City of Fort Collins Light & Power

Rocky Mountain Institute

STEPPING UP: BENEFITS AND COST OF ACCELERATING FORT COLLINS' ENERGY AND CLIMATE GOALS

BY ROCKY MOUNTAIN INSTITUTE,
IN PARTNERSHIP WITH FORT COLLINS UTILITIES

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PUBLISHED SEPTEMBER, 2013.

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EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

This report examines the opportunity for accelerating Fort Collins' energy and climate goals to reflect the community's values, and capture economic, social, and environmental benefits. In the five years since Fort Collins initially established its current greenhouse gas emissions goals, rapid changes in the cost and availability of clean, energy efficient technologies, together with the emergence of new business models and financing methods for implementing these measures, have dramatically shifted the solutions space for addressing the community's energy needs. The cost of solar panels, for example, has fallen nearly 75% since 2008, with further dramatic declines yet to come; the retail price for energy-efficient LED lightbulbs has fallen by 50% in the past year. These and other changes have opened the door for the City to implement new solutions to reduce emissions and waste, stimulate local economic development, improve security, and reduce risk.

ANALYSIS APPROACH

This study provides an independent, forward-looking view of Fort Collins' energy options, based on the latest information about state-of-the-art technologies, policies, and programs. The approach is built largely on accepted methods and findings from Rocky Mountain Institute's (RMI) nation-wide study, *Reinventing Fire: Bold Business Solutions for a New Energy Era*, as well as from other relevant studies and meta-analyses, which have been adapted to Fort Collins as appropriate and possible. The analysis also takes into account researched case studies and lessons learned from RMI's related energy consulting and advisory work for cities and states, university campuses, building portfolio owners, and industrial clients.

To answer questions about how far and how fast Fort Collins could reduce its CO_2 emissions, and at what cost, the report first assesses the economic potential for efficiency and renewables in Fort Collins and the opportunities for integrative, cross-sector solutions:

- How much efficiency is available in Fort Collins' building stock?
- By how much could the city reduce fossil fuel consumption from transportation activities?
- To what extent could the community's energy needs be met by both local and centralized renewable energy resources?

Models for each sector have been developed reflecting the City's existing and projected building stock, economic and population growth, transportation assets and requirements, electricity distribution system, distributed resource potential and other attributes. To provide a basis for comparing the overall costs, emissions, and other implications of energy policy choices for the City, the study compares an *accelerated* scenario to a *business-as-usual* scenario. The *business-as-usual* scenario analyzes what might happen absent additional intervention; the *accelerated* scenario reflects a combination of policies and strategies across the sectors aimed at increasing energy efficiency and reducing emissions. While the *accelerated* scenario "pushes the envelope," the measures considered and the approaches to implementation are based on rigorous analysis drawing on best practices, technology trends, and plausibly achievable goals for customer adoption.

The total cost of the two scenarios is evaluated on a present value cost basis for the periods 2013–2030 and 2013–2050. Because high initial investments in the *accelerated* scenario confer long-term benefits of reduced fuel and operating costs, the longer time horizon captures the benefit streams more completely for a fair comparison of the consequences of the policy choices considered. Today, a growing number of cities and states are already making energy investment choices based in part on a carbon price, and the federal government has recently issued a report that assesses the social cost of carbon starting today. This analysis uses a conservative figure of a “penny a pound” ($22 per metric ton in $2012) to value carbon emissions in both scenarios, with no escalation to 2030.

KEY FINDINGS

This analysis indicates that, in the *accelerated* scenario, Fort Collins can achieve an approximate 80% reduction in CO_2 emissions by 2030, two decades ahead of its existing 2050 greenhouse gas reduction target. In doing so, the community could:

- reduce building energy use by 31% through efficiency,
- achieve a carbon neutral electricity system by 2030, and
- reduce transportation energy use by 48%.

In the ***buildings sector,*** increased investment in energy efficiency could reduce energy use in buildings 31% compared to *business as usual* by 2030, saving the community $140 million and reducing the cost of meeting future electricity supply needs from renewable sources.

- Driven by economic growth and increasing population, building energy demand under ***business-as-usual*** could increase 19% by 2030 from today’s consumption levels, increasing CO_2 emissions by 24%.
- Through a combination of cost-effective efficiency measures including conventional energy efficient technologies, behavior changes and smart controls, and integrative design approaches, building energy use could be reduced by 31% from *business as usual.* This would also reduce building CO_2 emissions by 30% from *business as usual.*
- Fuel switching for building heating would reduce energy use by an additional 8% from *business as usual*, and CO_2 emissions by another 5% by 2030.
- Achieving these goals would entail achieving an equivalent of 2.4% electricity efficiency savings improvements annually between now and 2030. Fort Collins currently targets 1.5% annual efficiency savings (which it achieved in 2012), already putting it among the highest tier of efficiency targets in the nation. By comparison, Efficiency Vermont, one of the best-in-class electricity efficiency programs in the nation, has achieved a maximum electricity savings of 3.1% of retail sales in a single year, and 1.8% of retail sales or greater each year since 2007.

In the ***electricity sector,*** Fort Collins can achieve a carbon neutral electricity system by 2030 while providing 25% of electricity supply from local resources.

- Today, Fort Collins Utilities provides its customers with very low cost power—in 2012, the utility’s residential customers paid average monthly bills that were lower than 46 of Colorado’s 53 electric utilities and 40% lower than the national average.

- The total present value cost of achieving the *accelerated* scenario would be 19% higher than the costs of *business as usual* through 2030, taking into consideration the value of avoided carbon emissions; the equivalent additional cost per person per year from 2013–2030 would be $69. Over the period from 2013–2050, however, the total costs of the *accelerated* scenario would be lower by 14%. This reflects a significantly greater up-front investment that is repaid by dramatically lower fuel costs and reduced exposure to carbon prices over time.
- Approximately 25% of electricity supply in the *accelerated* scenario would be provided by distributed resources, largely financed by developers or third parties.
- Efficient, scaled deployment of solar PV, together with simplified permitting, inspection, and interconnection rules, could result in significant reductions in the “soft costs” of solar deployment with significant benefit for Fort Collins' citizens.
- Wind generation capacity would increase by approximately 230 megawatts by 2030, providing 45% of Fort Collins total electricity supply.
- The *accelerated* scenario would lower cumulative CO_2 emissions from electricity generation by 10 million metric tons relative to *business as usual* between now and 2030, and by 30 million metric tons between now and 2050, equivalent to removing 600,000 cars from the roads for ten years.

