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DEVELOPING SOLAR ENERGY TO MEET THE UNIVERSITY OF COLORADO'S COMMITMENTS TO CARBON EMISSIONS REDUCTIONS

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Executive Summary

CU Boulder committed to reducing its carbon emissions by signing the American College and University Presidents' Climate Commitments in 2007. CU set specific goals to reduce its greenhouse gas emissions by 20% by 2020, 50% by 2030, and 80% by 2050 in its Campus Master Plan and Carbon Neutrality Plan. Current rates and trends of solar energy development on CU's campus demonstrate a concentrated attempt to meet those goals. However, current efforts by CU are not enough to meet CU's long term carbon emission goals. CU will have to overcome challenges related to funding, support by campus leadership, lack of accountability, and the administrative process to put solar development on track to meet CU's goals. There are opportunities for proponents of solar to support future development by supporting specific upcoming solar projects, helping develop the in-progress Campus Energy Plan, leveraging student involvement, and building strong administrative leadership. Understanding and evaluating CU's past solar development is critical to effectively supporting future development needed to meet CU's carbon reduction commitment.

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Introduction

When walking around CU Boulder's campus, any visitor takes notice of CU's iconic style. They take note of the uniqueness of each building while still recognizing the architectural motifs of sandstone walls and red tile roofs that unify the campus. This vision is completed by the Flatirons, which serve as a dramatic visual backdrop to the carefully cultivated campus look.

The campus's style took a modern turn recently with the completion of the new Indoor Practice Facility. Amongst the fields of red roof tile, there is now a bold accent of black created by a large solar array.[1] This project is one of the newest additions to CU's renewable energy portfolio and the most recent project aimed at meeting CU's carbon reduction goals. Although the Indoor Practice Facility array is the most visually significant display of CU's commitment to sustainability, there are lots of other renewable energy projects across CU's campus. One can find solar panels tucked away amongst the various peaks of red tile on a number of buildings including Wolf Law, the University Memorial Center, the Village Center Dining and Community Commons, and even the Chancellor's Residence. These and other solar projects[2] tell a larger story about the concentrated efforts of multiple managing groups to support CU's commitments to reducing carbon emissions.

CU's commitment to carbon reduction is contextualized by a number of larger trends. Primarily, CU's carbon reduction goals relate to CU's desired status as a leader in sustainability in both practice and academic programs. As aptly put by CU Boulder's Chancellor, Phil DiStefano, "[o]ur goal is nothing less than being the global leader in sustainability - and that aspiration carries with it great responsibility to advance on all fronts . . . ."[3] One of those fronts is carbon reduction and investment in renewable energy. CU's carbon reduction commitment is also in line with significant efforts made by other peer institutes across the country. Investment in renewables also

[1] See https://www.colorado.edu/today/sites/default/files/styles/advanced_article_hero/public/cu_solar_panels4ga.jpg?itok=LuUyuHhS for a look at the new array.

[2] For the purposes of this White Paper, "solar" refers specifically to solar photovoltaic technology.

[3] *Sustainability*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/sustainability/ (last visited Mar. 22, 2019).

parallels the interests of CU's students, the surrounding community, the City of Boulder, and the local energy utility, Xcel Energy.

Although CU is undeniably working toward carbon reductions as a whole, this paper explores whether the current rate of renewable development is truly enough to meet CU's carbon reduction commitments. While the addition of the solar arrays on the Indoor Practice Facility were a welcome addition to the CU campus skyline, it raises the question of "where's the rest of it?" CU is known for sustainability and as such, the stark lack of solar panels adds a surreal note when walking through CU's campus and solely seeing red tile across the entire skyline. This paper seeks to explore that disconnect.

This paper begins by outlining CU's commitments to carbon reduction and the integration of carbon reduction goals into campus planning. Next, it explains background issues surrounding the science, finances, support, and trends of solar development by universities. The paper then describes the existing solar projects on campus and discusses trends in size, funding, and investment by different funding groups. The heart of the paper is an evaluation of CU's progress towards stated goals, how much development is still required to meet those goals, and what challenges impacted CU's past solar development. The paper concludes by identifying potential opportunities for different actors to influence future solar development to ensure that CU meets its carbon reduction commitments.

Meeting CU's carbon reduction goals and commitments to sustainability will require an increased investment in solar development. Over time, this development has the opportunity to transform the campus from a reflection of purely aesthetic beauty and uniformity to a reflection of unity between CU's values and direct investment in sustainability and the future.

I. CU's Commitments to Renewable and Solar Development

CU has made multiple commitments to carbon reduction. Concrete goals manifest across different official planning documents. These commitments and goals are important in understanding CU's existing investment in continued future on-site and off-site solar development.

A. Campus Master Plan

CU's planning department develops a Campus Master Plan every 10 years to "outline the growth of the campus."[4] The planning process includes campus and community constituents and seeks to reflect their needs, values, and vision for CU's future.[5] The most recent Campus Master Plan was completed in 2011.[6] This plan incorporates principles of sustainable development and has specific commitments and goals for renewable energy generation.

Section III of the plan is about sustainability and outlines specific carbon reduction goals.[7] These goals were designed to meet standards set by the Governor's Executive Order "Greening of

[4] *Campus Master Plan*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/masterplan/ (last visited Feb. 12, 2019) [hereinafter Master Plan Website].
[5] *Process*, *Campus Master Plan*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/masterplan/process (last visited Feb. 12, 2019).
[6] PHILLIP A. SIMPSON, UNIVERSITY OF COLORADO BOULDER, CAMPUS MASTER PLAN (July 2011), https://www.colorado.edu/masterplan/plan [hereinafter Campus Master Plan].
[7] *Id.* at § III.

State Government"[8] and commitments made by signing the American College and University Presidents' Climate Commitment in 2007.[9] Using a 2005 baseline, the plan articulated short-term goals including a 20% reduction in energy intensity and a 25% volumetric reduction of petroleum fuel usage by 2012.[10] The plan sets long-term greenhouse gas reduction goals at a 20% reduction by 2020, 50% reduction by 2030, and 80% reduction by 2050 in comparison to the 2005 baseline.[11]

Section III.A.4. of the plan specifies detailed goals for energy efficiency and carbon reduction.[12] The section begins with a broad commitment to greener energy solutions:

> The manner in which CU-Boulder produces and consumes energy directly affects sustainability and carbon neutrality goals. About 80 percent of CU-Boulder's reported greenhouse gas (GHG) emissions are from the combustion of fuels for heat, power, and chilled water. Conservation, energy efficiency, and renewable fuel sources are among the best methods to reduce these emissions. The utility infrastructure must strive for a balance between costs, conservation, and carbon through "greener" energy solutions.[13]

The plan then identifies renewable energy development as a means to reduce carbon emissions for main campus. Solar energy is specifically mentioned as an option.[14] The plan provides guidelines to meet the aforementioned energy reduction and greenhouse gas reduction goals.[15] One guideline outlines a proposal for a large-scale solar project on 15-25% of CU's South Campus.[16] Another guideline specifically points to STARS and LEED certifications[17] as means to identify and take advantage of opportunities for renewable development on campus.[18]

The Campus Master Plan does not independently bind the actions of CU's administrators or staff. However, the University considers it a "crucial step in achieving the Flagship 2030 Strategic Plan,"[19] which outlines CU's strategy to become "a leading model of the 'new flagship university' of the 21st century."[20] As such, working towards and achieving the goals and commitments to renewable energy established in the Campus Master Plan is important.

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[8] Colo. Exec. Order D 005 05 (July 15, 2005) (signed by Governor Owens). Subsequent Governors signed additional "Greening the State Government" Executive Orders that restated and amended the goals contained in the original 2005 Executive Order. Colo. Exec. Order D 011 07 (Apr. 16, 2007) (signed by Governor Ritter); Colo. Exec. Order D 2015 013 (Oct. 25, 2015) (signed by Governor Hickenlooper); Colo. Exec. Order D 2018 026 (Sept. 11, 2018) (signed by Governor Hickenlooper).

[9] *Id.* at § III(A).

[10] *Id.*

[11] *Id.*

[12] *Id.* at § III(A)(4).

[13] *Id.*

[14] *Id.*

[15] *Id.*

[16] *Id.*

[17] STARS and LEED are sustainability certification programs for universities and buildings respectively. See discussion *infra* Section II.B.

[18] *Id.*

[19] Master Plan Website, *supra* note 4.

[20] UNIVERSITY OF COLORADO BOULDER, FLAGSHIP 2030 STRATEGIC PLAN 2 (2007), https://www.colorado.edu/chancellor/sites/default/files/attached-files/cuflagship.pdf.

B. Carbon Neutrality Plan

CU developed a Carbon Neutrality Plan in 2009 after signing the American College and University Presidents Climate Commitment ("ACUPCC") in 2007.[21] The plan was developed by campus and community members with the goal of "reaching carbon neutrality by providing leadership and instilling the necessity of practical solutions and efforts."[22] The plan sets short-term and long-term goals to help CU meet the commitment it made when signing the ACUPCC.[23]

The Carbon Neutrality Plan reiterates the Campus Master Plan's greenhouse gas ("GHG") reduction goals of 20% by 2020, 50% by 2030, and 80% by 2050.[24] It also sets a short-term goal of a 20% reduction of energy, vehicle fuel, and materials use (paper and other waste) by 2012 as a means of meeting the Governor's Executive Order.[25]

The plan specifically identifies large-scale wind and solar energy projects as necessary for achieving the 2030 goal of a 50% reduction.[26] The plan outlines timelines for carbon reduction development which projects 1.5 tons of CO2/yr offset by solar energy by 2030 and 2.7 tons of CO2/yr offset by solar energy by 2040.[27]

Like the Campus Master Plan, the Carbon Neutrality Plan does not have binding authority on CU's actions. However, it was created in response to formalized commitments, and it is important that CU adhere to the plan in order to honor those commitments, meet its stated GHG reduction goals, and preserve the integrity of the University.

C. White House Campus Climate Action Pledge

CU reaffirmed its commitment to the Campus Master Plan's carbon reduction goals through the CU Student Government ("CUSG") Environmental Center's 2016 Annual Report, which "pledge[d] to accelerate the transition to low-carbon energy while enhancing sustainable and resilient practices across [CU Boulder's] campuses."[28] This pledge responded to a White House initiative, known as the 2015 American Campuses Act on Climate, which was designed to "amplify the voice of the higher-ed community in support of a strong international climate agreement in the [U.N.] COP21 climate negotiations in Paris."[29]

The pledge begins: "As a charter signatory of [ACUPCC], adopted by our Board of Regents [on 11/12/2009], and as articulated by Chancellor Philip Distefano that [CU's] 'goal is nothing

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[21] *Carbon Neutrality Plan, Environmental Center*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/ecenter/energyclimate/cu-and-energy/carbon-neutrality-plan (last visited Feb. 2, 2019).
[22] CU CARBON NEUTRALITY WORKING GROUP, UNIVERSITY OF COLORADO BOULDER, CONCEPTUAL PLAN FOR CARBON NEUTRALITY AT THE UNIVERSITY OF COLORADO AT BOULDER 2 (Aug. 2009), availble at https://www.colorado.edu/ecenter/sites/default/files/attached-files/cu_carbon_plan.pdf [hereinafter Carbon Neutrality Plan].
[23] *Id.* at 8.
[24] *Id*.
[25] *Id*.
[26] *Id.* at 25.
[27] *Id.* at 29.
[28] ENVIRONMENTAL CENTER, UNIVERSITY OF COLORADO BOULDER, CUSG ENVIRONMENTAL CENTER ANNUAL REPORT 2016 32 (2016), https://www.colorado.edu/ecenter/sites/default/files/attached-files/ec_2016_annual_report_narrative.pdf.
[29] *American Campuses Act on Climate*, THE WHITE HOUSE (Dec. 11, 2015), https://obamawhitehouse.archives.gov/the-press-office/2015/12/11/american-campuses-act-climate.

less than being the global leader in sustainability,' we pledge to maintain our ACUPCC commitment by implementing our [Carbon Neutrality Plan]. . . as reported by our Board of Regents in March 2015.[30] The document then cites CU's "legacy as a pioneer in the environmental movement" as well as its support for Governor Hickenlooper's Executive Order D-2015-13 to "green state government" as motivating factors for the pledge.[31]

D. REopt by NREL

The National Renewable Energy Lab ("NREL") provides a Renewable Energy Integration & Optimization ("REopt") analysis for small systems such as campuses.[32] In 2018, NREL performed a REopt analysis of CU Boulder's campus and produced an Energy Planning Assessment.[33] The Reopt analysis put numeric values to CU's stated goals and evaluated the trajectory of current development.

