% of residents find their homes drafty and only 40% of residents have LED lightbulbs in their homes.\(^\text{121}\) Deep retrofits include all improvements that would be in a light retrofit, but also include costly capital improvements to homes like installing solar or replacing HVAC systems. Energy savings from a deep retrofit can amount to almost 80%, but upfront costs are high at ~$41,200 on average; however, even with this high cost, deep retrofits produce significant savings and can result in a 4% rate of return.\(^\text{122}\)

\(^\text{120}\) “For existing homes, energy efficiency often has a better return on investment than solar” ACEEE (2019)
\(^\text{121}\) “Utah Energy Fact Sheet” SWEEP (2018)
\(^\text{122}\) “For existing homes, energy efficiency often has a better return on investment than solar” ACEEE (2019)

<table>
<thead>
<tr>
<th>No. of New Jobs</th>
<th>Time Period (Years)</th>
<th>At MW Installed</th>
<th>MWh</th>
</tr>
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<tbody>
<tr>
<td>Energy Efficiency</td>
<td>4,800</td>
<td>5</td>
<td>NA</td>
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<tr>
<td>Solar PV</td>
<td>13,239</td>
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<td>Wind</td>
<td>2,090</td>
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<td>Geothermal</td>
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<td>750</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>25,329</strong></td>
<td><strong>8,405</strong></td>
<td><strong>26,636,478</strong></td>
</tr>
</tbody>
</table>

Sources: NREL, EPA
Figure 11: Energy Savings & Rate of Return by Retrofit Type

Source: American Council for Energy Efficiency
According to research performed by NREL within the U.S. Department of Energy (and supported by the U.S. Department of Energy Building Technologies Office and the Office of Energy Policy and Systems Analysis), the top 10 improvements Utah can make in its residential energy efficiency sector are as follows.

Figure 12: Utah Top 10 Energy Efficiency Improvements

<table>
<thead>
<tr>
<th>Utah Top 10 Improvements</th>
<th>Utah Utility Bill Savings (electricity, gas, propane, and fuel oil)</th>
<th>Statewide Annual Consumer Savings</th>
<th>Average Annual Savings per Household</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC</td>
<td>* High-efficiency heat pump (replace electric furnace at wear out)</td>
<td>$0</td>
<td>$715</td>
</tr>
<tr>
<td>Enclosure</td>
<td>Drill-and-fill wall cavity insulation</td>
<td>$10</td>
<td>$251</td>
</tr>
<tr>
<td>Enclosure</td>
<td>R-10 basement wall insulation</td>
<td>$20</td>
<td>$151</td>
</tr>
<tr>
<td>Lighting</td>
<td>LED lighting</td>
<td>$30</td>
<td>$100</td>
</tr>
<tr>
<td>HVAC</td>
<td>Smart thermostat</td>
<td>$40</td>
<td>$69</td>
</tr>
<tr>
<td>HVAC</td>
<td>Ductless heat pump (displaces electric baseboard)</td>
<td>$0</td>
<td>$689</td>
</tr>
<tr>
<td>Enclosure</td>
<td>R-49 attic insulation</td>
<td>$10</td>
<td>$79</td>
</tr>
<tr>
<td>HVAC</td>
<td>High-efficiency heat pump (replace propane furnace at wear out)</td>
<td>$20</td>
<td>$914</td>
</tr>
<tr>
<td>HVAC</td>
<td>Duct sealing &amp; Insulating</td>
<td>$30</td>
<td>$91</td>
</tr>
<tr>
<td>Enclosure</td>
<td>R-5 insulated wall sheathing (at siding replacement)</td>
<td>$40</td>
<td>$172</td>
</tr>
</tbody>
</table>


Commercial banks are often not equipped to fill the financing gap for residential home retrofits. Light retrofits may only need ~$1,000 of capital, and without a mechanism currently in place, it may not be cost-effective for a bank to underwrite a loan of such a small amount on a project they are not familiar with. A Clean Energy Fund can fill that gap by providing subject matter experts prepared to offer loans for residential retrofits. Capital can be more readily accessible to the public, and immediate savings on energy costs will ensure that the loans will be profitable for the Clean Energy Fund. If the residential sector of Utah was to reduce its energy
consumption by 10% overall through light, medium, and deep retrofits, that would save 17.7 trillion BTU of energy.\textsuperscript{123}

Another opportunity relates to the Utah Home Performance Program. The Utah Home Performance Program was instituted by the Governor’s office with support from Obama-era stimulus funding. The program offered training for contractors, access to grant funding for homeowners, and added support for efficiency efforts. When federal funding dissolved, the program lost momentum; however, the UCEF could explore the possibility of reviving certain aspects of these programs. Home performance programs could be even more impactful with greater uniform information about home energy efficiency.

According to local experts in the energy efficiency sector in Utah, a UCEF could fill important gaps in the commercial energy efficiency market as well. C-PACE, the Commercial Property Assessed Clean Energy program, helps commercial business owners pay for energy efficiency retrofitting by providing financing and long-term repayment options. However, smaller building owners and contractors are often unable to access these offerings given they need much smaller sizes of loans and lenders are generally uninterested in making loans of these sizes. Therefore, many projects, those that are $500k and under, are left on the table. A UCEF could be a source of capital for these loans, and fill a large gap in the market.

Solar Photovoltaic (PV)

Solar energy in Utah has strong potential for future implementation and adoption. Costs for solar energy in Utah have fallen by 45% over the last 5 years, indicating improvements in efficacy and feasibility for solar energy.\textsuperscript{124} Incentives sponsored by the state and private sector continue to create opportunities for increased installations. Despite these merits, hurdles for further adoption remain in place. Developing infrastructure to maximize the efficiency still needs to be created. Solar energy is hindered by the current inability to store and transport the energy to meet current demand.\textsuperscript{125} The electric vehicle revolution and emphasis on renewables has led to major improvements to battery technology and has created new inexpensive power storage solutions. According to NREL, “the price of lithium-ion batteries has fallen by 80% over the past five years, enabling the integration of storage into solar power systems”.\textsuperscript{126} A June 2019 report by the National Renewable Energy Laboratory estimates that four-hour battery costs could be reduced up to 67% by 2030 and up to 80% by 2050.\textsuperscript{127} In addition to reductions in battery costs, innovative storage solutions have emerged over the past decade. The energy company SolarReserve established a large solar plant in the Nevada desert that utilizes molten salt to fuel steam-powered generators. The system can generate electricity even 10 hours after sundown, and was one of the first utility-scale projects in the world.\textsuperscript{128} As the technology of solar energy

\begin{itemize}
\item \textsuperscript{123} “Profile Data” EIA (2020)
\item \textsuperscript{124} “Utah Solar” SEIA (2020)
\item \textsuperscript{125} “When Relying On the Sun, Energy Storage Remains Out of Reach” NPR (2015)
\item \textsuperscript{126} “Declining Renewable Costs Drive Focus on Energy Storage” NREL (2020)
\item \textsuperscript{127} “Cost Projections for utility Scale Battery Storage” National Renewable Energy Laboratory (2019)
\item \textsuperscript{128} “Solar and Wind Energy May Be Nice, But How Can We Store It?” NPR (2016)
\end{itemize}
continues to evolve, solar energy will become increasingly feasible for the state of Utah. The variability of solar energy is also a concern, and will require the implementation of more flexible electric infrastructure that can adjust to power fluctuations and draw from the sources most viable at any given time.

Among the key challenges for increased solar adoption are the high up-front costs and lack of financing available for commercial and residential entities. While Utah has a program in place to finance sustainable energy programs for commercial properties (“C-PACE”), there is not a similar program available to private residences. A Clean Energy Fund has the potential to mitigate this risk and expedite further adoption of solar technologies.