In the ***transportation sector,*** Fort Collins could reduce gasoline and diesel consumption by 48% from *business as usual*, saving $480 million in fuel costs and avoided vehicle maintenance by 2030.

- Fort Collins could reduce vehicle miles traveled by building on existing smart growth strategies to provide increased access to pedestrian, bicycle, and public transport options. Doing so could reduce transportation energy consumption by 30% from *business as usual.*
- Less driving means less congestion, and consequently, improved local air quality, and builds on one of the community’s greatest strengths—being a bikable, walkable city.
- Increased adoption of more efficient and electric vehicles with lower total costs to owners could reduce energy consumption by an additional 18% from *business as usual.*

IMPLICATIONS

By 2030, combining results across all sectors, the *accelerated* scenario results in a net benefit of $260 million for the community compared to *business as usual*, and an avoided 15 million metric tons of CO_2. By 2050, the *accelerated* scenario could result in a total net benefit of $2.0 billion compared to *business as usual.*

Moreover, the *accelerated* scenario represents a fundamentally different paradigm for investment in energy-related assets and infrastructure compared with *business as usual*, providing greater local job creation, economic development, stimulus for innovation, and growth for local businesses. Investments in energy efficiency and distributed energy resources along the lines of the path already envisioned for FortZED contribute to the local economy and reduce cash flows out of the community. By investing now in efficiency and renewables, the City can reduce outflows of cash for decades to come.

In the *accelerated* scenario, the amount of money spent on coal and natural gas to generate electricity supplied to the community is lower by an average of $16 million per year compared with *business as usual.* Investment in efficiency, distributed solar power, smart grid, and other local energy assets is higher by $20 million per year. This shift in investment—from distant to local resources—would generate an additional 400–500 jobs within Fort Collins over the entire period from 2013–2030.

RECOMMENDATIONS

Few communities in the nation have the combination of factors that align to make Fort Collins a community that can lead in creating forward-looking energy policy for community benefit. These factors include strong and pragmatic civic leadership, manageable size, an innovative and well-positioned municipal utility, workable options for creative transportation policy, and low cost options for clean and affordable electricity supplies. Accordingly, it is no surprise that Fort Collins' innovative energy programs and policies, notably the FortZED project, have already attracted national and international attention. By stepping forward to pioneer new approaches, Fort Collins has galvanized the support of community leaders and attracted the participation of leading businesses and other institutions in the area.

Now the City has an opportunity to sustain and advance its leadership position by taking up new goals that leverage existing achievements and opportunities. In doing so, Fort Collins could embark on a transformative path of reinvestment in community-based energy systems and put itself at the forefront of innovation nationally—stimulating local economic development, reducing outflows of money from the community, improving security, and reducing risk.

ABOUT THIS REPORT

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ABOUT THIS REPORT

In 2008, the City of Fort Collins adopted a climate action target to reduce greenhouse gas emissions by 80% from 2005 levels by 2050. Five years later, significant opportunities and motivations to accelerate Fort Collins' goals have arisen. Today, Fort Collins could embark on a transformative path of reinvestment in community-based energy systems and put itself at the forefront of innovation nationally—stimulating local economic development, reducing outflows of money from the community, improving security, and reducing risk.

In November 2012, major energy stakeholders including representatives from the City of Fort Collins, Fort Collins Utilities, Colorado Clean Energy Cluster, Fort Collins Energy Board, and the FortZED Steering Committee came together to explore the opportunities and challenges in creating a clean energy future for the community. Participants in that two-day workshop expressed enthusiasm not only for developing strategies to achieve Fort Collins' greenhouse gas emission targets, but also for accelerating the time frame.[1] They posited that not only is acceleration feasible, it could drive local economic growth and system resilience at the same time.

This report answers that call to action by exploring "how far" and "how fast" Fort Collins can go toward a prosperous, secure, and clean energy future.

[1] FOR A COMPLETE LIST OF PARTICIPANTS AND FULL SUMMARY OF THE WORKSHOP, VISIT HTTP://WWW.RMI.ORG/PDF_FORT_ZED_REPORT

THE PURPOSE OF THIS DOCUMENT IS TO:

- offer a non-partisan framework for thinking about the community's full potential for efficiency and renewable energy supply,
- provide a foundation for the Energy Board and City Council to move forward with a reassessment of the community's climate action goals,
- explore the implications, costs, and benefits of accelerating the City's goals,
- recommend new community-wide and sector based climate action goals, and
- identify the most important target areas and strategies to address in an accelerated timeframe.

GOAL SETTING APPROACH

This report is based on the premise that there are "right steps in the right order" to take in energy goal setting and planning. Before a community decides on an energy target and creates programs to meet that target, it should first understand what is technically and economically possible. How much efficiency is available in Fort Collins' building stock? By how much could the city reduce fossil fuel consumption from transportation activities? To what extent could the community's energy needs be met by local renewable energy resources? To answer questions about how far and how fast Fort Collins can reduce its emissions, this report seeks first to understand the full potential for efficiency and renewables available to Fort Collins.

The analysis presented in this report was conducted by RMI. An "***accelerated*** scenario" is compared to "***business as usual***" that represents what might happen in the community absent additional intervention. Our approach is built largely on accepted methods and findings from our nation-wide study, *Reinventing Fire: Bold Business Solutions for a New Energy Era*, as well as from other relevant studies and meta-analyses, which we have adapted to Fort Collins as appropriate and possible. We also take into account researched case studies, as well as lessons learned from our own experiences in a range of related energy consulting work. We provide a brief description of our quantification methods, along with major data sources, in the appendix to this report.