The CU 2005 baseline for GHG production is 135,609 metric tons of CO2 equivalent.[34] A 20% reduction from that baseline would translate to a total output of 108,487 metric tons of CO2 equivalent (mTe), a 50% reduction to 67,805 mTe, and a 80% reduction to 27,122 mTe.[35] The 2016 GHG emission value was 134,377 mTe, which is just below the 2005 baseline, and is less than 5% of the total reduction needed to meet CU's desired 2020 GHG goal.[36] The REopt estimates that CU must reduce annual carbon by 42,479 mTe—over 34 times CU's carbon reduction from 2005 to 2016—to meet its 2030 goal.[37] For CU to meet its 2030 GHG reduction goals, it will have to replace 65% of utility electricity with renewable electricity or replace 97% of its natural gas usage with renewable fuel or heat.[38]

CU's commitment to sustainable development, its goals for GHG reduction, and the numerical reality of meeting those goals contextualize CU's current and future solar development. Solar development is an attractive option for CU for a number of reasons discussed in the next section. However, in order to meet its commitments to sustainability, CU needs to view solar development as a necessity rather than an optional policy decision.

II. Incentives to Develop Solar

CU has a number of reasons to invest in solar in addition to meeting its GHG reduction targets.. Solar development will contribute to broader campus environmental goals, its resiliency, and ultimately will reduce its energy costs. There are pressures from peer institutions on CU to continue to be recognized as a leader among institutions committed to sustainable development by increasing its performance in LEED and STARS. Additionally, local entities, including Xcel

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[30] *Id.*
[31] *Id.*
[32] *REopt: Renewable Energy Integration & Optimization*, NATIONAL ENERGY RENEWABLE LAB, https://reopt.nrel.gov/ (last visited Feb. 12, 2019) [hereinafter Reopt].
[33] DAN OLIS & DYLAN CUTLER, NATIONAL RENEWABLE ENERGY LABORATORY, UNIVERSITY OF COLORADO – BOULDER ENERGY PLANNING ASSESSMENT USING REOPT (Feb. 20, 2018) [hereinafter REopt] (available as Appendix A).
[34] *Id.* at 6.
[35] *Id.*
[36] *Id.*; The REopt based its projections on 2016 data and that data is the most recent, publicly available data on these metrics.
[37] *Id.* at 11.
[38] *Id.*

Energy and the City of Boulder, are publicly committed to the rapid development of renewable energy, which creates pressure for CU to collaborate and keep pace with their transitions to clean energy. CU markets itself as a sustainable school, and additional solar development would improve and substantiate its public image. Finally, investments in renewable technology align with the values of the University and its students, and students have directly expressed the desire for additional development.

A. Meeting CU's Goals, Cost-efficiency, and Resiliency

As the sections above detail, CU has committed itself in various published and public documents to reduce its future carbon footprint over several phases. While the Campus Master Plan's goal for 2020 is currently on-track,[39] NREL's REopt and the Carbon Neutrality Plan indicate that to meet the 2030 goal, CU must replace most of its utility electricity and natural gas power sources with renewable energy.[40] To do so at the least cost to the school, NREL recommends maximizing solar to fill available space and adding Battery Energy Storage Systems ("BESS").[41] The campus currently has 2,247 kW of solar.[42] It has room to add almost 5.5 times that amount (or 12,320 kW).[43] The space for new solar is roughly evenly split between rooftops (4,920 kW), open ground (3,220 kW), and on top of carports (4,200 kW).[44]

Meeting the stated 2050 reduction goal will require even greater commitments to renewable energy. NREL suggests expanding development of green energy projects off-campus and coordinating with the City of Boulder to investigate future renewable energy and storage opportunities such as community solar.[45]

Fortunately, installing solar contributes to a system that is more cost-effective than CU's current energy system. CU's current energy portfolio, including its Combined Heat and Power ("CHP") plant, is not found to be cost-effective because CU must pay high demand charges to Xcel for energy when there is a higher demand among Xcel customers.[46] By reducing the use of the CHP plant in favor of solar with battery storage technology, CU will reduce its need to purchase energy during periods of peak demand. Installation costs for solar are also economically feasible. Total costs are estimated at $2.30/Watt for self-financed panels, and $0.10-$0.12/kWh for those installed (at the panel owner's cost) through power purchase agreements ("PPAs").[47] While the

[39] Campus Master Plan, *supra* note 6, at § III; REopt, *supra* note 32, at 7.

[40] REopt, *supra* note 32, at 11; Carbon Neutrality Plan, *supra* note 22, at 25.

[41] REopt, *supra* note 32, at 12.

[42] REopt, *supra* note 32, at 31. A kilowatt (kW) is 1,000 watts, which is a measure of power. A kilowatt-hour (kWh) is the amount of electricity that a machine needs to run for one hour. For perspective, the average American residence uses 28.9 kWh per day and the average household refrigerator uses 1.8 kWh per day. This means that, operating at full capacity over the course of an hour (2,247 kWh/ hour), CU's solar could generate enough electricity to power about 77 residences, or 1,248 refrigerators for one day. *What is a Kilowatt-hour (kWh) and What Can it Power*, ELECTRICITY PLANS (Apr. 3, 2017), https://electricityplans.com/kwh-kilowatt-hour-can-power/.

[43] REopt, *supra* note 32, at 31.

[44] *Id*. These estimates are currently being supplemented through an ongoing viability study, and they do not reflect logistical concerns of using these spaces such as the feasibility of retrofitting rooftops.

[45] REopt, *supra* note 32, at 2.

[46] *Id.*

[47] REopt, *supra* note 32, at 13.

up-front costs of a self-financed transition to solar power would be considerable, PPA agreements could offset most of these costs.[48]

Finally, investing simultaneously in solar and battery storage technologies would "contribute to resiliency within a potential future microgrid[49] if specified for that purpose."[50] With proper planning, distributed generation from solar could be directly connected to CU's facilities, allowing CU to meet more of its own energy needs and reducing its reliance on Xcel for energy transmitted through the grid. If CU developed a microgrid, energy from solar could be transmitted throughout campus and used where it is needed. Additionally, the development of a microgrid is attractive to CU because it would allow the campus to be self-supporting in the case of a wider energy outage or crisis. Solar and battery technologies, installed together, would also increase the scale of cost-effective solar.[51]

In short, CU should invest in additional solar and battery storage technologies to satisfy its Campus Master Plan and Carbon Neutrality Plan commitments to reduce its carbon footprint, to economically transition towards a system of clean energy, and to build resiliency by connecting distributed sources of energy directly to its grid.

B. Signaling Sustainability

By improving its certification levels through programs like LEED and STARS, CU would substantiate its public image as a sustainable, elite research institution, and be recognized as such.

1. LEED

CU should invest in solar development to help new and renovated buildings that require construction achieve LEED Platinum certification. This would demonstrate CU's progressive commitment to sustainable development and innovation.

The Leadership in Energy and Environmental Design ("LEED") certification system is the "most widely used green building rating system in the world," and LEED certification is a globally recognized "symbol of sustainability achievement".[52] LEED buildings "save energy, water, resources, generate less waste, and support human health."[53] Buildings that meet LEED criteria also cost less to operate and boost the productivity of their users.[54]

LEED credits, which are applied towards a net score that determines the certification tier of each building, can be earned by meeting a variety of metrics, including up to 3 points for "renewable energy production"[55] and up to 2 points for "green power and carbon offsetting."[56] LEED has several tiers, and Silver (50-59 points), Gold (60-79 points), and Platinum (80+ points)

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[48] See *infra* Section II.B. for a detailed discussion of PPAs.

[49] A microgrid is a "local energy grid with control capability, which means it can disconnect from the traditional grid and operate autonomously." *How Microgrids Work*, U.S. DEPARTMENT OF ENERGY, https://www.energy.gov/articles/how-microgrids-work (last visited Feb. 20, 2019).

[50] REopt, *supra* note 32, at 8.

[51] *Id.*

[52] *LEED*, U.S. GREEN BUILDING COMMISSION, https://new.usgbc.org/leed (last visited Feb. 2, 2019).

[53] *Id.*

[54] *Id.*

[55] *Credits*, U.S. GREEN BUILDING COMMISSION, https://www.usgbc.org/credits (last visited Feb. 2, 2019).

[56] *Green Power and Carbon Offsets*, U.S. GREEN BUILDING COMMISSION, https://www.usgbc.org/node/2612837?return=/credits/new-construction/v4 (last visited Feb. 2, 2019).

are relevant to solar development at CU.[57] In addition, under Colorado state law, CU is required to meet a minimum standard of LEED Gold for any building undergoing substantial renovation, design, or new construction.[58]

Based on data combined from university materials[59] CU currently has 1 silver-,16 gold-, and 10 platinum-rated buildings. While this is impressive, as CU replaces older buildings, it should strive to bring all of its new or newly-renovated facilities up to the platinum tier. CU should focus on earning the LEED "renewable energy production" credits,[60] and by committing to purchase clean energy from PPAs to earn the "green power and carbon offset" credits.[61] CU's certified buildings have notably eschewed credits from categories related to renewable technology: among the 6 categories from which credits can be earned for its 23 certified buildings (that we have data for), CU left more points on the board (192 points unused) for the "energy and atmosphere" category than any other.[62] In other words, CU earned these certifications while avoiding energy and emissions programs worth an average of 11+ credits/building. LEED certifications are achieved when a building's construction is completed and cannot be "upgraded." However, additional solar, even solar applied to existing buildings, can be used to boost LEED scores for new construction.

CU should capitalize on these credits in the future to boost total scores of its new buildings into the Platinum tier.