Utah is one of the sunniest states in the country, and with the falling cost of solar is fueling increased adoption trends. The table below illustrates the growth of solar adoption in Utah.

Given the growth in feasibility and prevalence, Solar PV offers significant opportunities for Utah and should be a primary focus for the fund. Specific areas of focus include:

- Financing for Residential Solar Installations
- Utility-Scale Solar Projects
- Rural Solar Applications
Wind

Wind energy throughout Utah has strong potential in several locations where micro conditions make it not only feasible but economically viable for development. However, large scale investment faces several potential challenges. Overall, these challenges create conditions where much of the current wind energy investment is less cost-effective than alternatives.

Utah has some of the lowest average electricity prices in the nation. These prices benefit consumers of electricity but make it more difficult for wind energy investments to recoup large capital and development costs when selling the electricity to Utah residents and businesses. Two of the largest wind farms in Utah currently export power to California where average electricity prices are almost double that of Utah. UCEF investment in wind energy could follow this same model to sell wind energy to neighboring states, such as California, Colorado, or New Mexico, where energy prices are significantly higher.

The costs for other renewable energy sources, such as solar, have decreased significantly in recent years. This has made solar a more cost effective alternative to wind energy, especially in Utah where potential for solar power is one of the highest in the nation. Current state energy policy sets a goal for utility companies to obtain 20% of its electric sales from renewable energy by 2025, if it is cost effective to do so. The combination of policy and market conditions on solar technology currently makes solar a stronger alternative investment for utility-scale renewable energy.

However, good opportunities do exist for small scale wind energy investment. Distributed wind is a sub-field of wind energy and provides energy to residential, public and commercial locations primarily where the wind turbine is located. This reduces transmission costs and energy losses in the process. The three smallest Utah wind energy sites at Spanish Fork, Tooele Army Depot, and Camp Williams are examples of distributed wind projects.

Physical conditions in Utah and growing trends among organizations to reduce environmental impact make distributed wind projects a great opportunity for investment. The state of Utah does not have many large areas with optimal wind energy conditions of high sustained wind speeds, dense air, and close proximity to large populations. Instead there are many small areas where the local circumstances are great for wind power. Specifically, these areas are at the

129 “Rankings: Average Retail Price of Electricity to Residential Sector, September 2020 (cents/kWh)”, US Energy Information Administration
130 Southern California Public Power Authority, Milford Wind Corridor Phase I and II
131 “The price of solar electricity has dropped 89% in 10 years” Fast Company (2020 December 9)
132 U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis, National Renewable Energy Laboratory
133 “MUNICIPAL ELECTRIC UTILITY CARBON EMISSION REDUCTION ACT”, Utah Senate Bill 202, 2008 General Session
134 Powlick, Phillip “Energy News: The Status of Wind Energy Development in Utah” Utah Geological Survey, Department of Natural Resources"
intersection of valleys, mountains, and canyons. Although not always sustained, these locations produce high wind speeds especially at night when cold dense air flows down and is channeled through these canyons and intersection points. Because 80% of Utah’s population resides at the foot of the Wasatch mountain range, investing in wind turbines in these locations would be able to create an efficient supply of wind power without long transmission lines.\textsuperscript{135}

Many fortune 100 companies are purchasing wind power directly out of a growing concern for environmental impact. From 2017 to 2019 the amount of non-utility wind power purchases doubled from 2500 MW to 5000 MW.\textsuperscript{136} This presents an opportunity for UCEF to partner with private companies to develop distributed wind power at company locations or nearby to power their operations.

Immediate recommendations for wind power include:

- Investment in distributed wind energy projects for public schools and organizations at the foot of the Wasatch range where micro conditions for wind power are good and transmission to the end user is short.
- Financing options for public and private organizations to invest in distributed wind energy solutions.

Geothermal

Geothermal energy is an underutilized resource for Utah homes and businesses. There is massive unrealized potential for geothermal production, yet only a fraction of this potential has been reached due to technical and non-technical barriers that constrain industry growth. Utah’s potential 10-year growth would increase the state’s geothermal capacity by 400%, produce almost 2bn KWh of electricity, and create approximately 5,200 jobs.\textsuperscript{137}

Some risks and concerns surrounding geothermal energy development are environmental and financial risks. Examples of these risks include greenhouse gas emission byproducts released from conventional geothermal plants and substantial capital requirements including drilling costs, land purchases, and other expenditures.\textsuperscript{138} However, despite the risks, geothermal has been evaluated as an area of key growth potential which would create positive impacts on the environment, reduce overall costs and increase renewable power deployment. Geothermal technologies have evolved from conventional to enhanced energy production, and with further technology enhancements, geothermal developments could produce 60 GW by 2050 to meet the U.S. heating and cooling demands.\textsuperscript{139}

Overcoming these barriers to increase geothermal

\begin{itemize}
  \item \textsuperscript{135} “Utah State Profile and Energy Estimates”, U.S. Energy Information Administration
  \item \textsuperscript{136} “Wind Power America Annual Report 2019”, American Wind Energy Association
  \item \textsuperscript{137} See Table 5: Summary of Potential Job Creation in Utah; “Geothermal Electricity Generation”, US Energy Information Association
  \item \textsuperscript{138} “GeoVision: Harnessing the Heat Beneath Our Feet” U.S. Department of Energy
  \item \textsuperscript{139} “GeoVision: Harnessing the Heat Beneath Our Feet” U.S. Department of Energy
\end{itemize}
energy production would stimulate market growth and increase residential and consumer heating and cooling capacity from 2 million households to 28 million households.\textsuperscript{140} Conventional and enhanced geothermal systems are constant “always-on” energy sources which are unaffected by intermittent weather.

In figure 14, the chart depicts the low amounts of greenhouse gas emissions from each energy source. Non-renewable energy sources have a significantly higher amount of greenhouse gases emitted in contrast to geothermal and other renewable energy sources.

**Figure 14: Estimates of Lifecycle Greenhouse Gas Emissions by Power Generation Source**

Geothermal power development requires large capital investments specifically with enhanced geothermal systems (EGS), which require deeper drilling and technology improvements. In figure 15, estimates and projections of capital expenditures (CAPEX) for the next 30 years show higher costs for Deep EGS than more conventional geothermal sources including hydrothermal systems.

\textsuperscript{140} “GeoVision: Harnessing the Heat Beneath Our Feet” U.S. Department of Energy
With higher CAPEX for enhanced geothermal, the yield of energy production is also much higher than conventional hydrothermal and other renewable energy sources. EGS plants will fully operate 24/7 and consistently produce energy to a higher megawatts capacity than other plants.

The potential opportunities to utilize geothermal energy for both direct applications (greenhouses, space heating, aquaculture, spa, swimming pool) and electric power generation is due primarily to the existence of well infrastructure from the oil and gas industry. Studies indicate western Utah’s Basin and Range as potential geothermal wells. The UCEF could consider investments in conventional geothermal systems in these regions. While Utah also has excellent potential for advanced geothermal, the technology is still quite nascent. Therefore, UCEF should consider investments in advanced geothermal further into the future, when the technology becomes more commercially viable with reasonable return on investment periods.