Understanding the community's full potential, and quantifying the biggest areas of opportunity, will allow Fort Collins to set an aggressive goal along with a rationale for where to focus future program design and set in motion detailed analysis that may be needed for implementation plan development and funding commitment.

EMISSIONS SCOPE

Fort Collins' current climate action goals are based on reductions in community greenhouse gas emissions—specifically carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O)—from Scope 1, Scope 2 and Scope 3 emissions sources.[2] In contrast, the analysis in this report is limited to the quantification of CO_2 emissions from Scope 1 and Scope 2 emission sources. Emissions from the embodied energy in materials purchased by the community, as well as from community airplane travel and waste, are not included in our analysis.

NEXT STEPS

Fort Collins Utilities plans to submit this report to the Fort Collins Energy Board for consideration. Should the Energy Board recommend the City consider new energy policy and climate action goals, additional analysis may be conducted and recommended goals presented to the City Council.

[2] FOR A FULL DESCRIPTION, SEE: 2012, "CITY OF FORT COLLINS ENVIRONMENTAL SERVICES, COMMUNITY GREENHOUSE GAS EMISSIONS INVENTORY QUALITY MANAGEMENT PLAN: YEARS 2005 THROUGH 2011 AND 2020 FORECAST," P14.

ABOUT ROCKY MOUNTAIN INSTITUTE

Rocky Mountain Institute (RMI) is an entrepreneurial non-profit with 30 years of research and collaboration experience in the electricity, building, industry, and transportation energy sectors. Our mission is to drive a business-led transition from fossil fuels to efficiency and renewables in the United States in ways that strengthen and sustain communities. In 2011, we published *Reinventing Fire: Bold Business Solutions for a New Energy Era*, a roadmap for eliminating oil, coal, and nuclear energy in the U.S. by 2050, while reducing national reliance on natural gas to one-third of today's consumption. Realizing this vision would provide improved energy services, generate opportunities for job and economic growth, and save $5 trillion in net-present-valued cost while shrinking fossil carbon emissions 86% from 2000 levels.

At the invitation of Fort Collins Utilities, RMI, as part of on-going work with electricity leaders through the Electricity Innovation Lab (e^-Lab), convened and facilitated the November 2012 workshop in Fort Collins.

INTRODUCTION:

WHY ACCELERATE FORT COLLINS' CLIMATE GOALS?

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Image courtasy of Ryan Burke

INTRODUCTION:

WHY ACCELERATE FORT COLLINS' CLIMATE GOALS?

It may be surprising to think of Fort Collins as being at an urgent energy crossroads. Many of us think of decisive moments in the energy sector as ones defined by crisis, whether by a natural disaster that disables the grid or the closure of a critical power plant. We expect brownouts or blackouts that necessitate, very visibly, a different path forward. Fort Collins, on the other hand, enjoys lower retail energy costs and service interruptions than most of the nation. Its municipal utility has one of the highest annual energy efficiency savings rates. Why is there an urgent need for Fort Collins to change its course and take on bolder goals?

As a handful of cities in the United States and around the world are starting to demonstrate, the real opportunities in energy don't precipitate from avoiding disaster. They result from preemptive decisions to capitalize on being first. Fort Collins can anticipate the evolving demands and interests of its citizens, and plan strategically in the face of national and regional energy trends. In fact, what constitutes leadership today in energy planning is not sufficient for tomorrow. Next-generation cities are the ones making the transition to a clean energy future...and there is no such thing as doing nothing. Today's energy system continues to require operations and maintenance, and also requires major investments and infrastructure upgrades that commit Fort Collins for decades or longer. Even maintaining the status quo has consequences.

Five years ago, when Fort Collins committed to climate action goals to reduce greenhouse gas emissions by 80% (from 2005 levels) by 2050, it began the community's trajectory towards reshaping its energy future, and along with it, establishing the future form and footprint of the city's energy infrastructure for decades to come. The community is on track to meet an interim 20% reduction target by 2020, and is exploring options for meeting its 2050 target. The coming months present an opportunity for the City to not only revisit that target, but in doing so, ask whether it is ambitious enough. As the City reassesses its emissions targets and energy goals, it could make a bold choice to accelerate the date by which it can achieve its goal. Specifically, this report outlines a pathway by which:

FORT COLLINS CAN ACHIEVE AN 80% REDUCTION IN CO_2 EMISSIONS BY 2030, TWO DECADES AHEAD OF ITS 2050 GHG TARGET, AND IN THE PROCESS:

- *REDUCE BUILDING ENERGY USE BY 31% THROUGH EFFICIENCY,*
- *ACHIEVE A CARBON NEUTRAL ELECTRICITY SYSTEM, AND*
- *REDUCE TRANSPORTATION ENERGY USE BY 48%.*

WHAT WILL BE GAINED BY ACCELERATING?

The path that Fort Collins chooses to take towards a transformed energy system will impact the long-term benefits that result for the community. On one hand, it's possible for a majority of carbon reductions to be achieved "remotely." All future renewable energy could be supplied from centralized resources much like coal-based electricity is today, sourced from locations outside of Fort Collins. Or, emission goals could be met largely through the purchase of renewable energy credits, offsetting Fort Collins' energy carbon footprint through investments in remote renewable projects. But if Fort Collins seeks to advance its local economic development and system resilience while simultaneously reducing carbon emissions, it also needs to consider major investments in community-based solutions.

The target suggested here would support local economic development, creating greater price certainty into the future, and sustaining already high reliability in the face of increasing risks. Initial analysis indicates that this transformation could be accomplished by 2030 for a net benefit of $260 million as compared to *business as usual* on a present value basis, with much of the investment directed toward local growth. Money, which today flows to remote infrastructure and energy sources, would stay within the community to fund local ingenuity and innovation. Fort Collins' citizens, largely passive in today's energy system, would drive their own energy future as principal change agents in local building efficiency, distributed power generation, and cleaner transport—becoming long-term benefactors of energy cost savings and other benefits, with a strong sense of ownership in the transformation of their community.