2. STARS

The Sustainability Tracking, Assessment, and Rating System ("STARS") is a transparent, self-reporting framework for colleges and universities to measure their sustainability performance.[63] CU has participated in STARS since 2010.[64] The STARS framework, like the LEED system, is tiered between bronze, silver, gold, and platinum. There are a range of categories from which points can be earned.[65] Unlike LEED, which focuses on individual buildings, the STARS rating applies broadly to CU's entire campus and considers factors such as "academics"

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[57] *Achieve Better Buildings with LEED*, U.S. GREEN BUILDING COMMISSION, https://new.usgbc.org/leed#how-leed-works (last visited Feb. 2, 2019).
[58] C.R.S. 24-30-1305.5
[59] UNIVERSITY OF COLORADO, CU BOULDER LEED V2.2 (Feb. 14, 2018) [hereinafter CU LEED] (available as Appendix D); *LEED Certified Green Buildings at CU-Boulder, Facilities Management Sustainability*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/fmgreen/leed-certified-green-buildings-cu-boulder (last visited Feb. 2, 2019).
[60] *Renewable Energy Production*, U.S. GREEN BUILDING COUNCIL, https://www.usgbc.org/node/2612988?return=/credits/new-construction/v4 (last visited Feb. 2, 2019); It may be possible for CU to do so by purchasing its current solar arrays at their depreciated values.
[61] *Green Power and Carbon Offsets*, *supra* note 56. The terms of PPA purchases must require that CU retains the emissions credits associated with that energy to earn LEEDs credits.
[62] CU LEED, *supra* note 59.
[63] *STARS, The Sustainability Tracking, Assessment & Rating System*, THE ASSOCIATION FOR THE ADVANCEMENT OF SUSTAINABILITY IN HIGHER EDUCATION, https://stars.aashe.org (last visited Feb. 2, 2019).
[64] *University of Colorado Boulder*, THE ASSOCIATION FOR THE ADVANCEMENT OF SUSTAINABILITY IN HIGHER EDUCATION, https://reports.aashe.org/institutions/university-of-colorado-at-boulder-co/report/2010-11-09 (last visited Apr. 10, 2019).
[65] *About STARS*, THE ASSOCIATION FOR THE ADVANCEMENT OF SUSTAINABILITY IN HIGHER EDUCATION, https://stars.aashe.org/about-stars/ (last visited Feb. 2, 2019).

and "engagement" in addition to facility efficiency and carbon footprint.[66] The STARS program is internationally recognized, and rated institutions are included in the annual Sustainable Campus Index ("SCI"), where best practices of featured institutions are highlighted for others to emulate and to generate new ideas.[67]

Despite earning the first STARS Gold rating ever awarded to any campus in 2010, CU still has yet to meet its goal of reaching the platinum tier. The platinum tier requires a rating of 85%, and CU currently has a rating of 75.41%.[68] Meanwhile, five major universities including Colorado State (94.4%), Stanford (85.74%), Thompson Rivers (88.31%), California Irvine (94.08%), and New Hampshire (96.5%), have reached platinum ratings. CU now has dropped to thirteenth in rank in the 2018 SCI.[69]

CU can work towards obtaining the 20.10 points[70] needed for a platinum rating by developing solar on campus. CU could earn 10.64 points between the "Energy" and "Air & Climate Operations" categories. For example, CU scored only 5.19 points out of 10.0 for GHGs and zero points out of 4.0 for clean and renewable energy.[71] In contrast, Stanford and UC-Irvine, which have achieved platinum ratings, each scored higher than CU in both the Energy and Air& Climate Operations categories.[72]

It is possible to reach a platinum STARS rating without substantial investment in renewables, and CU could pursue such a route to improving its ranking. However, peer schools like Stanford and UC-Irvine still would be able to boast that their commitments to renewable energy were better than CU's. To the extent that CU desires to use its "green" public image to recruit talented faculty and students, its green image needs to be competitive with other top STARS institutions.

C. Commitments by Local Entities

CU is a part of the Boulder community and benefits from maintaining a positive relationship with its citizens and the local entities that support the city. Boulder's energy utility, Xcel, and the City of Boulder have each committed to expand their use of solar to reduce carbon emissions. These commitments have aligned their financial commitments with the values of their constituents, who support clean energy development.

By collaborating with these entities and increasing its commitment to solar development, CU would keep pace with local utility and municipality goals to transition to clean energy. In doing so, CU would align itself with the values of the environmentally-conscious community that hosts the University. The University benefits from building a good relationship with local government, and increasing solar energy offers some common ground on which to build such a relationship.

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[66] *Participate*, THE ASSOCIATION FOR THE ADVANCEMENT OF SUSTAINABILITY IN HIGHER EDUCATION, https://stars.aashe.org/participate/ (last visited Feb. 2, 2019).
[67] *Why Participate*, THE ASSOCIATION FOR THE ADVANCEMENT OF SUSTAINABILITY IN HIGHER EDUCATION, https://stars.aashe.org/about-stars/why-participate/ (last visited Feb. 2, 2019).
[68] UNIVERSITY OF COLORADO BOULDER, STARS 2018 CU BOULDER SUBMITTAL ANALYSIS 3 (Aug. 2018) [hereinafter STARS Analysis] (available as Appendix E).
[69] *STARS Participants & Reports*, THE ASSOCIATION FOR THE ADVANCEMENT OF SUSTAINABILITY IN HIGHER EDUCATION, https://reports.aashe.org/institutions/participants-and-reports/?sort=rating (last visited Feb. 2, 2019).
[70] Points do not translate directly to % ratings.
[71] *See* STARS Analysis, *supra* note 68.
[72] *Id.*

1. Xcel Sustainability Goals

Xcel Energy is the electric utility provider for the city of Boulder and the provider of 93% of CU's energy.[73] Xcel has plans to greatly increase its commitment to renewable energy use, including solar, over the short- and long-term. Xcel's "vision" includes reducing carbon by 80% of 2005 levels by 2030 and reaching zero carbon by 2050.[74]

Under the Colorado Energy Plan, Xcel will retire 660 MW of energy from coal-powered plants and add 1,800 MW of wind and solar resources by 2026.That will create an energy portfolio from which more than half of electricity produced is from clean energy sources.[75] As of 2017, Xcel already reduced its carbon emissions by 35% from 2005 levels.[76] Although investment in additional wind power is the largest driver of Xcel's transition, Xcel also is relying on solar development. Xcel's use of solar has already quadrupled from 2011 to 2017 .[77] New solar projects vary from local and community-solar gardens to large arrays.[78]

2. Boulder Municipality Sustainability Goals

The City of Boulder has identified various goals and pathways to promote energy efficiency and solar development. The most ambitious of these is to power the city using 100% clean electricity by 2030, with the ultimate goal of reducing community emissions by 43% by the year 2050.[79] To that end, Boulder is focusing on renewable energy development, including solar projects that allow local residences and businesses to purchase energy generated on-site through solar panels.[80] The City is facilitating solar by using collective purchase agreements to lower the cost of owning solar panels.[81]

Boulder also is pursuing the municipalization of its own electric utility, which would displace Xcel's services within the City.[82] The City plans to emphasize energy efficiency and developing renewable energy to meet the 2030 goal.[83] According to the City of Boulder's website, this development may be funded using "on-bill financing," in which customers pay for necessary upgrades through charges on their monthly bills, and may feature incentives to develop additional solar generation on residences.[84]

Although the direct effects on CU Boulder of Xcel's and the City's transitions to zero-carbon clean energy are uncertain, those entities have made their values clear. CU would benefit

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[73] CARLY SNIDER, JESSICA FLECK, MATT FROMMER, MORGAN SHACKER, NEIL BRANDT & WHITNEY DODD, 3SO ASSIGNMENT FOR SYSTEMS CLASS CU RENEWABLE ENERGY SYSTEM 9 (Apr. 27, 2016) (available as Appendix F).
[74] *Carbon Free 2050*, XCEL ENERGY, https://www.xcelenergy.com/carbon_free_2050 (last visited Feb. 12, 2019).
[75] *Carbon Reduction Plan*, Xcel Energy, https://www.xcelenergy.com/environment/carbon_reduction_plan (last visited Feb. 12, 2019).
[76] *Id.*
[77] *Id.*; *Solar Power*, XCEL ENERGY, https://www.xcelenergy.com/energy_portfolio/renewable_energy/solar (last visited Feb. 12, 2019).
[78] *Solar Power on Our System*, Xcel Energy, https://www.xcelenergy.com/energy_portfolio/renewable_energy/solar/solar_power_on_our_system (last visited Feb. 12, 2019).
[79] *Energy*, CITY OF BOULDER COLORADO, https://bouldercolorado.gov/climate/energy (last visited Feb. 12, 2019).
[80] *Id.*
[81] *Id.*
[82] *Id.*
[83] *Id.*
[84] *Id.*

by collaborating with and aligning itself with the values of both its host city and its electric utility. One important way to show such alignment is for CU to increase its own support for renewable energy, including increasing solar on campus.

D. Comparison to Other Schools

As noted earlier, several of CU's peer schools are leading the charge in solar and renewable development, and CU could learn from their examples. If CU wants to compare favorably to its peers in that regard, it should consider their progress and make similar commitments to develop solar.

Stanford has committed through its Energy and Climate Plan to 100% solar-powered electricity by the year 2021, and the campus is ahead of schedule for its goal to reduce peak 2011 emissions by 80% by 2025.[85] In 2015, Stanford entered into a PPA with Sunpower to build 78.5 MW of solar, with 5.5 MW on campus and 73 MW off-site.[86] The on-campus installations were approved after consideration of their "aesthetic and historical impact to campus along with orientation, roof size and slope, and construction."[87] Since its first solar array was installed in 2016, Stanford has reduced GHG emissions by 68% of 2011 levels, and the university will completely offset emissions by 2021—exceeding its overall goal four years early.[88] That progress helped Stanford achieve a STARS platinum certification.

Colorado State University, another STARS platinum university, also has increased its commitment to solar. In its Climate Action Plan, updated September 6, 2016, the school committed to a 75% carbon reduction by 2030 and a 100% reduction by 2050.[89] Since Colorado State first installed solar in 2009, it has increased its current portfolio of solar to 10,429,824 kWh/year.[90] Solar investments include a 5.3 MW array owned by Xcel Energy, one of the largest on-campus solar projects in the U.S., and 1.45 MW of rooftop solar on campus buildings owned by CSU.[91]

UC-Irvine is yet another example of a peer school ahead of CU on solar. In order to meet the requirements of the California Global Warming Solutions Act of 2006 to reduce GHG emissions to 1990 levels by 2020, UC Irvine installed 3.7 MW of solar power on its campus, including 3.2 MW produced from parking structure canopy arrays and .5 MW produced from

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[85] Chris Peacock, *Stanford to Go 100 Percent Solar by 2021*, STANFORD (Dec. 3, 2018), https://news.stanford.edu/2018/12/03/stanford-go-100-percent-solar-2021/.

[86] DEPARTMENT OF SUSTAINABILITY AND ENERGY MANAGEMENT, STANFORD, STANFORD UNIVERSITY ENERGY AND CLIMATE PLAN 7 (3rd ed. Sept. 2015), http://sustainable.stanford.edu/sites/default/files/E%26C%20Plan%202016.6.7.pdf [hereinafter Stanford Energy and Climate Plan].

[87] *Id.* at 47.

[88] *Id.* at 48; *Campus Action, Sustainable Stanford*, STANFORD, http://sustainable.stanford.edu/what-we-are-doing (last visited Feb. 12, 2019).

[89] COLORADO STATE UNIVERSITY, SUSTAINABILITY STRATEGIC PLAN (Sept. 6, 2016), https://green.colostate.edu/media/sites/50/2016/10/CSU-Sustainability-Strategic-Plan-oct-27.pdf.

[90] *Solar and Biomass, Sustainability Initiatives*, COLORADO STATE UNIVERSITY, https://green.colostate.edu/solar-and-biomass/ (last visited Feb. 12, 2019).

[91] *Id.*

rooftop arrays.[92] The university is STARS platinum-certified and has received a U.S. EPA Climate Leadership Award, in part for its "establishment of on-site renewable energy systems.[93]

In contrast to those peer institutions, CU has not shown a comparable level of commitment to solar technology. Although CU installed its first solar project in 2004, it has since lagged behind many of its peers.[94] To date, CU has a total capacity of only 2.247 MW of total solar that produces 3,185,270 kWh/year. Peers like Stanford and UC Irvine have installed 3,493% and 165% of CU's total capacity, and Colorado State's arrays produce 327% as many kilowatts of solar energy per year than does CU.[95] The rapid development of solar at those institutions can be attributed in part to their more ambitious GHG reduction plans, but CU's slower development and smaller total array volume may also be caused by its reluctance to invest in ownership or commitments to PPAs to acquire additional solar. In contrast, Stanford's agreement with Sunpower, and Colorado State's agreement with Xcel energy, show the feasibility of rapid and large-scale solar installation where the host-institution is amenable.[96] Finally, all three of the highlighted institutions have been willing to utilize campus rooftops and parking structure canopies to maximize on-site solar potential, unlike CU.

In short, if CU wants to portray itself as a cutting-edge research institution dedicated to sustainable development, it needs to develop more solar on- and off-campus through the purchase and commitment to solar energy.

E. Public Relations

CU should invest in additional solar to convey its commitment to sustainability, which would improve public perceptions of the University and help it compete for students and faculty as well as help CU improve alumni relations.