Hydrogen

Hydrogen power and storage has some very promising potential, especially in Utah due to the salt domes natural to the state. However, there are still some barriers and opportunities for innovation in the industry. Hydrogen energy from renewable sources still costs 400% more than the amount to produce hydrogen from fossil fuels.\textsuperscript{141} One key factor in cost reduction will be in

\textsuperscript{141} Jeff St. John “How to Build a Green Hydrogen Economy for the US West” GreenTechMedia (2020, November 17)
the scale of the electrolysis industry, which will need to grow by several orders of magnitude and improve in efficiency over the coming decade. Investments in electrolyzer technology are expected to reduce the cost of hydrogen from renewable sources by 60% by 2030.\textsuperscript{142} Currently, 99% of U.S. hydrogen production is sourced from fossil fuels, and only 1% is produced from electrolysis.\textsuperscript{143}

Figure 16: Cost of Hydrogen Production and CO\textsubscript{2} Intensity

Solutions for major gaps for hydrogen production and storage are still in the research and development stage. Therefore opportunities for immediate investment by the Utah Clean Energy Fund are slim. Examples of these focus areas include:

- Carbon-neutral hydrogen production using gasification and reforming technologies
- Large-scale hydrogen transport infrastructure
- Large-scale onsite and geological hydrogen storage
- Hydrogen use for electricity generation, fuels, and manufacturing\textsuperscript{144}

Given the capital intensive nature of these major gaps in the hydrogen industry, it is recommended that the Utah Clean Energy Fund not consider investments in this space until further down the line, when the industry is more mature and efficient, and the capital base of the fund is larger.

\textsuperscript{142} John Parnell “As Green Hydrogen Gains Favor, Europe Sees Signs of an Electrolyzer Manufacturing Boom” GreenTechMedia (2020, October 6)
Chapter 4 - The Clean Energy Fund Model

This chapter draws upon the research performed by the Coalition for Green Capital, presented in the Nevada Green Bank Study (June 30, 2016). Additional context and any applicable updated information has been provided.

Introduction to Clean Energy Funds

Over the past decade, a number of public jurisdictions and organizations have formed entities that seek to finance clean energy, energy efficiency, and other sustainable projects. These entities, often referred to as “clean energy funds” have also used names such as “green banks”, “infrastructure banks”, and more. Given the nature of the recommended fund (outlined in chapter 5), the term “Clean Energy Fund” is used moving forward. A Clean Energy Fund is a public or quasi-public institution that finances renewable energy, energy efficiency, and other clean energy infrastructure projects in partnership with private lenders. Clean Energy Funds are typically government-chartered, nonprofit entities capitalized with public and/or private funds, which are then used to offer loans, leases, credit enhancements and other financing services to clean energy projects. Clean Energy Funds typically invest in mature, commercially viable projects – not in early stage tech or in clean energy companies.

The goal of a Clean Energy Fund is to accelerate the deployment of clean energy by removing the upfront cost of adoption, leveraging greater private investment in clean energy, and increasing the efficiency of public and private dollars. Through Clean Energy Funds, consumers and businesses can install clean energy technologies with little to no upfront cost while reducing energy expenses. States can also meet their public policy objectives to increase the amount of renewable energy generated and consumed in their jurisdiction. Because public dollars are used for financing, rather than grants, all public dollars are preserved through loan repayment.

Clean Energy Funds are increasingly common across the U.S., as governments recognize the importance of financing in addition to traditional grant models. For example, both Colorado and Nevada recently created Clean Energy Funds. Historically, many governments have supported the adoption of clean energy technologies by offering incentives, rebates, tax credits and more. These programs have been generally effective in improving the economics of clean energy installation and stimulating demand among consumers.

Rebate programs have two primary shortcomings that financing can address. The first is that rebates traditionally only cover a small portion of a project’s cost. If a rebate covers $2,000 of a $15,000 efficiency project, for example, then the customer still must find $13,000 in cash. This requirement for upfront, out-of-pocket cash is a barrier to adoption. The second problem with rebates is that they are not as scalable or sustainable as they are expenditures of taxpayer dollars. To bring clean energy markets to a meaningful scale using rebates would require more
public expenditure than is available or politically viable. Therefore, Clean Energy Funds address upfront costs for consumers and reduce expenditures of public capital.

Barriers to Private Financing

Private financing would be the ideal mechanism to cover upfront costs of clean energy project deployment, but capital market inefficiencies and other challenges create roadblocks for lenders, which inevitably lead to insufficient investment. Even if a clean energy project is financed, however, loans with high interest rates and short terms erode its economics. Clean energy projects will ideally be cash flow positive upon inception so the borrower is able to, on net, save money every month without paying any upfront costs.

Private financing gaps exist for the following reasons:

- **Track Record** – Clean energy projects have short track records in comparison to other projects or assets that banks traditionally lend to. Without extensive performance data and repayment histories, banks are unable to properly assess the project’s credit risk and likelihood of repayment. This becomes a significant roadblock to financing. Due to more conservative lending standards implemented over the past decade, there are limitations on the risk-taking capabilities of banks and credit unions.

- **Small Projects** – Clean energy projects such as building retrofits and rooftop solar installations are relatively small investments, with varying credit among project off-takers. These types of investments are not cost effective to lenders and are relatively expensive to underwrite.

- **Lack of Capital Market Liquidity** - Secondary markets for energy efficiency loans are growing but remain very limited. Unlike mortgages or auto loans, which can easily be sold off to be bundled into securitized investments, a commercial bank may have difficulty selling an energy efficiency loan to another lender.

- **Organizational Change** - In order to begin lending into a new market, a bank has to train or hire new staff, learn about the risks and processes of a new market, and determine the profile of what kind of project and credit level they are willing to lend to. With the efficiency of many clean energy projects rapidly improving, few banks are prepared to move rapidly to address these issues.

Clean Energy Fund Benefits

Clean Energy Funds present many benefits to the markets they address. These benefits include:

- **Elimination of Upfront Cost** – By offering 100% financing, Clean Energy Funds remove the greatest barrier to consumer and business adoption of clean energy projects.

- **Lower Energy Costs and Demand** – Clean Energy Funds enable consumers to adopt clean energy and lower their energy costs. By improving the terms of financing, Clean
Energy Funds can lower the price of solar electricity and aggregate energy demand is reduced through efficiency.

- **Preservation and Coordination of Public Capital** – Clean Energy Funds are increasingly growing less reliant on funding from governments. For example, the two most recently chartered Clean Energy Funds in Colorado and Nevada are designed to use little public capital and instead are relying on direct and indirect public support. Public support provides a “seal of approval” for Clean Energy Funds and allows it to access a variety of private resources. Clean Energy Funds are designed to earn enough interest and fees to break even so that the pool of original public and private funds never erodes. An additional benefit is that by sourcing private capital, government budgets can be shifted to focus on other priorities.

- **Program Coordination** – Clean Energy Funds can also play an important role in coordinating public clean energy efforts that are facilitated by different agencies. Public programs to support clean energy deployment are often operated by different public or quasi-public agencies. To ensure those programs operate at maximum efficiency and create a single point of contact for customers, it can be beneficial if one agency is tabbed to coordinate and align programs across agencies.

- **Growing Secondary Market** – “Sustainable” or “Impact” investing, which is investing that seeks a market-like return but focuses on environmental or social objectives – is one of the fastest growing components of the investing world. Investors include institutional investors such as pension funds, family offices, and endowments. Individual investors, through mutual funds, are also increasingly focusing on investments with these objectives. This is critical to a Clean Energy Fund’s success, because without meaningful government financial support the Fund will need to source capital from private investors to execute its strategy. With the flexibility of accessing these investors, the Fund can more efficiently recycle and re-lend its capital. For example, loans originated by a Clean Energy Fund can be sold to private lenders, securitized by selling into the secondary market and pooled with other clean energy loans, or used to create bespoke investment funds with third-party capital. Having multiple pathways to recycle capital helps to lower financing levels, making financing incrementally competitive.