Hitting the audacious targets suggested here would dramatically reduce Fort Collins' contribution to climate change and other environmental degradation. Some climate action plans, such as Fort Collins's current plan, call for an 80% reduction in CO_2 emissions by 2050 in order to limit global warming to 2 degrees centigrade.[3] However, many scientists believe that this goal is simply not aggressive enough, calling a 2-degree global warming limit a "prescription for disaster."[4] By accelerating its goal twenty years, Fort Collins would avoid an additional 22 million metric tons of CO_2 emissions by 2050 above and beyond its current goal. By accelerating its goal and leading a rapid transformation of the community's energy system, Fort Collins would draw the best and brightest energy minds throughout the nation. Through expanded research, university, and industry partnerships, Fort Collins would become a hot bed for established companies and start-up efforts alike, magnetizing funding support and partners, and seeding the creation and growth of innovative local businesses. Ancillary businesses would cluster around the burgeoning economy, attracting residents and investors to what continues to rank as one of the nation's "best places to live."

WHY NOW?

National and local trends make it feasible and attractive for Fort Collins to depart today from *business as usual.* Circumstances surrounding Fort Collins' incumbent energy sources (coal for electricity and oil for transportation) create a growing imperative to find alternatives. The nation is moving decisively away from coal; the Environmental Protection Agency's in-progress rules will effectively prevent new coal plants from being built while shutting down some of the oldest, dirtiest existing plants, and utilities and communities around the country are already reflecting the cost of carbon in planning.

[3] ROADMAP TO MOVING TO A LOW-CARBON ECONOMY IN 2050," HTTP://EC.EUROPA.EU/CLIMA/POLICIES/ROADMAP/INDEX_EN.HTM. ACCESSED 9/12/13.

[4] "2-DEGREE GLOBAL WARMING LIMIT IS CALLED A 'PRESCRIPTION FOR DISASTER'," MARK FISCHETTI, SCIENTIFIC AMERICAN, 12/6/11. HTTP://BLOGS.SCIENTIFICAMERICAN.COM/OBSERVATIONS/2011/12/06/TWO-DEGREE-GLOBAL-WARMING-LIMIT-IS-CALLED-A-PRESCRIPTION-FOR-DISASTER/

Capital expenditures required to maintain the nation's aging electricity infrastructure are translating into higher rates for customers across the nation, inviting scrutiny into energy supply, transmission, and distribution options for the coming years. Fort Collins' current low energy costs do not make it immune. Fort Collins has experienced a total rate increase of 41% since 2004, and the community is expecting electric rates to increase an average of another 2% in 2014.

Meanwhile, exciting alternatives are currently viable from a functional and economic perspective. Improved technologies like smart grid, electric vehicles, and thermal storage are no longer "next generation" capabilities but are being adopted today. Recent developments in the production of alternative technologies and leasing business models make cost, once an excuse to "buy later," a compelling reason in many cases to "buy now." Regional utility-scale wind is already cost-competitive for Fort Collins. Solar photovoltaics are experiencing steep and persistent cost declines. More efficient vehicles—and even electric vehicles—are competitive today against their conventional counterparts, especially when buyers take into account near term costs for fuel in addition to sticker price.

A greater array of effective financing mechanisms and models exists today than ever before to enable community-scale investment and overcome high up-front costs. Today's relatively low cost of capital from public and private sources presents a compelling, and potentially limited, window to invest.

AUDACIOUS BUT NOT UNPRECEDENTED

The accelerated Fort Collins climate goal is audacious but not unprecedented. Communities around the country and the world are moving towards drastically reducing or eliminating carbon emissions over the coming decades. An 80% carbon reduction goal by 2050 is no longer uncommon in cities and communities ranging from Madison, Wis., to Burlington, Vt., to Chicago, Ill. Some cities are targeting more than an 80% reduction by 2050, while the most ambitious are moving ahead to be completely renewable much sooner.

The specific goals and approaches of leading cities vary significantly, reflecting differences in priorities and timetables. Greensburg, Kansas, leveled in 2007 by a tornado, has rebuilt municipal and commercial buildings to LEED platinum standards and has eliminated electricity-related carbon emissions by investing in a large wind farm on the edge of town. On a larger scale, San Francisco has achieved greenhouse gas emission reductions of 7% below 1990 levels, and is aiming to provide 100% of electricity from renewable sources by 2020. In that effort, San Francisco has installed 18.5 MW of in-city renewables, including 15 MW of solar PV. Locally sourced, truly clean electricity is always preferred, however some cities are using other means to reach clean energy targets.

The City of Palo Alto achieved carbon neutrality this year by relying on renewable energy credits for a large share of purchases for at least the early transitional years. Santa Barbara is accelerating its own clean energy plans, embarking on a "Fossil Free by '33" campaign that includes permitting a 100 MW wind farm in the county and ordinances requiring all new or remodeled buildings to be carbon neutral. On the other side of the world, Copenhagen is promoting itself as a "living lab" for clean energy solutions in order to increase energy efficiency and renewable energy supply to support its target for carbon neutrality by 2025. By 2012, the Danish capital achieved 25% carbon reductions below 1990 levels, and it has a 50-point strategy in place to achieve carbon neutrality. Elsewhere, Sydney, Australia released a master plan in 2013 to achieve 100% renewable energy for electricity, heating, and cooling by 2030, relying on a diversified energy portfolio and development of decentralized generation sources.

Fort Collins is thus among the leaders but not at the forefront. At this formative moment, Fort Collins can stay on its current path or it can choose to accelerate its carbon reduction plan and stand among the world's leading cities. The community is uniquely positioned to accelerate its goal, develop a specific implementable plan, and in doing so, become a replicable model for cities elsewhere, contributing to a broader energy shift nationally and globally.

WHY WILL FORT COLLINS SUCCEED?

The biggest challenges Fort Collins faces to meeting this accelerated goal are not technical. Success depends largely on the community's ability to drive down costs, quickly ramp up to landmark levels of community adoption of efficiency and renewables, create and deliver attractive financing mechanisms, and foster effective collaboration between public and private stakeholders. The following unique characteristics put Fort Collins in a position of strength:

- ***Significant head start from past successes and existing programs,*** such as participation in the Global Reporting Initiative, local business commitment and partnership through ClimateWise, the recent Renewable and Distributed System Integration (RDSI) project, Advanced Metering Infrastructure (AMI) rollout, on-bill financing, and existing pedestrian- and bicycle-friendly infrastructure.