The University markets itself as a sustainable institution, touting the campus' national achievements and innovations on the Sustainability page of CU's website. The list includes: "top 10 university for sustainability," "first university to achieve a STARS GOLD rating," "#5 Environmental Law Program," "first division 1 zero-waste stadium and athletic program", and "first LEED Platinum research lab in the U.S."[97] Further, the sustainability page features a photo of the Indoor Practice Facility's solar array and the headline "Sustainability is Embedded in Our Campus Life," above the quote "Our goal is nothing less than being the global leader in sustainability – and that aspiration carries with it ***great responsibility to advance on all fronts*** …."[98] The page also emphasizes the University's many environmental programs, its 2020 carbon

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[92] *Energy, UCI Sustainability*, UNIVERSITY OF CALIFORNIA, IRVINE, https://sustainability.uci.edu/sustainablecampus/energy/ (last visited Feb. 12, 2019).
[93] *Id.*
[94] *See infra* Table 1.
[95] *Id.*
[96] Taylor Kubota, *Stanford Unveils Innovative Solar Generating Station*, STANFORD UNIVERSITY (Dec. 5, 2016), https://news.stanford.edu/2016/12/05/stanford-unveils-innovative-solar-generating-station; ALISON HOLM & ILYA CHERNYAKHOVSKIY, NATIONAL RENEWABLE ENERGY LAB, COLORADO STATE UNIVERSITY: A MIDSCALE MARKET SOLAR CUSTOMER CASE STUDY 6 (2016), https://www.nrel.gov/docs/fy17osti/67540.pdf.
[97] *Rankings & Achievements*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/about/rankings-achievements (last visited Feb. 12, 2019).
[98] *Sustainability*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/sustainability/ (last visited Feb. 12, 2019) (emphasis added).

reduction commitment, and selected responses from the survey cited below, including "40% of students report they chose CU in part because of its sustainability reputation."[99]

Clearly, CU deliberately projects a sustainable image in order to benefit from positive public relations. That image is justified in part because of efforts to reduce waste and promote efficiency. However, CU's promotion of its solar and renewable energy projects, but exclusion of data on the total capacity of these arrays, fails to convey the reality that solar development has been stagnant in recent years, especially compared to peer institutions.[100]

CU's image could benefit from developing and committing to additional renewables that could be publicly promoted to substantiate the University's sustainable image and bring it on par to peer institutions such as Colorado State and Stanford. The positive press generated by such solar developments could contribute to the attraction of talent. Hopefully, alumni who value sustainable development would be prompted to financially support the University as well.

F. Student Support

CU depends on the support of the student body to finance its operations and promote its brand, which emphasizes sustainability. CU's student body has expressed its approval and desire to increase solar and other renewable power on campus. Recent survey results and student initiatives show that approval.

CU should invest in solar development to continue to attract students who are drawn to the University by its professed commitments to sustainability.

1. Campus Survey

In 2017, the CU Environmental Center ("E-Center") issued a Campus Sustainability Survey ("Survey") to a representative sample of 3,000 graduate and undergraduate CU boulder students.[101] The response rate varied from 284 to 310 responses per question, or about 10%. Although this rate is admittedly low, the Survey, which aimed to assess the values of students, still shows some helpful trends.[102]

The results showed that students strongly support renewable energy projects on campus. Notable responses include:

- 90% indicated that sustainability was either "very" or "somewhat" important to them prior to attending CU Boulder[103]
- 97% indicated that sustainability was either "Very" or "Somewhat" important to them now that they are CU Boulder students[104]

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[99] *Id.*

[100] That data is not included on the Sustainability page with CU's other achievements, despite featuring a photo of CU's solar panels. It can be found on the Facilities Management Energy Page. *Facilities Management Energy*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/fmenergy/reporting (last visited Apr. 8, 2019).

[101] KELLY SIMMONS, CU ENVIRONMENTAL CENTER, 2017 CAMPUS SUSTAINABILITY SURVEY 2 (Dec. 2017) [hereinafter Sustainability Survey] (available as Appendix B).

[102] *Id.*

[103] *Id.* at 8.

[104] *Id.*

- 95% of students think that climate change is a legitimate concern for their generation[105]
- 98% of students rated Renewable Energy projects as "Very" or "Some" [importance for formal school programs][106]
- 95% of students rated Petroleum Use Reduction (idling vehicles, more electric) as "Very" or "Some" [importance for formal school programs][107]

While the survey was limited by a low response rate, the CU students who responded value sustainable development and are concerned with the effects of climate change. 90% of respondents indicated that they valued sustainability before attending CU, while 97% currently value sustainability. That suggests not only that CU attracts a very high percentage of applicants who value sustainability, but also that the University fosters a culture that instills those values in its student body. Furthermore, students expressed a desire for the University to reduce its carbon footprint and increase its commitment to clean and renewable technology, such as solar. While 95% of respondents ranked it important that the University implement programs designed to reduce petroleum use, a whopping 98% ranked school renewable energy programs as important.

2. Student Initiatives

The results of two recent CU Student Government ("CUSG") elections also demonstrate student support for increased solar on campus.

In 2004, participating students voted overwhelmingly in favor of a referendum that would have increased solar power and solar panels on campus in exchange for a student fee increase of $2.80 per semester.[108] Although the initiative ultimately failed due to insufficient voter turnout,[109] 78% of election participants approved the proposal (1,938/2,476 votes).

Four years earlier (in 2000), students successfully passed a similar referendum to purchase clean, renewable, wind-generated energy to power the University Memorial Center, Recreation Center, and Wardenburg Health Center in exchange for a four-year student fee increase of $1.00 per semester.[110] Like the solar referendum, this initiative was supported by a large majority of voters, with 82.5% of election participants voting in its favor (5,178/6,274 votes).[111]

Although the solar program failed to formally pass due to CUSG's procedural rules, both elections nevertheless suggest that there is strong student support for increasing campus commitments to solar and other renewable energy. Notably, students are willing to vote with their wallets to make that happen.

Therefore, adding solar and committing to additional renewable development would align the administration's actions with values expressed by students in recent surveys and referenda. By

[105] *Id.* at 9.
[106] *Id.* at 13.
[107] *Id*.
[108] COLORADO UNIVERSITY STUDENT GOVERNMENT, SOLAR POWER REFERENDUM RESULTS (Nov. 11, 2004) [hereinafter Solar Referendum] (available as Appendix C).
[109] CUSG's by-laws require 10% of the total student-body to approve an initiative.
[110] Solar Referendum, *supra* note 108.
[111] *Id*.

implementing actions supported by the student body, CU would retain the respect of its constituents.

III. The Current Solar Energy System at CU

In order to understand how solar development could happen on campus, it is important to understand current solar energy projects. That understanding requires more than a surface audit of the current power and energy provided by solar. It is important to inspect CU's general funding structure, how specific projects are funded, and particular project details, and related regulatory schemes. All of those topics provide insights that are useful to understanding future solar development on campus.

A. CU's Funding System

CU's overall budget is divided into different categories of funds.[112] Each separate fund receives money from different sources and each fund is used to pay for different groups of expenses.[113] Further, buildings on campus are managed and operated by different funding groups. Costs associated with construction, maintenance, retrofitting, and utilities for each building are the responsibility of the funding group that is in charge of the building.

The General Fund (GF) is made up of tuition and fees, direct state appropriations, and indirect cost recovery.[114] GF manages many of the administrative, classroom, and research buildings on Main Campus and East Campus.[115]

Auxiliary funds are individual entities that produce their own revenues to provide various facilities or services to CU. Different auxiliary funds include the Book Store, Parking Services, and Continuing Education. In the context of property management and project development Athletics, Housing & Dining, and Real Estate Services (formerly Research Property Services) are important auxiliary funds. Housing & Dining manages most of the residential buildings including residence halls, faculty and staff apartments, and the Chancellor's Residence.[116] Athletics manages the Champions Center, the Indoor Practice Facility, the Dal Ward Athletic Center, the Events Center, and other athletics facilities.[117] Research Property Services manages various properties in the Research Building System on Main and East Campus.[118]

CU's budget also is comprised of restricted funds made up of gifts, donations, endowments, contracts, grants, investments, and federal financial aid programs.[119] The money in restricted funds

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[112] *How CU Boulder is Funded, Budget & Fiscal Planning*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/bfp/funding-overview/how-cu-boulder-funded (last visited Feb. 12, 2019).
[113] *Id*.
[114] *Id.* at 95.
[115] UNIVERSITY OF COLORADO, MASTER BUILDING LIST (Dec. 2018), https://www.colorado.edu/fm/sites/default/files/attached-files/sr1020.master_building_list_december2018_0.pdf [hereinafter Building Master List].
[116] *Id*.
[117] *Id*.; *3 Athletics Facilities Score LEED Platinum for Green Building Excellence*, UNIVERSITY OF COLORADO BOULDER (Dec. 12, 2017), https://www.colorado.edu/today/2017/12/12/3-athletics-facilities-score-leed-platinum-green-building-excellence [hereinafter Athletics Green Building Excellence Article].
[118] *Real Estate Services*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/res/ (last visited Feb. 12, 2019).
[119] *How CU Boulder is Funded*, *supra* note 112.

is allowed to be used only for purposes that the donor/grantor/financier specified.[120] Finally, CU Student Government receives money from student fees and allocates those funds to specific groups or for specific projects.[121] Restricted funds may be allocated to a GF or Auxiliary Fund entity to be used for a permitted purpose related to a building under that fund's management. For example, restricted funds from the Sustainability Fund[122] and from the CU Sustainability Grant[123] have been used for past solar development.[124]

Effective solar development across CU's campus requires each funding group to consider solar development. Each funding group has a different set of employees, leadership, and mission. As such, solar development across each funding source can look different and can require different considerations.

B. Power Purchase Agreements

A Power Purchase Agreement ("PPA") is a third-party financing mechanism within the solar industry.[125] In a PPA, a third-party solar developer pays for the installation of, and owns, a solar array on a customer's property.[126] The customer then buys the power generated by the solar array at a fixed or escalating rate from the developer.[127] That rate is typically lower than offered by the utility. Thus, the customer gets the benefit of paying less for its energy, avoiding the upfront investment in the array and the costs of maintaining and repairing the array, and using renewable energy rather than a carbon-intensive alternative.[128]

PPAs have additional monetary benefits for tax-exempt entities, such as CU, by allowing them to benefit from tax incentive programs that would otherwise exclude them.[129] Federal and state policies provide tax incentives for solar development.[130] Since tax-exempt entities do not pay taxes, they typically would not benefit from the solar-related tax incentives.[131] However, taxable third-party investors, or tax equity investors, can receive the tax benefits from developing solar

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[120] *Id*.

[121] *Who We Fund, Student Government*, UNIVERSITY OF COLORADO BOULDER, https://custudentgov.org/who-we-fund/ (last visited Feb. 12, 2019).

[122] The "Sustainability Fund" was a term used by CU staff members to refer to a restricted fund composed of student fees that is managed by the Environmental Center. The Environmental Center has the ability to allocate those funds for sustainability projects. We have not been able to independently substantiate detailed information about the fund.

[123] *Sustainable CU, Environmental Center*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/ecenter/greening-cu/sustainable-cu (last visited Feb. 12, 2019). The CU Sustainability Grant is one specific allocation of funds from the Sustainability Fund.

[124] *See infra* Table 1.

[125] UNDERSTANDING THIRD-PARTY OWNERSHIP FINANCING STRUCTURES FOR RENEWABLE ENERGY, U.S. ENVIRONMENTAL PROTECTION AGENCY, https://www.epa.gov/repowertoolbox/understanding-third-party-ownership-financing-structures-renewable-energy (last updated June 26, 2018).

[126] *Id*.

[127] *Id*.

[128] NATIONAL RENEWABLE ENERGY LAB, USING POWER PURCHASE AGREEMENTS FOR SOLAR DEVELOPMENT AT UNIVERSITIES 2 (Jan. 2016), https://www.nrel.gov/docs/gen/fy16/65567.pdf.

[129] *Id.* at 3.

[130] *Id*.