- **Economy & Employment Growth** – The increased investment sparked by a Clean Energy Fund accelerates economic growth and creates jobs. Adoption of clean energy often requires installers and contractors to carry out the project and these projects will result in more jobs. Utah added the third most solar jobs of all 50 states in 2019, an 18% growth, which will only increase with a Clean Energy Fund.\(^{145}\) Additionally, Goldman

\(^{145}\) "Solar Jobs Up Nationwide and in 31 States After Two Years of Losses" The Solar Foundation (2020)
Sachs predicts that renewable energy infrastructure spending will, for the first time, be the largest area of spending in the energy industry.  

- **Market Standardization** – Clean Energy Funds can introduce standardized financing practices and documentation into the clean energy market. Standardized financing leads to more cost-effective underwriting and more efficient secondary markets, which will further increase private investment.

- **Market Transparency** – Clean Energy Funds can be a centralized source of market information that increases understanding and interest in clean energy opportunities. A Clean Energy Fund’s website can be a hub of information on market basics, remove ambiguity surrounding clean energy adoption, and provide estimates on potential energy savings for consumers and businesses.

**Clean Energy Fund Organization**

A Clean Energy Fund is a mission-driven financial entity that supports private sector investments into public and state-wide clean energy markets. At the state level, Clean Energy Fund institutions manage the fund per the directive of the state government. Clean Energy Funds also exist at the non-profit organizational level, in which case the fund is managed in accordance with the organization's mission. The Clean Energy Fund is traditionally capitalized with public dollars, but also leverages private sector capital to support and expand clean energy financing markets.

Clean Energy Funds use financing, not grants, meaning that deployed capital is eventually expected to be returned. The financing models help ensure that each dollar is invested in projects that maximally deliver impact in markets where there is potential for payback. At the institutional level, Clean Energy Funds generally invest in projects developing proven clean energy technologies that are well past the research and development stage with the aim of maximizing market penetration as quickly as possible.

When a state establishes a Clean Energy Fund, that institution becomes a financing wing of the state’s Clean Energy Fund. Therefore, government direction and internal governance determines how Clean Energy Funds invest capital in the state, which energy markets to apply focus, and how to incorporate private investment. Clean Energy Funds provide a bridge between the state and private lenders by investing in partnerships to facilitate clean energy projects. For instance, a Clean Energy Fund may invest in a regional credit union lender for small-scale, single-home energy efficiency retrofits, as that partner already has a network within the community. This enables engagement with state-wide clean energy initiatives at a level that is generally overlooked by the public sector.

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146 “Goldman Sachs sees $16 trillion investment opportunity in renewable energy” IEEFA (2020)
Target Markets

Clean Energy Funds finance mature sustainable energy technologies that can deliver loan repayment and return on investment. Among those technology sectors are solar photovoltaic energy, wind energy, geothermal energy, bio energy, and fuel cells, as well as systems sectors such as micro-grids, energy storage, clean transportation infrastructure, and smart grids. In each case, the Clean Energy Fund develops a pipeline of projects and seeks out market opportunities for investment in these technology sectors.

Clean energy funds examine mature technology with expected financial returns such that portfolio revenues exceed operating costs and expected portfolio losses. For example, sustainable green projects are likely to save more money than what they borrow on a monthly basis. By taking this into practice, Clean Energy Fund borrowers are able to sign for loans at low risk, cultivating an overall positive reputation for both Clean Energy Funds and clean energy projects.

Clean Energy Funds help secure low-cost capital at favorable rates and terms to both traditional and otherwise challenging market segments. Typically, traditional market segments with technology applications that are well capitalized by private investors, such as utility-scale renewable energy projects like wind and solar, do not require Clean Energy Fund support. Therefore, Clean Energy Funds generally focus on distributed energy projects of small-scale (e.g. roof-top solar, other on-site generation) and medium-scale (e.g. fuel cell parks). These distributed energy projects tend to have the greatest difficulty finding reasonably priced capital. Clean Energy Funds fill the gap in private lending for small and disperse renewable energy installations to create a more robust and available market.

Clean Energy Funds work to animate private investment in non-traditional market segments by working closely with the private sector and using market-responsive strategies like credit enhancements and other risk mitigants, project aggregation, contract standardization and demonstration investments to build a track record and increase the confidence of private investors.147

Understanding that public capital is often in short supply, Clean Energy Funds use the limited public resources available to connect projects with the capital markets and unlock new pools of capital such as institutional investors and the green bond market.

Clean Energy Fund Financing Techniques

The Clean Energy Fund Model utilizes financial products and techniques to unlock more private capital using the following products.

147 “About Green Bank Network” Green Bank Network 2020
Credit Enhancements

A credit enhancement is a risk-reduction technique that provides protection, in the form of financial support, to cover losses on loans made by private lenders. The benefits include encouraging lenders and investors to enter into unfamiliar markets, reducing interest rates and extending loan terms, and negotiating underwriting criteria to allow lending to individuals with lower credit profiles. Several forms of credit enhancements include loan loss reserve (LLR), loan guarantee, loan loss insurance, debt service reserves, and subordinated and senior capital. Each provides a specific level of assurance to lenders, but also incentivizes appropriate risk assessments. These kinds of investments can attract more private investor dollars per public dollar of investment.

Predevelopment and Bridge Financing

Predevelopment loans and bridge financing provide greater flexibility during periods of the development process that are typically undercapitalized. Potential clean energy projects face barriers of predevelopment costs such as consulting fees, appraisals, surveys, soil tests, environmental assessments, and other costs. Bridge loans can also be used side-by-side with other loans when subordinate debt is needed for meeting working capital needs or to engage in more projects.

Direct Co-Investment

A co-investment alongside private investors would allow direct use of public dollars in clean energy projects. Clean Energy Fund investments may provide multiple forms of capital through debt or equity issuance paired with other forms of private investments.

Warehousing & Securitization

The Clean Energy Fund may also underwrite 100% of a loan because there may be no interest from private investors due to market risks, poor credit, or cost-effectiveness. Small and medium-sized clean energy projects can face challenges in securing private capital because of the high costs associated with underwriting and originating. Using aggregation or warehousing, and securitization strategies to scale and diversify risk would facilitate more efficient financing arrangements. Aggregation techniques such as loan warehousing can reduce transaction costs for private investors and facilitate investment in bundled small-scale projects. The Clean Energy Fund can then sell the loans to private investors through a private placement of the whole loans or securitization of the small-scale assets.

Securitization of the bundled assets are monetized through a commercial bank loan facility, a solar fund, or a tradable security sold on the capital markets (via private placement, general note, or bond issuance). These are important strategies for clean energy projects to unlock capital sources that are typically unavailable.

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Related Financing Mechanisms

Innovative mechanisms for financing energy efficiency and renewable energy projects include Property Assessed Clean Energy (PACE) model and on-bill repayment (OBR).