- ***Momentum gained from the ongoing FortZED projects,*** which aim to transform the downtown area of Fort Collins and the main campus of Colorado State University into a net-zero energy district. FortZED will put Fort Collins on a steep learning curve to coordinate unprecedented levels of customer engagement in energy issues, allowing Fort Collins to test and extrapolate programs from this microcosm of 7,200+ stakeholders to the larger community.

- ***Benefits from being a municipally-owned electric utility with a collaborative power supply partner***, such as greater control of energy decisions, established partnerships in the community, and access to low-cost capital and creative financing.

- ***A highly engaged community with prominent leaders in energy research and awareness*** (Colorado State University, New Belgium Brewery, Woodward, Spirae and others) whose reputational standing in the community and focus on sustainable initiatives make them effective drivers of change. Colorado State University alone accounts for more than a fifth of Fort Collins' population, and represents a valuable source of cutting edge technical research to help speed Fort Collins' energy transformation.

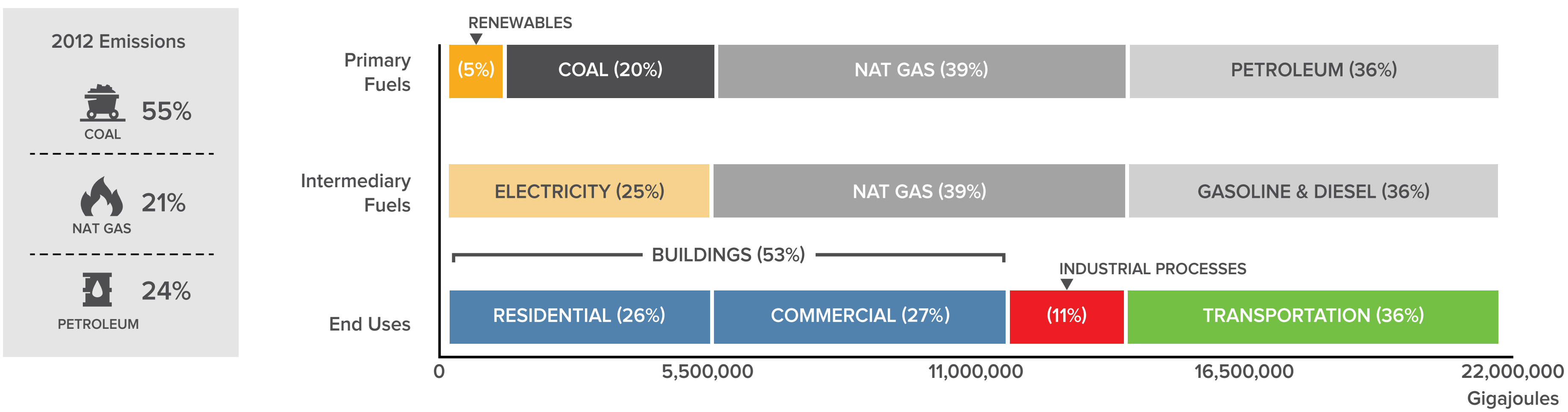
WHERE IS FORT COLLINS STARTING?

Ninety-five percent of the energy consumed by Fort Collins' today is sourced from fossil fuels: coal, oil, and natural gas. While coal accounts for only 20% of Fort Collins' energy consumption, it is responsible for 99.5% of its electricity CO_2 emissions and 55% of its overall CO_2 emissions. All of Fort Collins' coal consumption and 0.5% of its natural gas consumption is used to produce electricity; the remaining natural gas is used for heating, cooking, and industrial process heat; and virtually all petroleum is used to produce transportation fuels. As far as end uses, 26% of total energy fuels Fort Collins' residences; 27% its commercial buildings, 11% its industrial processes; and 36% its transportation fleet.

IN THIS REPORT

The way in which energy is used ultimately determines how the community can reduce its carbon emissions and by how much; thus the remainder of this document is organized accordingly. In the buildings chapter, we explore the full potential for energy efficiency based both on how people use energy within buildings and on how an integrated, whole system view can expand that potential. In the electricity chapter, we identify the portfolio of central and distributed technologies that can replace fossil fuel electricity supply, and the key strategies needed to enable them. In the transportation chapter, we assess both the potential to reduce the need for fossil-fueled transportation and the options available to replace it with alternative modes and drivetrains. Finally, in the implications and moving forward chapters, we highlight the implications of achieving an accelerated climate goal and suggest key actions the City and community must take to put itself on a path toward a clean energy future.

2012 FORT COLLINS ENERGY PROFILE



Source: "FC GHG and RE Data 2005-2012.xls"; City of Fort Collins, 2012. "Community Greenhouse Gas Emissions Inventory Quality Management Plan 2005-2011," City of Fort Collins, Environmental Services, October 2012. Available at http://www.fcgov.com/climateprotection/FC GHG Quality Management Plan

Figure 1: Fort Collins' 2012 energy profile, in terms of emissions, primary fuels, intermediary fuels, and end uses.

EFFICIENT BUILDINGS

03

EFFICIENT BUILDINGS

BY 2030, ACCELERATION COULD REDUCE ENERGY USE IN BUILDINGS BY 31% COMPARED TO BUSINESS-AS-USUAL, SAVING THE COMMUNITY $140 MILLION.

Fort Collins is home to over 65,000 buildings powered by electricity and natural gas. Consider all the equipment we use to light, heat, and cool our homes and workplaces. Add to that the computers and appliances we plug in to enable our modern lives. Buildings are responsible for 85% of the community's electricity consumption and 82% of its natural gas use, costing about $150 million annually and making them the number one contributor to Fort Collins' CO_2 emissions.