[131] *Id*.

arrays on University property.[132] The investor then further reduces the energy rates that the tax-exempt entity, like the University, has to pay.[133]

Third-party financing and PPAs are included in CU's Carbon Neutrality Plan as a strategy to successfully drive solar development.[134] Many of CU's existing solar arrays were financed through PPAs.[135] Several of CU's current PPAs have an option for CU to buy the solar array from the third-party developer after a set number of years for the depreciated value of the array.[136]

One drawback of CU's heavy use of PPAs is that STARS and LEED do not permit CU to credit energy offsets from solar developed through a PPA.[137] Nonetheless, many of the PPAs require the vendor to donate the Renewable Energy Credits back to CU at the end of the agreed terms, which can then be counted towards STARS and LEED for new buildings. Even without specific credit for each solar project, solar arrays funded by PPAs still impact CU's carbon emissions and sustainability.

C. Existing Solar Arrays

CU has developed solar projects since 2004. The size of the projects ranges from 6 kW to 850 kW arrays. The total estimated annual energy across all the solar projects on CU Boulder's properties is 3,185,270 kWh/yr. The numerical and descriptive data in the proceeding chart come from a combination of a CU Renewable Energy Report prepared by Masters of the Environment graduate students,[138] E-Center website,[139] Building Master List,[140] and Facilities Management.[141]

Project	**Year**	**Power (kW); Energy (kWh/yr)**	**Funding Group**	**Owner**	**Funding**
Indoor Practice Facility	2016	850 kW; 1,056,653 kWh/yr	Aux(Athletics)	PPA: Sunpower	Sunpower
Grounds and Recycling	2016	11 kW; 15,755 kWh/yr	General Fund	CU	Sustainability Fund (Student Funding)
Village Center (Village Commons)	2016	140 kW; 194,970 kWh/yr	Aux(Housing & Dining)	PPA; Custom Solar	Custom Solar
Coors Event Center II	2013	290 kW; 320,000 kWh/yr	Aux(Athletics)	PPA; SH COD XIII, LLC	SH COD XIII, LLC
Research Park Solar Farm (SEEC)	2012	500 kW; 850,000 kWh/yr	Aux(RES)	PPA; Pansonic	Pansonic
Research Lab 2	2012	49 kW; 71,000	General Fund	CU	Donated by CIRES

[132] *Id*.
[133] *Id*.
[134] Carbon Neutrality Plan, *supra* note 22, at 100.
[135] *See infra* Table 1.
[136] Carbon Neutrality Plan, *supra* note 22, at 98.
[137] *Id.* at 100.
[138] Snider et al., *supra* note 73.
[139] Sustainable CU, *supra* note 123.
[140] Building Master List, *supra* note 115.
[141] *Reporting, Facilities Management Energy*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/fmenergy/reporting (last visited Feb. 12, 2019).

		kWh/yr			
William Village North/Bear Creek Car-port	2011	100 kW; 141,422 kWh/yr	Aux(RES)	PPA; SMX Capital	SMX Capital
Center for Community (C4C)	2011	98 kW; 140,000 kWh/yr	Aux(Housing & Dining)	PPA; SMX Capital	SMX Capital
Institute for Behavioral Science	2011	10 kW; 13,000 kWh/yr	General Fund	CU	Sustainability Fund (Student Funding)
Center for Innovation and Creativity (CINC)	2010	102 kW; 135,102 kWh/yr	Aux(RES)	PPA; LIghthouse Solar	Lighthouse Solar
Mountain Research Station II	2010	30 kW; 43,500 kWh/yr	Aux(RES)	CU	Sustainable CU Grant (Student funding)
Mountain Research Station I	2009	Combined with II	Aux(RES)	CU	Sustainable CU Grant (Student funding)
Coors Event Center I	2009	88 kW; 115,375 kWh/yr	Aux(Athletics)	PPA; Rockwell Financial Group	Rockwell Financial Group
Wolf Law	2009	12 kW; 15,643 kWh/yr	General Fund	PPA; Rockwell Financial Group	Rockwell Financial Group
Housing and Maintenance Center	2009	42.84 kW; 54,000 kWh/yr	Aux(Housing & Dining)	PPA; Rockwell Financial Group	PPA; Rockwell Financial Group
Chancellor's Residence	2008	6 kW; 8,700 kWh/yr	Aux(Housing & Dining	CU	Donated by Xcel
University Memorial Center (UMC)	2004	7 kW; 10,150 kWh/yr	Aux(Student Government)	CU	E-Center; Student Fees

D. Discussion of Data

Examining the above chart of existing solar energy at CU reveals interesting trends and variation in time periods, funding groups, project scope and financing. Solar development occurred in waves of projects. After the initial small project on the UMC in 2004, four years passed before the small project at the Chancellor's Residence was installed. After that, there were consistent project additions between 2009 and 2013, several of which were related to each other. For example, Mountain Research Stations I and II are parts of the same project, and the Housing and Maintenance Center, Wolf Law, and Coors Event Center I projects were negotiated together with one funder. After 2013, there was no further development until 2016 when Housing & Dining, Athletics, and GF each finished a project. Since 2016, there have been no projects brought online. There are, however, some projects in the works in a few different funding groups, which will be discussed in a later section.

There is significant variation in project sizes. Of the 17 listed projects, only four (Indoor Practice Field, Village Center, Coors Event Center II, and Research Park Solar Farm) are above 150 kW. Those represent four of the five most recent projects. Of these larger projects, the Indoor Practice Field is significantly larger than the others. It produced just over 33% of the total annual power on campus. Five of the projects (Grounds and Recycling, Institute for Behavioral Science,

Wolf Law, Chancellor's Residence, and UMC) were under 15 kW. That number increases to seven if you divide the combined power for Mountain Research Station I and II.

Funding sources for solar development heavily favored PPAs. Ten of the seventeen projects were funded by PPAs and are still owned by third-party investors. The remaining seven are owned by CU. Of the seven owned by CU, two were paid for by the restricted Sustainability Fund, two were paid for by students through the restricted Sustainable CU Grant, one was paid for directly by the Environmental Center (which is funded by students), and the final two were donated, one by Xcel Energy and the other by the Cooperative Institute for Research in Environmental Sciences ("CIRES").

Abundance, size, and funding structures for projects vary by funding group. Four projects are managed by GF. The thirteen other projects are managed by auxiliary funding groups: four for Housing & Dining, three for Athletics, five for RES, and one for Student Government. GF is the largest energy consumer, consuming roughly 60% of the total energy campus. Housing & Dining the second largest at around 15% energy consumption and the rest of the axillaries compose the final 25%. Of the 372 "buildings"—including sheds, parking structures, etc.—belonging to CU Boulder, 103 are attributed to GF, 24 to RES, and 237 to the all the other auxiliaries combined.[142] By square-footage, GF manages 5,512,782 square-feet of property, all auxiliaries combined manage 5,992,934 square-feet, and RES manages 731,446 square-feet.[143] In terms of overall assets, GF represents 44.1% of the 2019 budget, while all auxiliaries (including those other than RES, Housing & Dining, and Athletics) represent 24.2% of the 2019 budget.[144] Considering the comparative size of the GF to all of the other funding groups, it seemingly has the most opportunity to develop solar and yet has proportionally less solar than any of the other funding groups.

In addition to project abundance, the average size of individual arrays also varies by group. The four GF projects are 11, 49, 10, and 12 kW arrays. In contrast, each of the auxiliaries have a mix of large and small projects. Housing & Dining projects are 140, 98, and 6 kW arrays, and RES projects are 500, 102, 100 and 30 kW arrays. Athletics primarily has large arrays, and its projects are 850, 290, and 88 kW arrays. Looking at the size of individual arrays and the total amount of power each funding groups again shows more development by Auxiliary groups than by GF.

Funding also varies by group. GF utilized few PPAs. Two of the projects were funded through the Sustainability Fund, and one was donated. The only PPA that GF has is for Wolf Law, and it was negotiated along with two other projects managed by different project groups. In contrast, all but three of the projects managed by auxiliary funds were PPAs. The Chancellor's Residence was donated to Housing & Dining, and Mountain Research I and II, which are managed by RES, were funded by the Sustainable CU Grant. Groups that developed more solar—such as Athletics—utilized PPAs more while groups that developed less solar—such as GF—relied more heavily on opportunistic funding such as grants or donations. Based on that trends, the utilization of PPAs seems to be an important component of successful solar development.[145]

Examining and understanding CU's past solar development for trends in funding, scope, time, and managing funding group provides insights that are relevant to future solar development.

[142] Building Master List, *supra* note 115.
[143] *Id*.
[144] *How CU Boulder is Funded*, supra note 112.
[145] See *infra* Section IV.C. for additional analysis and conclusions based on these descriptive trends.

Subsequent sections of this paper will use these trends to draw areas of support, resistance, and opportunity for meeting CU's sustainability and GHG emission goals.

IV. Evaluating Current Progress Towards Stated Goals

Future solar development is dependent on past solar development in multiple ways. Past solar development creates patterns or practices that can serve or hinder future development. By understanding the various sources of past support and opposition, CU can identify changes in practices that it will need to make in order to increase the rate of new solar development.

A. Current Trajectory with CU's Goals

Checking progress is a critical part of meeting goals. It is important to reflect on the progress made and look forward to the work remaining. Reviewing CU's progress towards energy related sustainability goals reveals areas of success and areas for improvement. CU's stated goals are:

- 2012: 20% reduction in energy intensity from a 2005 baseline.[146]
- 2012: 25% volumetric reduction of petroleum fuel usage from a 2005 baseline.[147]
- 2020: 20% reduction of GHG emissions from a 2005 baseline.[148]
- 2030: 50% reduction of GHG emissions from a 2005 baseline.[149]
- 2050: 80% reduction of GHG emissions from a 2005 baseline.[150]

The 2005 baseline for energy intensity was a total of 130,115,696 kWh consumed.[151] A 20% reduction from this level of energy intensity is 104,092,556.8 kWh consumed.[152] CU missed this goal in 2012 with an energy intensity of 147,963,869 kWh consumed.[153] Instead of decreasing, CU's energy intensity increased by 13.7%.[154] The most recent data shows that the level continued to increase at a slightly slower rate to 153,005,446 kWh consumed.[155] This is 147% the amount of the 2012 goal.[156] However, these energy increases need to be considered in light of the fact that the campus has grown significantly since 2005. Data for the 2012 goal for the volumetric reduction of petroleum fuel usage was unavailable.[157]

The REopt extensively examined CU's system and projected CU's progress for each of the three upcoming carbon goals.[158] The 2020 goal is 108,487 mTe.[159] CU's actual carbon emissions were 134,377 mTe—only 5% of the needed reduction to meet the 2020 goal—in 2016 when the

[146] Campus Master Plan, *supra* note 6, at § III; Carbon Neutrality Plan, *supra* note 22, at 8.
[147] Campus Master Plan, *supra* note 6, at § III; Carbon Neutrality Plan, *supra* note 22, at 8.
[148] Campus Master Plan, *supra* note 6, at § III; Carbon Neutrality Plan, *supra* note 22, at 8.
[149] Campus Master Plan, *supra* note 6, at § III; Carbon Neutrality Plan, *supra* note 22, at 8.
[150] Campus Master Plan, *supra* note 6, at § III; Carbon Neutrality Plan, *supra* note 22, at 8.
[151] University of Colorado at Boulder, Summary of Energy Use and Scope 1&2 GHG Emissions, Net of Offsets, 2005-2016 (June 14, 2017) (available as Appendix G).
[152] *Id*.
[153] *Id*.
[154] *Id*.
[155] *Id*.
[156] *Id*.
[157] *Id*.
[158] *See* REopt, *supra* note 32.
[159] *Id.* at 6.

study was conducted.[160] CU was able to manage load growths through campus expansions, keeping the carbon emissions from growing from the 2005 baseline.[161] 93% of CU's energy is supplied by Xcel energy.[162] Colorado's Renewable Energy Standards require Xcel to meet 30% renewable energy by 2020, which Xcel is confident it can meet.[163] Xcel projects that 48% of energy will be from renewable sources by 2022.[164] As Xcel shifts its portfolio to more renewable energy, CU's carbon emissions will decrease. The REopt predicts that if CU keeps utility loads the same and Xcel develops their portfolio as planned, CU's carbon emissions will be 109,400 mTe in 2020.[165] The prediction just barely misses the 2020 goal of 108,487 mTe, but is based on CU doing nothing other than keeping levels flat. It is possible that last-minute development might allow CU to meet the 2020 goal. CU is on roughly on track to meet its 2020 goals, however that is primarily due to Xcel Energy's renewability efforts, not CU's.