Property Assessed Clean Energy (PACE)

PACE programs allow a property owner to finance the upfront cost of energy or other eligible improvements on a property through paying the costs back over time through voluntary assessments in addition to the owner’s regular property taxes. PACE financing is available for clean and efficient energy upgrades for commercial (C-PACE) and residential properties (R-PACE). A PACE assessment is a debt of property, where the property serves as collateral and the debt is tied directly to the property, rather than to the property owner. The repayment obligation may transfer with property ownership addressing a key disincentive to invest in energy improvements due to a property owner’s short term outlook of residing at the property. The advantages and disadvantages of PACE financing programs are listed below.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Allows for secure financing of comprehensive projects over a longer term</td>
<td>● Available only to property owners</td>
</tr>
<tr>
<td>● Spreads repayment over many years, no upfront payment, debt obligation carries over</td>
<td>● Cannot finance portable items (screw-in light bulbs, etc.)</td>
</tr>
<tr>
<td>● Can lead to low interest rates because of the high security of loan repayments attached to property tax bill</td>
<td>● May require high legal and administrative setup obligations</td>
</tr>
<tr>
<td>● Little risk to general funds of municipalities</td>
<td>● Not appropriate for investments below $2,500</td>
</tr>
<tr>
<td>● Taps into large sources of private capital</td>
<td>● Potential resistance by lenders/mortgage-holders whose claims to the property may be subordinated to the unpaid assessment amount in the event of foreclosure</td>
</tr>
</tbody>
</table>
On-bill Repayment & Financing

The Utah Clean Energy Fund could implement an on-bill repayment and financing (OBR) programs allowing property owners to pay investments in clean energy upgrades through their utility. OBR creates the incentive for both property owners and tenants to finance an energy upgrade as tenants repay for only the amount due as a tenant while benefiting from the energy efficiency. There is opportunity for state and local governments to capitalize on new on-bill loan funds. The challenges associated with OBR programs is the difficulty of changing billing systems for some utilities and increased risks to lenders due to repayment allocation. Despite these challenges, on-bill repayment and financing programs are effective financing techniques to incentivize clean energy consumption through savings and repayment on the same bill.

Generating Demand for Clean Energy Products

Slow adoption of clean energy products has been inhibited by several factors. Consumers struggle to dissect the unorganized array of information pertaining to affordable financing for clean energy products. Although these products have the capacity to offset initial costs over time, consumers often lack access to financing to support the initial project implementation. Overall, clean energy products lack a transparent and efficient market which is a key deterrent from further adoption.

A disconnect exists between the relatively abundant capital sources and consumer demand, which Clean Energy Funds work to resolve. By integrating the financing process with product supply in conjunction with synthesizing information, Clean Energy Funds can effectively stimulate demand by creating new synergies in the market.

In order to connect capital supply to consumer demand, Clean Energy Funds must effectively market, provide dedicated origination channels, partner with contractors, train contractors on how to sell their services with financing, coordinate financing and services with other incentives, and coordinate multiple contractors on multi-measure products.

By designing financing programs in coordination with delivery mechanisms, access to information, and consumer marketing techniques Clean Energy Funds can position themselves to ensure customers are presented with simple offers with positive net present values.

Clean Energy Fund Examples

While Clean Energy Funds are public/private partnerships, in many ways they are treated like private investment funds. More and more, they seek to raise investment capital from private investors instead of relying solely on government support. The funds publish independently audited annual financial statements, have a board of directors, and are staffed by experts in clean energy finance. They are required to follow strict corporate governance rules with clearly defined policies and procedures, investment committees, compliance guidelines, and other
standard corporate characteristics. Clean Energy Funds also share similar investment strategies with differences that are reflective of their sources of capital, unique demographic, geographic, and corporate needs, and other considerations. All funds focus on lending and financing as opposed to providing grants, and nearly all seek to leverage public capital to increase private investment. Below are several examples that are relevant to the Utah Clean Energy Fund.

**Connecticut Green Bank**

Created in 2011, the Connecticut Green Bank is the first state Green Bank in the United States. The quasi-public organization includes a diverse board consisting of both government and independent directors. The Green Bank brings in approximately $30 million per year, derived from two sources. The agency has leveraged the existing system benefit charge which generates annual recurring infusions ranging from $20 to $25 million dollars per year. Additionally, the organization acquires capital through the state’s proceeds from the sale of emission allowances through the Regional Greenhouse Gas Initiative (RGGI) Program. The Connecticut Green Bank has the ability to offer loans from its own balance sheet in addition to a limited ability to issue bonds that are supported by a state bond reserve fund. In it’s nine year history, the CGB has been funded with $394.2mm in ratepayer funds which has helped to attract $1.55bn of private investment in sustainable energy into Connecticut’s economy. This has reduced CO2 emissions by 9 million tons over the life of the projects while creating 20,000 job years and improving public health as a result of cleaner air. (source: CGB’s Comprehensive Annual Financial Report, fiscal year ended June 30, 2020, page iii)

The Connecticut Green Bank offers several financing products geared towards the residential market to support solar installation.

1. **State-Sponsored Solar Tax-Equity Lease Fund**
   a. Public-private partnership structure that created $50 million of lease financing
   b. 5-to-1 private:public leverage ratio
   c. Deployed through local installers who otherwise would not have been able to offer financing to consumers
2. **CT Solar Loan**
   a. Allows customers who want to directly own their solar panels but do not have the liquidity to pay for the installation
   b. Leveraged $5 million of capital to raise $100 million of private capital from Digital Federal Credit Union
3. **Smart-E Loan**
   a. Green Bank provides a standard-offer loan loss reserve to multiple lenders to support their loans into the residential market
   b. In exchange for the Green Bank’s loan loss reserve, banks agree to offer capital at specific terms and rates limited by a predetermined cap.
In 2018, CGB created a subsidiary, not-for-profit investment fund called Inclusive Prosperity Capital, ("IPC"). IPC was created specifically to source private capital targeted for debt and equity investments and operates at the intersection of community development, clean energy finance, and climate impacts using a collection of investment products and strategies that were scaled throughout Connecticut. IPC and CGB have provided financing for household energy efficiency programs, electric vehicle charging stations, C-PACE loans, low income housing solar financing, and carbon offset credit strategies.

New York Green Bank

The New York Green Bank (NYGB) entity is a division within NYSERDA (the state’s energy office). Sources of funding were modeled after the Connecticut Green Bank, where capitalization was derived from a portion of the ratepayer surcharge funds collected annually to support grant programs as well as a one-time capital infusion of the state’s RGGI proceeds. The NYGB received approval in December 2013 with an initial capitalization of $210 million. Of this $210 million, $165.6 million came through the form of ratepayer dollars in conjunction with the annual $45 million in RGGI proceeds. Since its inception, NYGB has generated over $100 million in revenues with only $53 million in expenses.\(^{149}\) Given the substantial capital made available by the state, as well as this earnings surplus, the New York Green Bank operates as a wholesale clean energy finance lender. For example, to date the NYGB has invested in a wide variety of projects, including wind, sustainable agriculture, community solar, low income and municipal energy efficiency retrofits, fuel cells, sustainable transportation, anaerobic digesters, and others. NYGB has also invested in multi-state home energy upgrade facilities as well as projects sponsored by IPC, its neighbor in Connecticut, highlighting the potential for regional coordination amongst clean energy funds.

Hawaii Green Infrastructure Authority

Given its isolation from oil and natural gas markets, Hawaii has the highest electrical rates in the U.S. Consumers pay more than twice the national average. This has incentivized Hawaii to be the first state to set a deadline to generate 100% of its electrical needs from renewable resources by 2045.\(^{150}\) The Hawaii Green Infrastructure Authority, created in 2013, was established to provide funding for commercial and residential small scale solar programs. It relies on third-party contractors to administer its financing program. The first program instituted, known as the Green Energy Market Securitization program, provides solar lease financing to underserved market segments. The Hawaii Green Infrastructure Authority has focused on low-income housing, where a disconnect exists between Hawaii’s residential solar boom and lower-income households. 27% of households earning $90,000 or more were equipped with solar, while only 6% of households with less than $60,000 in income had access to solar infrastructure.