Not only is building energy demand significant today, it is expected to increase as Fort Collins grows. The community's near term projected population growth is 1.9% per year—almost three times the national average.[5] At this rate, business-as-usual efficiency improvements would not be sufficient to curtail energy growth. Without additional intervention, building energy demand could increase as much as 19% by 2030 from today's consumption levels, increasing CO_2 emissions by 24%.

The good news is that it's possible for Fort Collins' buildings to use much less energy while providing the same or better functionality. Building occupants aren't interested in consuming energy per se; they're interested in the services provided by energy, such as lighting, heating, cooling, and entertainment. By using more efficient technologies and intelligent, whole-system design, buildings can do more with less, eliminating wasted energy while bringing occupants greater comfort, productivity, and health with less expense.

How much better Fort Collins' buildings perform by 2030 depends on the level and type of intervention carried out by the City, owners, occupants, and other stakeholders. Our analysis suggests an estimated 18.6% of Fort Collins' total building energy use could be reduced from *business as usual* through the widespread adoption of conventional, cost-effective, efficient technologies. An additional 5.7% (on average, but up to 12% in some building types) could be achieved through behavioral and smart control strategies that optimize when and how occupants use energy. Another 6.8% savings can be achieved through integrative designs that coordinate deep energy saving retrofits with planned renovations or new construction, and through deep engagement with industrial energy users. This brings total reductions from efficiency alone to 31% from *business as usual.* On top of that, fuel switching for building heating (from natural gas to electricity) could save an additional 8%, bringing total potential reductions in buildings by 2030 to 39% from *business as usual.*

While Fort Collins' current retail electricity and natural gas prices are low compared to national averages, most efficiency measures are even cheaper. Initial analysis indicates that reducing total building energy use by 31% through efficiency could yield the community a net benefit of $140 million in avoided utility bills between now and 2030.

[5] "COMMUNITY GREENHOUSE GAS EMISSIONS INVENTORY QUALITY MANAGEMENT PLAN: YEARS 2005 THROUGH 2011 AND 2020 FORECAST," CITY OF FORT COLLINS, ENVIRONMENTAL SERVICES, OCTOBER 2012, P. 38.

Dramatic efficiency savings will benefit Fort Collins' future in significant ways besides and beyond energy cost savings. First, efficiency doesn't just reduce the environmental impact of the buildings sector, it also speeds the transformation of the entire electricity supply system. The more Fort Collins can reduce its energy demand, the smaller the investment required to meet the community's changing energy supply needs. Second, efficiency is by nature local, requiring onsite skills and labor. At scale, efficiency contributes both directly and indirectly to demand for local service providers and practitioners. Third, well-designed, efficient buildings can be healthier and more comfortable than their conventional counterparts, providing better spaces in which to live and work.[6] Finally, efficiency is Fort Collins' cleanest resource, since the resource that produces the least emissions is the energy that isn't used at all.

[6] KATS, G. 2010. "GREENING OUR BUILT WORLD: COSTS, BENEFITS, AND STRATEGIES." ISLAND PRESS, INC.: WASHINGTON DC.

2012 FORT COLLINS BUILDINGS ENERGY EFFICIENCY POTENTIAL

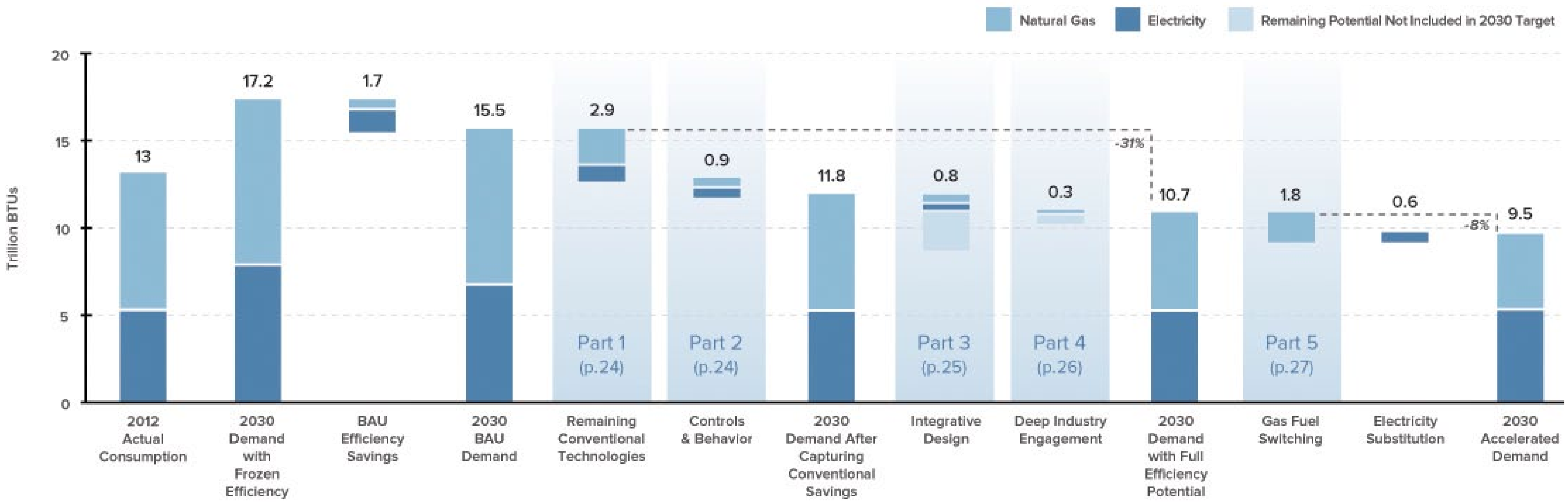


Figure 1: This building energy efficiency potential estimate for Fort Collins is based on a detailed, national-level analysis conducted by Rocky Mountain Institute for Reinventing Fire, which draws from analysis by National Academies and Lawrence Berkeley National Laboratory. Potential savings from industrial process loads, while not strictly addressing building end use, are also included in this potential since they represent a considerable opportunity and also frequently occur in or around buildings.

UNDERSTANDING THE FULL POTENTIAL

By adapting national findings around technical and economic efficiency potentials to Fort Collins' unique building stock, we can get a sense of the full potential for efficiency in Fort Collins.