Similar reliance on Xcel is not enough to meet the 2030 goal of 67,805 mTe.[166] Based on the predicted 2020 value of 109,386 mTe, CU needs to reduce annual carbon by 42,479 mTe, which is around a 60% reduction of the predicted 2020 level.[167] According to the REopt, this would require replacing 65% of the utility electricity with renewable electricity or replacing 97% of natural gas with renewable fuel or heat.[168] NREL suggests that maximizing solar energy in current available space is a major component of the "least cost pathway to 2030 CO2 goal."[169] The report indicated that CU has available space to develop 4,920 kW of solar on rooftops, 3,220 kW on open ground, and 4,200 kW on carports.[170] Between 2005 and 2016, CU reduced its carbon emissions by 1,232 mTe through its development of solar projects. The necessary reductions between 2020 and 2030 is 3,448% the carbon reductions from 2005 and 2016. Meeting the 2030 goal will require renewable development on a much larger scale than past development.

All of this development is necessary to meet the 2030 goal. The higher 2050 goal would require further development of carbon reduction opportunities and more investment in renewables—potentially off-site—to meet CU's energy needs and carbon emission goals.[171]

Although CU is likely able to meet the 2020 goals though little additional action, meeting the 2030 and 2050 goal requires further renewable development. CU not only should develop more solar energy projects, it has to do so at a faster rate than the current solar was developed.

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[160] *Id*.
[161] *Id*.
[162] Snider et al., *supra* note 73, at 9.
[163] *Renewable Energy*, XCEL ENERGY, https://www.xcelenergy.com/company/corporate_responsibility_report/library_of_briefs/renewable_energy (last visited Feb. 12, 2019).
[164] *Id*.
[165] REopt, *supra* note 32, at 7.
[166] *See Id.* at 11. Increased reliance on Xcel Energy—beyond the current reliance for 93% of campus' energy needs—similarly is not enough to meet CU's 2030 goals. Beyond strict numbers, CU has interests in using visible renewables, maintaining a direct investment in sustainability, and producing its own electricity that cannot be met by relying entirely on Xcel for its energy production.
[167] *Id*.
[168] *Id*.
[169] *Id.* at 12.
[170] *Id.* at 31.
[171] *See generally Id.* at 2.

Understanding the challenges that faced past projects is important to developing strategies to overcome those challenges in the future.

B. Challenges of Solar Development

The most obvious challenge to any renewable energy development is funding. Upfront costs can be a barrier to any kind of new development, including solar. Even though renewables are good long-term investments that ultimately reduce costs over time, if the upfront costs are too high, the University may not have sufficient financial resources to fund the project. The issue is important enough that both the REopt and the Carbon Neutrality Plan specifically address costs.[172] The Carbon Neutrality Plan addresses the issue by setting the expectation that solar projects would primarily use third-party financing, such as PPAs, rebates, or a combination of the two.[173] Even with third-party financing, the University will eventually still have to pay a lump sum of money if it opts to buy back the arrays at a reduced cost at the end of the contract.[174] For example, the Carbon Neutrality Plan analyzed the solar project for Wolf Law, Coors Event Center I, and the Housing and Maintenance Center. The financial analysis showed 210 kW of solar arrays would initially cost $1.5 million covered by third party financing, produce an annual saving of around $50,000, and would eventually cost the University $400,000 when it bought the project back seven years later.[175] Although the actual project was closer to 150 kW and the University has not bought back the solar arrays from the third-party financer, the analysis still illustrates the long-term economic sense of funding solar projects.

The REopt looked at the long term costs for meeting the Carbon Neutrality Plan and found that maximizing solar energy on campus was the most cost-effective way to meet the 2030 goal.[176] Developing solar was cost effective either when directly investing in the solar projects or using PPAs.[177] Even though solar makes long-term financial sense for the University, the University still will need to plan for some kind of financial outlay.

Administrative and procedural steps for approving a building project can also create barriers for solar development. At CU, a building project must be reviewed and approved by the Design Review Board (DRB).[178] The DRB is comprised of architects and design professionals appointed by the president of the University who are charged with reviewing projects for aesthetic and physical characteristics.[179] New construction, major renovations, and "all aspects of the built environment"[180] are reviewed by the DRB. Thus, DRB must review any solar projects. The DRB's goal is to review projects for consistency with the development goals of the Campus Master Plan

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[172] *Id.* at 9; Carbon Neutrality Plan, *supra* note 22.
[173] Carbon Neutrality Plan, *supra* note 22, at 100.
[174] *Id.* at 41.
[175] This financial analysis uses time-specific monetary incentives because incentives are subject to change. Currently, the solar investment tax credit program is in a "phasedown" that began in 2015. *Solar Investment Tax Credits (ITC)*, SOLAR ENERGY INDUSTRIES ASSOCIATION, https://www.seia.org/initiatives/solar-investment-tax-credit-itc (last visited Apr. 11, 2019).
[176] REopt, *supra* note 32, at 9.
[177] *Id.* at 13.
[178] UNIVERSITY OF COLORADO, DESIGN REVIEW BOARD PROCESS AND PROCEDURES 1 (Aug. 5, 2015), https://www.cu.edu/sites/default/files/DRB%20Procedures%20Document.pdf [hereinafter DRB Procedures].
[179] *Id*.
[180] *Id*.

and aesthetics of the campus design guidelines.[181] The DRB's scope of review specifically includes "building performance, and sustainable and integrated design methods and materials."[182] A big consideration for the DRB is preserving the "Tuscan vernacular" aesthetic of the campus.[183] The campus architecture website states:

> CU Boulder is recognized as one of the most beautiful and environmentally conscious college campuses in the nation. Set against a prominent mountain backdrop, its buildings are universally admired for their uniform style of sandstone walls, red tile roofs, limestone trim and black wrought iron accents - all in a romantic Italianate style.[184]

The general design principles for Boulder's campus list only a few key design principles, which include being "soft and playful" and "picturesque and exhibit[ing] charm."[185] Further, the guidelines provide that "[t]he continued use of the existing building materials palette -- indigenous sandstone walls, red barrel tile roofs, limestone framed wall openings, and black wrought iron accents -- is imperative."[186] There is a conflict between preserving the design aesthetic of red roof tiles and covering roofs in solar panels. As such, the DRB has a reputation of pushing back against large, visible arrays.

Additionally, even if the DRB approves a solar project, it can be costly to retrofit campus roofs to accommodate solar panels. In general, the University prefers to develop solar as a part of new buildings rather than through retrofitting buildings. Retrofitting a building for solar requires that the tile be removed so panels can be secured in a fashion capable of withstanding the strong winds that Boulder regularly faces. Since the buildings were not originally designed to withstand those winds on attached solar panels, a lot of infrastructure is needed to ensure the building can take the force. Solar on new projects is preferred because it is designed with solar in mind from the outset.

Another systematic challenge to solar development is the need for strong professional staff and leadership support. CU has a number of students interested in solar and renewable energy development. Those students pursue work related to solar energy through academic programs, clubs, and projects through the E-Center. However, the inevitable path of a student is to leave the university after a few years. Supporting large-scale solar development and a holistic energy strategy for CU is outside of the temporal scope of student work and support. Instead, the long-term planning and implementation of projects requires dedicated staff members. The E-Center has staff members who are dedicated to sustainability, but long-term solar development must be supported systemically. There needs to be support throughout the groups that directly finance and develop solar projects, namely Facilities Management (for GF), Athletics, Housing & Dining, and RES. The overall efforts also need to be supported by chancellors, the president, and the Board of Regents.

In order for CU to meet its stated commitments to renewable energy and carbon emissions reductions, there must be actual people or departments that are accountable. Right now, CU's

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[181] *Id.* at Preface.
[182] *Id.* at 2.
[183] *Campus Architect, Facilities Management*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/fm/departments/planning-design-construction/campus-architect (last visited Feb. 12, 2019).
[184] *Id*.
[185] *Id*.
[186] *Id*.

commitment and goals are aspirational. The University has not identified how it will hold itself accountable for failing to meet its goals. At best, accountability is loose or attenuated. The Board of Regents might be held accountable by Colorado voters. The President of the University might have some reputational accountability to the Association of American College and Universities after signing the ACUPCC and the Carbon Neutrality Plan. However, there is no legal authority or administrative authority that directly holds any person or department accountable if the goals are not met or are not pursued. The only current accountability mechanism is the need for high level leadership to protect and maintain the reputation of the University. The lack of direct accountability to CU's renewable-related goals is a major barrier to solar development. CU's commitment to reducing carbon emissions is unrepresented in planning decisions. Instead, solar development relies on the personal commitment of specific individuals involved in each project.

C. How Challenges Impacted CU's Past Development

To understand how the challenges impact the solar development project, it is helpful to begin with the successes. The existing projects have all overcome the listed obstacles. Some of the general trends between the projects demonstrate certain ways in which these projects overcame the challenges they faced.

Funding is one of those trends. Ten projects were funded by third-party financiers through PPAs, two were donated by third-parties, four were paid for by grants or reserved funds, and only one (UMC) was bought outright by the managing funding group. Clearly, there are a few different ways to finance solar development other than direct investment that have worked.

Support by leadership and accountability can also be observed in the larger trends of the existing projects. Notably, there is a difference in the proportional number of projects and size of completed projects. GF has a small number of projects compared to the amount of the campus it manages and the amount of money it has. The projects are also all smaller at 49 kW, 12 kW, 11 kW, and 10 kW. In contrast, Athletics manages a smaller number of properties but has almost the same number of completed projects with seventeen times the amount of power. The difference in development between these groups is not the result of money or size as GF has more of both, so it must be a difference in actionable commitment to renewable development. Although to a lesser extent than Athletics, Housing & Dining and RES also have less existing property but more new development than GF. The important distinction between the groups on this front is the groups' willingness and commitments to push projects through.

Leadership and accountability can also be seen through the differences in financing across different groups. There is more involvement by groups outside of respective funding group in GF and RES projects than there is in Athletics and Housing & Dining. The E-Center was involved in negotiating the PPA for the Coors Event Center I, Wolf Law, and Housing and Maintenance Center which includes all the groups except for RES. However, while Athletics and Housing & Dining's future projects rely on securing funding for their projects through PPAs, GF relies more heavily on outside groups when funding its projects. The GF relied on the Sustainability Fund for two of its projects which was money reserved for these types of projects and then received one project as a donation. Although there is nothing inherently wrong with funding projects in this manner, it communicates that GF solar projects historically relied on support from outside of GF, rather than internally within the GF. At the other end of the spectrum is the UMC, which is managed by Student Government who directly purchased its solar array due to a strong commitment to sustainability. RES falls between the two groups—two of its projects were funded by student fees

through the E-Center while the other three were through PPAs. While some funding groups demonstrate active investment in renewable project development, other groups seem to develop renewables on an opportunistic and passive basis. Support by leaders of each funding group is necessary to shifting the entire campus into active investment in solar development.

A project's ability to survive the administrative process and DRB review is also deeply tied to leadership and support. It is easiest to see that point by looking at solar projects that have successfully navigated the DRB.