\(^{149}\) "New York Green Bank Quarterly Metrics Report No. 25" (2020, December 3)

\(^{150}\) "Hawaii State Profile and Energy Estimates" EIA
The Green Energy Market Securitization program is funded with an existing and redirected ratepayer surcharge, collected by the Green Infrastructure Authority through the utility. The Green Infrastructure Authority issued a $150 million bond that will be paid off with future ratepayer collections. Since this bond is linked to utility collection rather than individual lease payments, the bond received a AA-rating and a 2.99% taxable-rate. These funds are then infused with private tax-equity capital to create a solar lease fund. The solar leases are repaid through on-bill repayment mechanisms that were established in parallel to the Green Infrastructure Authority’s creation.

Nevada and Colorado Clean Energy Funds

Several new additions to the state supported/sponsored market for clean energy funds are the two states bordering Utah, Nevada and Colorado. Like Utah, Colorado has a legacy industry focused on coal, oil, and gas extraction with employment highly concentrated in several counties. Colorado’s Fund was established as a private 501(c)(3) entity while Nevada’s fund was created through state legislation. Unlike many of the original “Green Banks”, neither fund has received direct government financial support, which has slowed their progress at achieving operational status.

Michigan Saves

Michigan Saves is a nonprofit green bank which focuses exclusively on credit enhancement. The organization works with private-lenders and energy providers to serve residential, commercial, and municipal customers. Michigan Saves also offers a network of authorized contractors throughout the state and provides technical assistance for both customers and contractors.

Public-Private Partnership

A Utah Clean Energy Fund would be a unique public-private partnership which would leverage the emerging focus of capital markets on sustainable and clean energy investing, Utah’s significant renewable energy capabilities, and its supportive business environment. In addition, the UCEF would seek to achieve a number of ancillary policy goals of the state. These policy goals include areas such as rural employment support, low income housing support, and innovative business development. Properly structured, the “seal of approval” provided by the state’s participation in the fund should assist the fund in sourcing investment capital.

Utah has the capability to become a leader in the clean energy industry, and a public-private partnership such as this would be a key component of realizing that future. While more mature renewable technologies such as solar also have great potential in the state, so do other more nascent technologies such as advanced geothermal and hydrogen. If Utah is able to utilize this public-private partnership to facilitate investment into developing and scaling these technologies within the state, it has a viable possibility to become a leader in energy production,
independence, and exportation to neighboring states, stimulating the economy and producing jobs for local Utahns.

Capital Market Landscape

Billions of dollars have been pouring into the sustainable finance market across asset classes and investor categories over the past few years, and growth is accelerating. The first half of 2020 saw a net of $20.9bn flow into sustainable funds, almost meeting 2019’s record of $21.4bn for the whole year, which was also 4x the net flows of 2018.\textsuperscript{151} In the third quarter of 2020, U.S. assets in sustainable funds jumped to $179bn, a 12.5% increase from $159bn at the end of June. Globally, sustainable fund assets hit $1.2tn in the same period.\textsuperscript{152} Asset inflows into sustainable investing funds far outpaced inflows to conventional funds through September 2020. Although this growth is substantial, it is important to note, as UBS has, “this is not a bubble”.\textsuperscript{153}

Sustainable funds span the spectrum of equity, fixed-income, asset allocation, and alternatives, and growing interest is evident across all of them. A Utah Clean Energy Fund would likely fall under the category of alternatives. In 2020, growth of assets in sustainable alternative funds grew 55%, with $438bn of the total $716bn invested going to 681 private equity and venture capital funds. The number of these funds also grew 21%.\textsuperscript{154} This growing interest bodes well for a potential UCEF, although it should have some unique characteristics compared to most alternative funds. Namely, the Fund should be designed to serve under-represented communities - such as low-to-moderate income communities and/or communities impacted by the decline of the carbon-based industries - and should be structured as a non-profit (discussed in more detail in chapter 5).

Interest is also evident among individuals, family offices, and foundations. Of the $16tn invested using ESG criteria, $12tn is institutional, and $4.6tn is from individuals.\textsuperscript{155} Hundreds of single and multi-family offices are involved in sustainable investing, but most don't disclose assets amounts. Of those reported (primarily multi-family offices) assets jumped 50% in 2020 to $6bn from $4bn in 2018. The biggest focus of these family offices is environmental criteria and clean technology, affecting $4.8bn in assets.\textsuperscript{156} Foundations also reported a 43% increase in ESG assets under management since 2018, to a total of $97bn. Top issues for foundations include

\textsuperscript{151} Jon Hale, Ph.D., CFA “Sustainable Funds Continue to Rake in Assets During the Second Quarter” Morningstar (2020, July 30)
\textsuperscript{152} “Sustainable-Fund Assets Hit $1.2 Trillion as ESG Continued to Gain Market Share” Barron’s (2020, October 29)
\textsuperscript{153} “Sustainable investing: a private investor perspective” UBS Chief Investment Office (2020, September 10)
\textsuperscript{154} “Future Returns: Sustainable Investing is Turning Mainstream” Barron’s (2020, November 17)
\textsuperscript{155} “Future Returns: Sustainable Investing is Turning Mainstream” Barron’s (2020, November 17)
\textsuperscript{156} “Sustainable investing in the US turns mainstream” Private Equity News (2020, November 19)
tobacco and conflict risk, and environmental issues also rank highly, with carbon emissions and clean technology topping the list.  

In Utah, growing interest in sustainable investing is evident through the growth in sustainable finance offerings by local wealth managers and investors. Examples of local firms now offering sustainable investing include Olympus Advisors | Raymond James, Responsible Asset Management, and Cicero.  

By offering a Utah Clean Energy Fund, the state of Utah can attract significant amounts of private capital to be invested locally, stimulating the economy and producing a plethora of jobs: over 18,000 within 5 years across energy efficiency and solar, and over 7,000 within 10 years across geothermal and wind. Given Utah’s especially attractive potential in various clean energy markets, it is uniquely positioned to capitalize on the growing interest in sustainable investing.

Chapter 5 - UCEF Recommendations

Recommended Structure

It is recommended that the Utah Clean Energy Fund be established as a new, purpose built, non-profit corporation. The UCEF should be established via legislation, although another option is to establish it through an existing agency such as the Office of Energy Development.

Legal Restrictions and Precedents

Unlike other states, Utah’s constitution does not have restrictive covenants regarding the state’s ability to lend to or invest in private corporations, making the creation and operation of the UCEF simpler.

There is also precedent within Utah for state support of private investment. In 2003 Utah passed the Venture Capital Enhancement Act. This established the Utah Capital Investment Corporation (UCIC). UCIC is a quasi-public, nonprofit, independent organization which is essentially a tax credit private equity program. UCIC seeks to facilitate private investment into the state and makes venture capital and private equity investments via the Utah Fund of Funds. UCIC’s financing is backed by tax credits which are approved by the state legislature. UCIC reported that it assisted in the creation of over 3,400 jobs with an average salary of $60k, although an

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157 “Sustainable investing in the US turns mainstream” Private Equity News (2020, November 19)
158 “The Goal of Investing is More Than Just Financial Growth” Olympus Advisors | Raymond James
159 “Sustainable, Responsible, & Impact Investing” Responsible Asset Management Investment Advisors
160 Cicero Impact Capital
audit in 2014 found this was likely overstated due to inconsistent measurement methodology.\textsuperscript{162} Regardless, this initiative indicates an appetite for state-licensed but financially independent investment organizations which seek to attract additional private capital to the state.