Part 1: An estimated 18.6% of energy could be saved from business-as-usual by 2030, through the widespread adoption of conventional efficient technologies.

A significant amount of savings could be achieved simply through replacing existing equipment in buildings with efficient technologies that are currently available and already employed throughout the nation. These technologies—ranging from efficient lighting to insulation—address all the ways people use energy in residences and commercial buildings, such as cooling, heating, lighting, cooking, refrigeration, and plug loads. The cost of conserved energy (CCE) for the conventional efficiency technologies analyzed in this study is, on average, 4.4 cents/kWh cheaper than the price of energy for electricity-saving measures, and $2.33/MMBtu cheaper for natural gas-saving measures. Of the 61 end uses we investigated, 60 were cheaper than respective electricity and natural gas retail rates in Fort Collins.

- *Electricity*

  All conventional electricity efficiency measures are cost-effective in Fort Collins today. Accessing this full potential would be equivalent to reducing total building electricity use in Fort Collins by 18.6% relative to *business as usual.*

- *Natural Gas*

  All conventional natural gas efficiency measures, with the exception of some for residential water heating, are cost-effective today in Fort Collins. If retail gas prices increased by $2/MMBtu for the residential sector, cumulative measures for this end use, too, would be cost-effective.

RETAIL RATE FOR ELECTRICITY AND NATURAL GAS vs. COST OF CONSERVED ENERGY

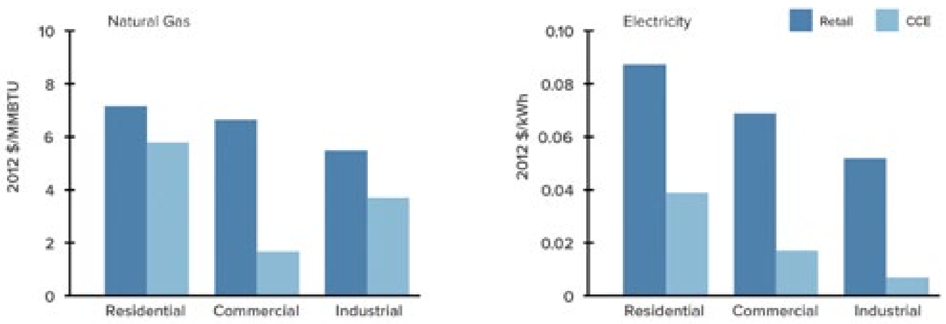


Figure 2: The average CCE for all conventional efficiency measures, by end use, is significantly less than the retail rate for both natural gas and electricity in all sectors.

Part 2: Targeting people, not just technology, can capture another 5.7% savings (on average, but up to 12% in some building types) in residential and commercial buildings.

After replacing building components with more efficient technologies, an additional 5.7% reduction in energy demand can be achieved cost-effectively by using smart controls and other strategies to encourage changes in how people operate and interact with buildings. After all, buildings don't use energy, people do. Measures in this category borrow from the latest in behavioral science about why and how people actually make decisions. Strategies range from providing real-time feedback on energy use to stirring competition and inciting neighborhood-scale change by letting people know how much energy they are using compared to their neighbors. As just one example, OPower works with utilities nationally to provide customers with information about how their energy use compares to others in their neighborhood, and that information alone has produced a steady state savings of 1.5–3.5%.[7] Fort Collins was one of the first ten utilities served by Opower, and is now in the 4th year of this program. The first three-year savings for customers was 2.5%.

Tactics like these aren't geared towards occupant sacrifice in terms of service, comfort, or convenience. Rather, they seek to raise awareness of, and curtail, wasteful habits that lead to unintended energy consumption, such as leaving the heat on at times when the home is unoccupied. Smart controls can cut energy use without changing individual occupant behavior, for example by automatically setting back thermostats or shutting off equipment during off-hours at work. The Nest smart thermostat learns and adapts to a homeowner's behavior, automatically adjusting the temperature to keep the home comfortable when occupied, and saving money and energy when not.

In a similar fashion, Fort Collins' water use dropped 25% during and immediately after the severe drought in 2002. The community has adopted more of an ethic of water conservation, supported by education, metering, and water rates such that water use has not bounced back to pre-drought levels even when water is more plentiful.

Part 3: Integrative designs that time deep energy-saving interventions with planned renovations and new construction could capture another 4.9% savings relative to business-as-usual.

Efficiency improvements can have cascading energy benefits that aren't typically recognized when measures are considered incrementally, as they almost always are. For example, a lighting retrofit from incandescent to compact fluorescent lamps (CFLs) or halogen reflectors directly reduces lighting loads in a building. But it also reduces the amount of heat generated by the lighting system, which in turn reduces demands on the building's cooling system.

Grouping individual measures together to capture these cascading, or "integrative," benefits can often uncover far greater energy savings per dollar invested than possible through an incremental, measure-by-measure approach. Integrative design can be so effective that, in some cases, buildings can achieve high enough levels of efficiency to downsize equipment or entire building systems, resulting in potentially significant reduced or avoided capital costs.

Fort Collins has existing as well as emerging programs to encourage and assist in integrative design practices for commercial new builds and existing buildings; increased adoption of these will be critical for adopting beyond-conventional savings. For example, Fort Collins' forecasted population growth will lead to construction of new buildings over the coming decades. Those new buildings present an important opportunity to "get it right the first time" from an energy efficiency perspective, and integrative design can be an important tool. Additionally, the majority of today's buildings will still be standing in 2030 and even in 2050. Integrative design can be employed in these buildings as well, through what is commonly known as a deep retrofit.

[7] "ELECTRICITY IMPACT" CHART, OPOWER WEBSITE, ACCESSED ON 8/19/13. HTTP://OPOWER.COM/UTILITIES/RESULTS/AV

Deep retrofits, which are sometimes thought to be too expensive by building owners, can become much more cost-effective when timed to coincide with ongoing capital improvement events in a building's lifecycle. For example, high-performance windows and LED lighting, expensive when planned as isolated efficiency events, can become cost-effective if together they reduce cooling loads enough to lessen or avoid the cost of an upcoming chiller replacement. In Fort Collins, coinciding deep retrofits with building repositioning (which is becoming increasingly common throughout local infill developments) could help owners access greater, cost-effective energy savings.