The Indoor Practice Facility is the largest solar array on campus. It is very visible, and was heavily supported by CU Athletics. CU has the first NCAA Division I zero-waste stadium and diverts 90% of game-day waste across all Athletics facilities.[187] CU is a member of the Pac-12 Sustainability Working Group[188] and hosted the first Pac-12 Sustainability Conference, which was "the first collegiate sports conference to convene a high-level symposium focused entirely on integrating sustainability into college athletics and across college campuses."[189] The Athletics Director, Rick George, has personally dedicated his time and efforts to sustainability. For example, George supported the solar project on the Indoor Practice Facility as a core part of the Athletic Complex Expansion.[190] Athletics uses sustainability as a way to engage its fan base over shared values. In relation to sustainability, Rick George has said: "We want to reward our sustainability-minded fans and build a stronger community culture around sustainable practices."[191]

This type of top-down support for sustainability makes overcoming typical challenges to solar development manageable. Athletics found financing for the solar array through a PPA with Sunpower. The Indoor Practice Facility was reviewed by the Design Review Board throughout 2014[192] and approved even though it includes a very visible array covering significant portions of the 109,000 square foot building.[193] In relation to the group of projects that included the Indoor Practice Facility, George stated: "These state-of-the-art facilities have proven transformational to the success of our Athletic Department. We're proud that sustainability was at the forefront in the way they were built and how we use them every day."[194] Support from leadership goes a long way in overcoming challenges to solar development.

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[187] *CU Athletics Department, Sustainability*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/sustainability/cu-athletics-department (last visited Feb. 12, 2019).

[188] *Pac-12 Sustainability Working Group*, PAC-12, https://pac-12.com/team-green/sustainability-working-group (last visited Feb 12, 2019).

[189] *Pac-12 Sustainability Conference - 2018 Boulder*, INNOVATION & TECH TODAY (July 12, 2018), https://innotechtoday.com/event/pac-12-sustainability-conference-2018-boulder/.

[190] *Rick George - Athletics Director*, UNIVERSITY OF COLORADO ATHLETICS, https://cubuffs.com/staff.aspx?staff=298 (last visited Feb. 12, 2019).

[191] *CU Athletics Expands Sports Sustainability Programs*, UNIVERSITY OF COLORADO ATHLETICS, https://cubuffs.com/sports/2015/9/9/210329196.aspx (last visited Feb. 12, 2019).

[192] DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF DECEMBER 11, 2014 (Dec. 22, 2014), https://www.cu.edu/sites/default/files/Dec_2014_DRB_Minutes.pdf [hereinafter Dec. 2014 DRB Minutes]; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF JANUARY 9, 2014 (Jan. 9, 2014), https://www.cu.edu/sites/default/files/January_2014_DRB_Minutes.pdf [hereinafter Jan. 2014 DRB Minutes]; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF APRIL 10, 2014 (Apr. 10, 2014), https://www.cu.edu/sites/default/files/April_2014_DRB_Minutes.pdf [hereinafter Apr. 2014 DRB Minutes].

[193] Athletics Green Building Excellence Article, *supra* note 117.

[194] *Id*.

There have been several renovation and construction projects that were ripe to integrate solar but lacked similar support. There have been no completed solar projects since 2016. Since the Indoor Practice Facility review in 2004, the DRB has reviewed 12 projects: Business and Engineering Schools Expansion;[195] Imig Building Addition, College of Music;[196] Ramely Biology Building Addition;[197] Aerospace - North Wing Addition, College of Engineering;[198] William Village East Residence Hall;[199] Aerospace Engineering Sciences Building;[200] Astrophysics Research Lab;[201] Jennie Smoly Caruthers Biotechnology Building E-Wing Addition;[202] Center for

[195] DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF OCTOBER 18, 2018 (Oct. 25, 2018), https://www.cu.edu/doc/oct2018drbminutespdf; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF JUNE 8, 2018 (June 13, 2018), https://www.cu.edu/doc/jun2018drbminutespdf [hereinafter June 2018 DRB Minutes]; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF APRIL 12, 2018 (May 10, 2018), https://www.cu.edu/doc/apr2018drbminutespdf [hereinafter Apr. 2018 DRB Minutes]; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF MARCH 7, 2018 (Mar. 22, 2018), https://www.cu.edu/doc/mar2018drbminutespdf; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF JANUARY 11, 2018 (Jan. 22, 2018), https://www.cu.edu/doc/jan2018drbminutespdf [hereinafter Jan. 2018 DRB Minutes].

[196] DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF SEPTEMBER 12, 2018 (Sept. 19, 2018), https://www.cu.edu/doc/sep2018drbminutespdf; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF JULY 12, 2018 (July 19, 2018), https://www.cu.edu/doc/july2018drbminutespdf; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF OCTOBER 12, 2017 (Oct. 12, 2017), https://www.cu.edu/doc/oct2017drbminutespdf [hereinafter Oct. 2017 DRB Minutes].

[197] DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF AUGUST 31, 2018 (Sept. 4, 2018), https://www.cu.edu/doc/aug2018drbminutespdf; June 2018 DRB Minutes, *supra* note 195; Apr. 2018 DRB Minutes, *supra* note 195; Jan. 2018 DRB Minutes, *supra* note 195; Oct. 2017 DRB Minutes, *supra* note 196.

[198] Apr. 2018 DRB Minutes, *supra* note 195; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF FEBRUARY 8, 2018 (Feb. 20, 2018), https://www.cu.edu/doc/feb2018drbminutespdf; Jan. 2018 DRB Minutes, *supra* note 195.

[199] DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF JUNE 15, 2017 (June 29, 2017), https://www.cu.edu/doc/jun2017drbminutespdf [hereinafter June 2017 DRB minutes]; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF APRIL 13, 2017 (Apr. 25, 2017),https://www.cu.edu/doc/apr2017drbminutespdf [hereinafter Apr. 2017 DRB Minutes]; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF MARCH 10, 2017 (Mar. 21, 2017), https://www.cu.edu/doc/mar2017drbminutespdf [hereinafter Mar. 2017 DRB Minutes]; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF JANUARY 12, 2017 (Jan. 24, 2017), https://www.cu.edu/doc/jan2017drbminutespdf; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF NOVEMBER 10, 2016 (Nov. 22, 2016), https://www.cu.edu/doc/nov2016drbminutes.pdf [hereinafter Nov. 2016 DRB minutes].

[200] DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF MAY 11, 2017 (May 25, 2017), https://www.cu.edu/doc/may2017drbminutespdf; June 2017 DRB Minutes, *supra* note 199; Apr. 2017 DRB Minutes, *supra* note 199; Mar. 2017 DRB Minutes, *supra* note 199; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF FEBRUARY 8, 2017 (Feb. 16, 2017), https://www.cu.edu/doc/feb2017drbminutespdf; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF DECEMBER 8, 2016 (Dec. 20, 2016), https://www.cu.edu/doc/dec2016drbminutespdf; Nov. 2016 DRB Minutes, *supra* note 199; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF OCTOBER 13, 2016 (Oct. 25, 2016), https://www.cu.edu/doc/oct132016drbminutes.pdf.

[201] DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF JULY 14, 2016 (July 21, 2016), https://www.cu.edu/doc/july2016drbminutes.pdf.

[202] DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF OCTOBER 8, 2015 (Oct. 20, 2015), https://www.cu.edu/sites/default/files/October_2015_DRB_Minutes.pdf; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF MAY 18, 2015 (May 21, 2015), https://www.cu.edu/sites/default/files/May_2015_DRB_Minutes.pdf [hereinafter May 2015 DRB Minutes]; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF APRIL 9, 2015 (Apr. 21, 2015), https://www.cu.edu/sites/default/files/April_2015_DRB_Minutes.pdf [hereinafter Apr. 2015 DRB Minutes].

Academic Success and Excellence (CASE);[203] Village Center Dining & Community Commons.[204] Of these projects, Village Center Dining & Community Commons and William Village East Residence Hall are managed by Housing & Dining, CASE is managed by RES, and the remaining seven projects are managed by GF. Only the two Housing & Dining projects included solar.

Housing & Dining has an extensive sustainability program that encourages efficient use and treatment of energy, water, and waste, and strives for LEED-Platinum certification for buildings and sustainable food production/sourcing.[205] Housing & Dining has integrated sustainability into leadership; the group has a Sustainability Coordinator and a Building Project Manager that has been behind multiple projects with a heavy focus on sustainability such as Williams Village North.[206] The Village Commons project made it through the Design Review Board process and has been in place with a solar array of 140 kW since 2016. The Williams Village East Residence Hall also made it through the Design Review Process with a 150.8 kW solar array, which is visible from campus. Upon completion of the project, the array is expected to produce 214,219 kWh annually. Both of the most recent projects for Housing & Dining were supported by the group's sustainability mission and were able to find funding and survive the administrative process.

In contrast, the recent project for RES and the projects for GF do not include solar arrays. Solar was likely considered for many of the projects, but ultimately deemed not-worthwhile for each of the projects. By the time the projects reached the DRB, solar was not a part of the proposal. Although the lack of solar is not attributable to the DRB in every case, funding groups know that the DRB pushes against solar, and this fact is present when deciding to include solar in a project. Both RES and Facilities Management (under GF) are headed by David Kang, the Vice Chancellor for Infrastructure and Sustainability.[207] Kang himself is personally invested in sustainability.[208] Kang even gave a presentation to the Design Review Board on the sustainability goals for the Boulder Campus in 2018.[209] However, purely looking at past development and missed opportunities, the GF, and to a lesser extent RES, do not develop as many solar and renewable projects as the other groups. No single project is itself evidence of a problem specific to GF for solar development. Projects are complicated and there are challenges to solar development; it is understandable that solar arrays will not be part of every project. However, the existing projects are categorically small and opportunities for further development have been regularly missed. GF is systematically unable to overcome the challenges to solar development while other groups regularly overcome these challenges. The low level of solar development by the groups that

[203] DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF JULY 9, 2015 (July 21, 2015), https://www.cu.edu/sites/default/files/July_2015_DRB_Minutes.pdf.
[204] DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF JUNE 17, 2015 (June 30, 2015), https://www.cu.edu/sites/default/files/June_2015_DRB_Minutes.pdf; May 2015 DRB Minutes, *supra* note 202; Apr. 2015 DRB Minutes, *supra* note 202; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF FEBRUARY 12, 2015 (Feb. 17, 2015), https://www.cu.edu/sites/default/files/Feb_2015_DRB_Minutes.pdf.
[205] *Sustainability, Housing & Dining Services*, UNIVERSITY OF COLORADO BOULDER, https://living.colorado.edu/sustainability (last visited Feb. 12, 2019).
[206] *Williams Village North Showcases Sustainable Design*, *CU Connections*, UNIVERSITY OF COLORADO BOULDER (Aug. 17, 2011), https://connections.cu.edu/stories/williams-village-north-showcases-sustainable-design.
[207] UNIVERSITY OF COLORADO BOULDER, INFRASTRUCTURE & SUSTAINABILITY DEPARTMENT OVERVIEW, https://www.colorado.edu/infrastructure-sustainability/sites/default/files/attached-files/vcis_fm_overview_v_3.pdf.
[208] Alex Borkowski, *Renovating for Resilience*, AMERICAN BUILDERS QUARTERLY (May 29, 2018), https://americanbuildersquarterly.com/2018/05/29/university-of-colorado-boulder/.
[209] Mar. 2017 DRB Minutes, *supra* note 199.

manage most of CU Boulder's buildings[210] undermines CU's ability to meet its commitments to carbon reduction and sustainability.

These past trends cause concern for current development. Energy Management—a sub-section of Facilities Management—has announced a multi-site solar plan that intends to introduce 8,500 kW of solar arrays to CU main campus and east campus over the next three years.[211] This project would increase the current capacity of the campus from around 2,300 kW to 10,800 kW. The first phase of development is intended to add 2,300 kW of solar in the next year, but so far, the only concrete project for phase one is the Recreation Center, at 303 kW.[212] This type of development would significantly contribute to CU's carbon reduction commitments.

However, it is unclear whether the project will actually be completed as planned. The size of the project has already been reduced from the 8,500 kW size originally announced by Facilities Management during the 2017 Campus Sustainability Summit.[213] The aggregate Multi-Site Project is ten times the size of the array on the Indoor Practice Facility. More significantly, the project would be far and away the largest solar project developed by GF. The Multi-Site Project would roughly increase GF solar by 1,000%.