Legislative vs. Statutory Approach to Utah Clean Energy Fund Creation

The Utah Clean Energy Fund should be established as a non-profit corporation through either legislation or through the power of an existing state agency such as the Office of Energy Development. Should the legislative approach be utilized, the proposed legislation should comprehensively address the following areas:

- **Organization, Placement, & Structure:** Here the legal nature of the fund should be defined.
- **Organization Governance:** This section should address the exact composition of the board of the fund, as well as details regarding director appointments and responsibilities, and any required committees. It should also specify the responsibilities and powers of the board, as well as desired qualifications and skills for all governance members.
- **Financial Instrument Authority:** This section should outline the authorities granted to the fund regarding what financing instruments it is approved to utilize, or how the instruments should be approved via the board. Should it be granted a bond authority, this section should also particularize the relationship between the fund’s bonds and the credit of the state (although it is not recommended that the bonds of the fund be tied to the state via credit ratings or other characteristics).
- **Types of Investment:** Here the various financing mechanisms to be utilized should be enumerated, if desired. Alternatively, the legislation could provide broad authority to use public capital to drive private investment.
- **Eligible Technologies & Projects:** This section should either define what technologies are eligible for financing from the fund, or lay out the general process for the decisions to be made via board approval.
- **Related Mechanisms & Powers:** This section may precisely define the fund’s relationship to existing clean energy/energy efficiency/etc. programs within the state such as C-PACE.

Advantages of the legislative approach for establishing the UCEF is that it allows policymakers to define the fund, its purpose, and its role. It also can simplify the funding process via general budget appropriations.

An existing state agency such as the OED could also establish the UCEF under its existing authority, which would likely be a much quicker and simpler process. However this makes the funding for UCEF much more complex and could potentially require amendments to the agency’s statute.

\textsuperscript{162} “A Performance Audit of the Utah Fund of Funds” Office of the Legislative Auditor General, State of Utah (2014, August)
Capitalization Methods & Sources

Methods
A fund such as this has three primary avenues for capitalization: initial infusion of funds from private sources, initial infusion of funds from public sources, and recurring revenue streams from legislatively-derived appropriations. UCEF could be structured as a non-for-profit private fund, raising capital from private investors (both institutional and individual) and then utilizing a fee structure to cover operating costs in the subsequent years. With an initial infusion of public funds, the UCEF would receive public dollars at its inception, using those funds to pay start-up expenses, and then operate as a revolving fund. This structure is straightforward, although it limits lending capacity if no other funds were authorized or acquired. UCEF would then rely on the repayment of the loans it previously provided to recapitalize and issue new loans. Alternatively (or in addition), the fund could utilize a recurring revenue stream. Methods utilized by similar entities include capital raised from a tax, ratepayer dollars, and system benefits chargers. For example, the Connecticut Green Bank is funded via ratepayer dollars, which flow to the bank indefinitely. In doing so, the bank always has liquid assets and flexibility for pursuing longer term investments.

Sources
The UCEF has multiple potential sources of funding. It is advisable that the Fund draw on multiple funding sources for diversification, which can mitigate risks and alleviate constraints of relying on one source, especially when it is a public source.

Upfront Financing
For an initial infusion of public funds, the UCEF could draw on state budget appropriations. While challenging during times of budget constraints, this is a simple and direct mechanism for funding. The UCEF could also access federal resources through existing programs within the DOE and USDA. The USDA operates the Rural Development Program, which operates the Rural Energy for America Program. The REAP offers grants and financing for clean energy projects in rural America. The UCEF could partner with REAP to identify, develop, and co-fund projects. USDA also runs the Rural Utility Service which provides the Energy Efficiency and Conservation Loan Program. The UCEF could act as an application aggregator and administer financing for the utilities. Within the DOE, the Loan Program Office is designed to provide tens of millions of dollars in loans and loan guarantees. In 2015, the LPO determined that state-affiliated financial entities (such as the UCEF) would be eligible to submit applications for projects. The LPO has $4.5bn available for loan guarantees and has approved $30bn of loans and loan guarantees.

for more than 30 projects. Another potential source of funding could be the National Clean Energy and Sustainability Accelerator, which has been proposed via bills in both the U.S. House and U.S. Senate and is currently being considered. This accelerator would seek to provide capital for clean energy projects and programs throughout the country, and the UCEF would be a viable recipient.

UCEF should be structured to optimize its options for sourcing investment capital. When many of the original “Green Banks” were formed, private capital for sustainable investing was extremely limited, if available at all. Therefore, the only source of capital was government appropriations. Since then, these banks have increasingly sought to move away from this legacy model and instead attract more private capital, focusing on leveraging smaller amounts of public dollars to do so. Some have had to use creative strategies to accomplish this goal. For example, the Connecticut Green Bank has spun off its own independent asset manager, Inclusive Prosperity Capital, in order to more effectively raise capital from sources such as endowments and family offices. As these banks have moved in this direction, it has been found that they can mobilize private capital by increasing demand for clean energy financing and reducing perceived risks for investors.

In Utah, many financial institutions participate in investing in low- and moderate-income (LMI) neighborhoods via the Community Reinvestment Act (CRA). Ally Bank, for example, plans to deploy $3.7bn in CD loans and investment originations via the CRA from 2020-2022. However, competition for ways to deploy CRA dollars is stiff due to the disproportionate number of large banks - many with assets over $50bn or even $100bn - in the state. As a result, these banks end up paying large “CRA premiums”. According to Utah code, CRA dollars can be used for urban renewal, economic development, community development, and community reinvestment. If the UCEF were to have a focus on LMI communities, and given its economic development opportunities, it would be a perfect conduit for banks and other firms to meet their CRA targets.

The UCEF would also be an attractive recipient of foundation investments, or Program Related Investments (PRI). The Connecticut Green Bank, New York Green Bank, and Baltimore Clean Energy Fund (Climate Access Fund) have each been awarded PRIs of $3mm, $6mm, and ~$1mm respectively. PRIs can be structured as loans, credit enhancements, and more. PRIs can also take first loss positions, thereby reducing risk for other investors and thus attracting additional capital. PRIs can also be meaningful for investing in projects commercial capital

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166 “S.2057 National Clean Energy and Sustainability Accelerator” United States Congress
167 “H.R.5416 National Clean Energy and Sustainability Accelerator” United States Congress
168 “Clean Energy Finance: Green Banking Strategies for Local Governments” EPA
169 “Ally Bank Strategic Plan 2020-2022” Ally Bank
170 “Ally Bank Strategic Plan 2020-2022” Ally Bank
171 “Title 17C Limited Purpose Local Government Entities - Community Reinvestment Agency Act (Effective 5/10/2016)” Utah State Legislature
might otherwise not be interested in, such as smaller projects, projects with longer return timelines, or projects that target low-to-moderate income communities.\(^{172}\)

**Recurring Revenue Streams**

As previously mentioned, additional sources of capital could stem from recurring revenue streams such as a tax, ratepayer dollars, and system benefits chargers. For example, the New York Green Bank receives funding via systems benefit charges, but this source will end once the bank has achieved $1bn in total funding (expected by 2025). While we do not see a clear path for UCEF to receive similar system benefit charges from the state government, there may be future state-based fees or charges related to clean energy investments that UCEF could administer.

**UCEF Operations**

The Utah Clean Energy Fund should seek to be self-sustaining through portfolio returns and a fee on assets under management structure. Given that realizing returns on investments may take some time, UCEF should hire a lean staff to begin with, and increase staffing as it matures.

**Self-Sustainability**

The UCEF would not be a government program which would require consistent and continuous public funds to operate. A small initial sum to hire a lean team and cover startup costs, and potentially an initial investment to attract additional private capital would be all that is necessary. The UCEF would reach fiscal self-sustainability relatively quickly given a fee on assets under management structure, in addition to returns which would provide increased resources over time. Although some losses are to be expected, the default rates of similar entities and investment programs can provide insight into the potential performance of a UCEF portfolio. For example, Nebraska's Dollar & Energy Saving Loan program has maintained a default rate of 0.08%.\(^ {173}\) Another state entity, Michigan Saves, has a default rate of 1.4%.\(^ {174}\) Each of these default rates are well within each institution's projected ranges. One of the top credit rating agencies, Moody’s, also found that green project loans have a cumulative 10-year default rate of 5.7%, compared to 8.5% for non-green project loans.\(^ {175}\) This data demonstrates that it is likely that the UCEF could maintain healthy reserves through its financing activities.

\(^{172}\)“Program Related Investments: Alternative Sources of Green Bank Investment Capital in the United States” Coalition for Green Capital (2019, February)


\(^{175}\)“New money: Green banks and green bonds are bringing billions to utilities for the energy transition” Utility Dive (2019, November 19)
Staffing

Hiring an experienced and capable team at the outset of the establishment of the Fund is imperative for its long term success. According to the NYGB Business Development Report, there are four crucial areas of expertise for an entity such as this: energy, finance, business development, and operations.\(^{176}\)

It is imperative that the Fund first appoint a board of directors as well as executive director who will be tasked with raising the capital from private investors. If possible, a chief investment officer should also be hired at the outset. Additional staff to be hired by the board of directors when appropriate should include: accounting, human resources, legal, and communications. Some of these functions can also be outsourced. The Fund may require additional functions, which will largely be dependent on its capitalization.

UCEF Impact

A Utah Clean Energy Fund can be economically beneficial, attracting substantial private investment into the state and creating an abundance of safe, high paying jobs. The exact impact of the UCEF will depend on the capitalization of the Fund, and the projects the Fund ultimately supports. However, similar entities in other states can provide insight into the potential impact this fund could provide.

In 2011, the state of Connecticut established a Clean Energy Fund which has since deployed over $1.9bn for clean energy projects.\(^{177}\) The bank estimates that investments have led to the creation of 23.45k direct and indirect job-years.\(^{178}\) These investments have also helped avoid over 8.9mm tonnes of CO\(_2\) and created an estimated $232-525mm in public health value.\(^{179}\) In 2019, the bank deployed 73.3 MW of clean energy, financed 12,992 projects, created 3,355 jobs, and generated $17.8mm in tax revenue.\(^{180}\) The Connecticut Green Bank is also an excellent example of private investment facilitation, demonstrating that public investment can attract huge levels of private capital. Through May 2020, the bank invested $282mm into projects with a total value of $2bn, a leverage ratio of 7:1.\(^{181}\) Using $40mm public dollars, in 2019 the bank facilitated $300mm in private investment into clean energy financing, a ratio of 7.5 to 1.\(^{182}\) Based on the above figures, Connecticut has spent approximately $12.6k of public dollars per job created, and $83k total per job created.\(^{183}\)

\(^{176}\) “New York State Green Bank Business Development Plan: Final Report” (2013, September 3)
\(^{177}\) “Changing Connecticut for the Greener” Connecticut Green Bank
\(^{178}\) “2019 Annual Report” Connecticut Green Bank
\(^{179}\) “Green Bank Impact Report FY 12-FY 20” Connecticut Green Bank
\(^{180}\) “2019 Annual Report” Connecticut Green Bank
\(^{181}\) “Connecticut Green Bank” Green Bank Network
\(^{182}\) “2019 Annual Report” Connecticut Green Bank
\(^{183}\) “Green Bank Impact Report FY 12-FY 20” Connecticut Green Bank
Another example with a longer history is the Rhode Island Infrastructure Bank, which was established in 1989. The bank estimates that since its inception, it has created over 62,000 jobs.\textsuperscript{184} It has also provided $2.2bn in financing, including $60.65mm in clean energy loans.\textsuperscript{185} Connecticut and Utah are of similar population size (roughly 3mm individuals) and Utah’s economy ranks as 3rd in the nation, while Connecticut’s ranks as 18th.\textsuperscript{186} Thus, the State of Utah could expect to see similar, if not better, outcomes in terms of private capital attracted and jobs created than the Connecticut Green Bank.

During the COVID-19 pandemic, Utah’s economy has demonstrated its resilience compared to other states, its job growth rate from October 2019 to October 2020 being -0.5%, compared to the national average of -6.0%. While impressive, the state did still lose over 8,000 jobs, and as of November 2020, 70,900 Utahans remain unemployed.\textsuperscript{187} As stated by the Department of Workforce Services’ Chief Economist Mark Knold, “eliminating Utah’s year-over job losses would be a milestone within the greater national pandemic’s economic sphere. Not only would it be the launching point from which Utah’s economy will once again grow, but it would mark Utah as one of the first states to regain economic expansion”.\textsuperscript{188} The Utah Clean Energy Fund could be a meaningful contributor to the achievement of this goal.

Utah’s rural economies have also not recovered to their pre-2008 recession levels with the same strength that Utah’s metropolitan areas have. Nearly a third of Utah counties have not recovered to their pre-recession levels and nearly all of them are rural.\textsuperscript{189} With an emphasis on investing in these rural communities, the Utah Clean Energy Fund can contribute to helping these communities recover and flourish.

Investing in clean energy industries can also help protect against future job loss from automation. In Salt Lake County alone, an estimated 33,400 jobs have a 98-99% likelihood of being automated.\textsuperscript{190} Research has indicated that investing in renewable energy development and energy efficiency can offset these losses by creating jobs in sectors such as engineering, manufacturing, construction, and installation.\textsuperscript{191} Investing in clean energy and energy efficiency also has the potential to considerably contribute to the reduction of pollutants in Utah’s air, as many of these pollutants come from sources such

\textsuperscript{184} “Building Rhode Island’s Future Through Clean Water, Green Energy, and Transportation” Rhode Island Infrastructure Bank
\textsuperscript{185} “The Results” Rhode Island Infrastructure Bank
\textsuperscript{186} Hoff, Madison “As the US teeters into recession, here’s how the economies of all 50 states and DC were doing before coronavirus hit” Business Insider (2020, April 6)
\textsuperscript{187} “Utah’s Employment Summary” Utah Department of Workforce Services (2020, December 18)
\textsuperscript{188} “Utah’s Employment Summary” Utah Department of Workforce Services (2020, November 20)
\textsuperscript{189} “Utah: A Tale of Two Economies” Utah Department of Workforce Services (2018, July 20)
\textsuperscript{190} “Automation Brief Report 2020” Salt Lake County Office of Economic Development (2020)
as commercial facilities, power plants, and burning of fossil fuels.\textsuperscript{192} Given that air quality issues can cost the state over $2bn annually, reducing air pollutants has both health and economic benefits.\textsuperscript{193}
Conclusion

Given the market potential of clean energy in the state of Utah, increasing interest in sustainable investing from private investors, as well as both economic and social benefits of a potential UCEF, it is recommended that a UCEF be established. It is recommended that UCEF learn from the experiences of older institutions, moving away from legacy models that rely on large amounts of public financing. Rather, the Fund should be established as a non-for-profit fund which can draw on both public and private capital, and utilize an assets under management fee structure to cover basic operating expenses.

Based on team analysis, approximately 18,000 jobs could be created within 5 years across energy efficiency and solar, and an additional 7,000 jobs could be generated within 10 years across geothermal and wind if investments in these sectors are made. The state of Utah is uniquely positioned to capitalize on growing demand for different types of clean energy technologies due to its geography, geology, and resilient economy. Attracting private capital to expand these industries within the state can help Utah become a national energy leader in the coming energy economy. Doing so would also create new jobs which can help rural communities flourish, protect against job losses from future automation, and replace jobs lost during the COVID-19 pandemic.