The pre-design for the first phase of the plan was brought before the Design Review Board during the January 2019 meeting.[214] The meeting minutes show that the plan for the Multi-Site Solar project will "exclud[e] improvements on the CU Main Campus," and only use parking carports and related structures.[215] The planning and design considerations for the project were discussed at the meeting. Two of those considerations were "solution needs to be consistent with the campus aesthetic" and "sensitive to views (can it be used to cover ugly things and don't cover up the beautiful)."[216] Many of the comments and parameters focused on the technical aspects of the project.[217] However, the meeting minutes revealed attitudes that fall short of full support for a solar project that is unprecedented in scope. The minutes from the DRB meeting suggest that it was less supportive than needed if CU wants to actually build the proposed multi-site solar project.

V. Opportunities to Influence Future Solar Development

The challenges and history of solar development on CU's campus are complex. As such, no one single strategy can overcome all challenges to solar development. A number of immediate and forward-looking strategies are discussed below. However, this is not an exhaustive list. The complexity of the problem creates room for many actors to try and address the issue with different

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[210] *See supra* Section II.D.

[211] *Facilities Management Energy*, *supra* note 100.

[212] *Id*.

[213] *Campus Sustainability Summit, Environmental Center*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/ecenter/css (Feb. 12, 2019).

[214] DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF JANUARY 10, 2019 (Jan. 18, 2019), https://www.cu.edu/doc/jan2019drbminutespdf [hereinafter Jan. 2019 DRB Minutes]. The Multi-Site Solar Project was not discussed at the subsequent February or March DRB meetings. DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF FEBRUARY 15, 2019 (Mar. 5, 2019), https://www.cu.edu/doc/feb2019drbminutespdf; DESIGN REVIEW BOARD, UNIVERSITY OF COLORADO, NOTES OF THE MEETING OF MARCH 15, 2019 (Mar. 22, 2019), https://www.cu.edu/doc/mar2019drbminutespdf.

[215] *Id.* at 4.

[216] *Id*.

[217] *Id*.

strategies and at different levels of organization. The specific opportunities and actors discussed below are just a few approaches to the problem. Hopefully, the discussion prompts more thought and new ideas.

A. Supporting the Multi-Site Project in the Design Review Board Process

The Multi-Site Project first officially appeared on the Design Review Board docket in January 2019.[218] The project should continue to be a topic in front of the Design Review Board for at least a few more months; the length of the review process for different projects varies from four months to a year. Design Review Board meetings are on the second Thursday and Friday of every month.[219] The location changes each month and varies across different CU campuses, but is included in the agenda which is posted in advance of the meeting.[220] Although there is no formalized role for public participation in the process,[221] meetings are open to the public. Parties interested in the project would benefit from observing the proceedings. Demonstrated support of the project might have an impact on the proceedings and the ultimate fate of the project.

There also is room for interested people to express their interest to parties directly involved in the process. CU Boulder has a "campus liaison" who,

> is responsible for selecting a DRB project representative for all major capital improvement projects, coordinating DRB review with the CU system office and submitting to the DRB the planning and design submittal work products that demonstrate project conformance with campus master plans, design guidelines and other DRB requirements necessary to accomplish the DRB evaluation. [222]

Each campus liaison is either the Campus Architect or Facilities Director. CU's Campus Architect is listed as the campus DRB member for the UC Boulder campus.[223] A Landscape Architect with Facilities Planning was the CU Boulder Campus Presenter for the January meeting.[224] The Assistant Direct and Planning Manager at Facilities Management was a present CU Boulder Campus Representative at the January meeting.[225] At a higher level, the multiple members of the Design Review Board, including the Chair, were present at the January meeting and directly reviewed the Multi-Site project.[226] The Chairperson of the Design Review Board is supposed to regularly meet with the Vice President for Budget and Finance.[227]

This project represents a large investment in future solar development for CU. Long-term organizational shifts toward institutional support of solar projects is likely too slow to support this specific project. However, there are ways for interested parties to provide needed support to the project.

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[218] *Id.* at 3-6.
[219] DRB Procedures, *supra* note 178, at 5.
[220] *Id.*; DESIGN REVIEW BOARD MEETINGS, UNIVERSITY OF COLORADO, https://www.cu.edu/budgetpolicy/capital-construction-and-planning-drb-meetings (last visited Feb. 12, 2019).
[221] *See* DRB Procedures, *supra* note 178.
[222] *Id.* at 4.
[223] Jan. 2019 DRB Minutes, *supra* note 206, at 1.
[224] *Id.* at 3.
[225] *Id.* at 4.
[226] *Id.* at 1.
[227] DRB Procedures, *supra* note 178, at 3; *Budget & Finance Team*, UNIVERSITY OF COLORADO, https://www.cu.edu/budgetpolicy/vpbf-contacts (last visited Feb. 12, 2019).

B. Inserting Accountability to Sustainability into the Campus Energy Plan

Facilities Management and campus administration are in the beginning stages of developing a strategic energy management plan ("Energy Plan") which would be another plan akin to the Campus Master Plan or the Carbon Neutrality Plan.[228] The Energy Plan would further Facilities Management's goal of "develop[ing] an adaptable energy management program to stabilize, reduce, and offset campus energy requirements in a fiscally responsible manner that will meet the campus wide environmental and sustainability goals."[229] The Campus Master Plan and Carbon Neutrality Plan drafting processes included a wide range of campus and community members.[230] The drafting process for the Energy Plan has yet to be similarly opened to the campus and community.

It is important that the Energy Plan include the perspectives of a full range of constituents on campus and in the community. Facilities Management should open the process to the public and should do so during the early and formative stages of the plan rather than once the plan has been mostly developed. Parties interested in being involved in drafting the Energy Plan should reach out to Facilities Management to express this interest and push for a concrete timeline on being included.

Public involvement in the Energy Plan presents opportunities to insert concepts designed to combat the challenges to solar development. The Energy Plan needs to expressly address CU's commitments and goals related to energy development. However, the goals cannot simply be listed; they need to be directly tied to the different elements of the plan. The Energy Plan should be explicitly designed to meet CU's energy goals. Done correctly, this is an opportunity to build accountability for CU's commitments. Integrating the goals into the Energy Plan transforms those goals into concrete action that is directly tied to Facilities Management. That could increase the Department's support of the carbon reduction goals across all levels of the Department. It also increases leadership's investment in actively pursuing the goals.

There also is room to address the challenges facing solar development more directly through creative drafting decisions. For example, the plan could directly assign responsibility for meeting targets as job responsibilities to specific leaders in Facilities Management, encouraging personal investment and ensuring professional investment in the issue. The Department's budget could be tied to progress on the goals. The budget could be reduced if Facilities Management fails to meet or fails to demonstrate good-faith efforts to meet annual targets. Alternatively, the Department could keep the difference between current energy rates and the reduced renewable energy rates as a financial incentive for its work on solar.

The Energy Plan presents a lot of opportunities to address some of the systemic challenges to solar development. It is important that the Plan get drafted in a way that engages the full range of interests across campus and reflects the lessons to be learned from CU's past efforts to develop solar.

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[228] The development of an Energy Plan was discussed by multiple CU staff members with us in person. However, we have not been able to independently substantiate that an Energy Plan is in the works.

[229] *Strategy*, *Facilities Management Energy*, UNIVERSITY OF COLORADO BOULDER, https://www.colorado.edu/fmenergy/strategy (last visited Feb. 12, 2019).

[230] *Process*, *Campus Master Plan*, *supra* note 5; Carbon Neutrality Plan, *supra* note 22, at 3.

C. Optimizing Student Involvement

Students can contribute to the development of solar at CU by utilizing campus organizations such as Student Government to act upon their stated preference for solar and other renewable development. The administration can be responsive to the expressed will of student constituents, whose tuition dollars are a critical part of the University's finances. But, the student body's annual turnover diminishes its ability to hold CU's administration accountable. Administrative commitments to major energy projects involve the deliberation of various bureaucratic entities such as the Design Review Board and the Board of Regents, who must consider financial, aesthetic, and political effects of projects. Consequently, this process often takes several years, and students who support energy projects may graduate or leave CU during that period, taking with them the organization and leadership crucial to make actual progress. It is key that campus organizations plan for continuity despite student turnover.

The student government and campus organizations that are dedicated to sustainability issues such as the E-center can continue to find ways to sustain momentum as individual students come and go. If the organizations themselves can have a steady focus on increasing renewable development and reviewing the University's energy commitments, that would enable new students to more quickly get up to speed and effectively participate in efforts to keep the administration on track with its sustainability and energy goals. The Environmental Board of the student government, for example, may be uniquely suited to take on a greater role in representing student sustainability interests and encouraging accountability. The board could monitor the school's progress towards stated goals and request an explanation when these goals are not met, and its feedback should be considered in the development of future goals and documents such as the Energy Plan.

D. Strong Leadership

CU cannot increase the amount of solar on campus without support from top University leadership.

- CU President
- CU Board of Regents
- Design Review Board (DRB)- Architects from across CO appointed by President and Regents to support the aesthetic beauty of the Tuscan Vernacular

<u>General Fund</u>:

- Campus Architect appointed by State Architect's Office to represent CU Boulder- determines what goes before DRB
- Assistant Vice Chairperson of Planning Design and Construction
- Assistant Vice Chairperson of Operations
- Chief Sustainability Officer
- Vice Chairperson of Infrastructure and Sustainability
- Project Manager
- Project Manager Supervisor

<u>Auxiliary Funds</u>:

- Director of Utility and Energy Services
- Campus Energy Manager
- The Environmental (E-) Center- Supports student initiatives for sustainable action on campus

- Director of E-Center
- Assistant Director of the E-Center
- Housing and Dining Services
- Athletics Department
- Real Estate Services

To see actual progress in CU's development of and commitment to renewables, these individuals must exercise their authority to this end. Non-binding statements of support will not be sufficient to build momentum. Genuine advocacy is needed. With support from higher-level officials, proposals are more likely to overcome barriers such as resistance from the Design Review Board and to result in success.

Conclusion

CU needs more solar development. CU needs solar to meet its carbon reduction commitments. CU needs solar to maintain its status as a leader in university sustainability. CU needs solar to ensure it actually supports its sustainability values which bring students and inspire alumni support.

Solar alone will not meet CU's carbon emission goals, but it will be a key element of CU's solution to reduce its emissions. Solar is a technically, financially, and politically viable option that CU has already started to explore. In addition to being a cost-effective path to reduce carbon emissions, it also builds resiliency in CU's energy system, contributes to the campus' research opportunities, and strengthens CU's sustainable programs and image. Perhaps most importantly, developing solar is a visible and tangible path for CU to take active steps to benefit its students and surrounding communities. For those reasons, solar should be a part of CU's renewable portfolio.

However, the need and incentives for solar alone have not been enough to inspire the amount of solar development that should have already happened. CU is already behind on its long term carbon reduction goals. The lack of solar development is noticeable to students, staff, faculty, and anyone who steps onto the campus. The historic barriers to solar development by CU are complex, and solutions to overcome those barriers will need to be inspired, supported, and strategic. Meeting CU's carbon reduction goals will require enthusiastic institutional support on every level and throughout every managing group. The challenge for solar proponents will be to build that institutional support through leveraging student involvement, building in accountability for the goals, and inspiring campus leadership to more thoroughly support the benefits of solar development.

Someday, when visitors walk around CU's campus, they will not just see an architectural aesthetic that works with Boulder's natural beauty. Instead, they will see a campus that has visually committed to maintaining its iconic natural surroundings. The various peaks and slopes of CU's rooftops will be iconic for its artful mix of solar panels and classic red tile. Instead of wondering about the lack of renewables on a campus known for sustainability, visitors and students will be able to see CU's genuine commitment to sustainability.

Appendices

All appendices are available virtually on the Colorado Law, Sustainable Community Development Clinic website at https://www.colorado.edu/law/academics/clinics/sustainable-community-development-clinic.

Table of Appendices