In early 2013, the New Buildings Institute documented 50 case studies of retrofit projects across the nation that save an average of 40% relative to existing energy use or local codes.[8] For example, the Johnson Braund design firm purchased a two-story office building built in Washington in 1984 with heating, cooling, and ventilating equipment that was nearing the end of its useful life. Instead of simply completing one-for-one equipment replacements, the firm implemented multiple efficiency measures to optimize the building energy performance. The building now operates in the 6th percentile for its building type and uses 47% less energy than a comparable building.

Figure 1 includes the full potential for energy reductions from employing integrative design practices; we estimate that only 30% of this potential is achieved as part of the *accelerated* scenario, resulting in the targeted 4.9% savings through this strategy.

Part 4: Deep engagements with industrial energy users could capture another 1.9% savings, bringing total potential reduction from efficiency to 31%.

Potential savings from industrial process loads, while not strictly addressing building end use, are also included in this potential since they represent a considerable opportunity and also frequently occur in or around buildings. Cost-effectively addressing industrial processes, especially those driven by natural gas, requires tailored strategies for individual manufacturers and users, many with unique loads and equipment. While there are hundreds of industrial energy users within Fort Collins, only a very small number account for the majority of industrial energy use. Direct engagements with these users to target deep savings, including for process loads, could result in additional savings. Industrial efficiency efforts have historically suffered from siloed design efforts. Convening experts from multiple disciplines and industries to tackle related problems across Fort Collins' large commercial and industrial energy users could kick-start an effective solution.

Figure 1 illustrates the full potential for energy reductions from employing deep engagement practices; we estimate that 50% of this potential is achieved as part of the accelerated goal, resulting in the targeted 1.9% savings through this strategy.

[8] A FULL CATALOGUE OF THE STUDIES CAN BE FOUND IN THE RESEARCH LIBRARY AT WWW.GREENBUILDINGFC.COM

Part 5: Fuel switching for building heating, from natural gas to electricity, could save another 7.8%. This brings total potential savings to 39% from business-as-usual.

For many buildings in Fort Collins, building heating and domestic hot water is fueled by natural gas. Viable alternatives exist today, including solar hot water, ground source heat pumps, and air source heat pumps. In fact, implementing these technologies is a common practice in new builds and retrofits today. The challenge for Fort Collins will be to help individual buildings right-time implementation to make installation more cost-effective, and to coordinate a high level of adoption at a fast pace.

Fuel switching is a key lever for meeting aggressive climate target goals, and has been and continues to be incorporated into strategic long term energy plans for cities and regions around the world. For example, the European Climate Foundation's Roadmap 2050 report, which lays out a pathway to 80% carbon reductions and provides policy guidance for the next 5 to 10 years to European leaders, addresses fuel switching as a viable and necessary strategy.[9] In this study we consider the potential of energy and carbon savings from switching from gas-powered heating to electric heat pumps.

ACHIEVING AN EQUIVALENT OF 2.4% ANNUAL EFFICIENCY SAVINGS IN ELECTRICITY

To fully capture the efficiency potential in electricity, the community would need to achieve an equivalent of 2.4% electricity efficiency savings improvements annually between now and 2030. Fort Collins currently targets 1.5% (met in 2012) annual efficiency savings, already putting it among the highest tier of efficiency targets in the nation.

In comparison, Efficiency Vermont, one of the best-in-class electricity efficiency programs in the nation, has achieved a maximum electricity savings of 3.1% of retail sales in a single year, and 1.8% of retail sales or greater each year since 2007.[10] Achieving a sustained 2.4% savings per year is unprecedented but achievable. To date, five states in the U.S. (California, Connecticut, Massachusetts, Rhode Island, and Washington) require utilities to pursue all cost-effective efficiency measures.[11] And it is important to note that efficiency savings numbers reported by utilities around the country may be underestimating the full amount of efficiency being achieved, since they rarely reflect efficiency driven by codes and standards or "naturally occurring" efficiency that people perform absent a utility incentive or mandate. For example, California's Energy Demand Forecast 2010-2020 shows a cumulative 2.8% savings from utility and public agency programs over the period, a 7.7% savings from codes and standards, and a 3.7% savings from naturally occurring efficiency in 2008.[12]

[9] "ROADMAP 2050: A PRACTICAL GUIDE TO A PROSPEROUS LOW-CARBON EUROPE," EUROPEAN CLIMATE FOUNDATION, 2010. HTTP://WWW.ROADMAP2050.EU/ATTACHMENTS/FILES/VOLUME1_FULLREPORT_PRESSPACK.PDF

[10] "VERMONT TOWN ENERGY USAGE AND SAVINGS" WORKSHEET, EFFICIENCY VERMONT WEBSITE, ACCESSED ON 8/15/13. HTTP://WWW.EFFICIENCYVERMONT.COM/ABOUT_US/ENERGY_INITIATIVES/VT_TOWN_ENERGY.ASPX

[11] "ON A RISING TIDE: THE FUTURE OF U.S. UTILITY CUSTOMER-FUNDED ENERGY EFFICIENCY PROGRAMS." CHARLES GOLDMAN ET AL., LAWRENCE BERKELEY NATIONAL LABORATORY, 2012, P3.

[12] "CALIFORNIA ENERGY DEMAND FORECAST 2010–2020: STAFF DRAFT FORECAST," CALIFORNIA ENERGY COMMISSION, JUNE 2009. HTTP://WWW.ENERGY.CA.GOV/2009PUBLICATIONS/CEC-200-2009-012/CEC-200-2009-012-SD.PDF

COUNTING BENEFITS BEYOND ENERGY COST SAVINGS

Numerous studies and surveys show that, compared to their average market counterparts, energy-efficient green buildings boast reduced absenteeism, better employee health, higher occupancy rates, increased sales prices, increased productivity, higher property values, and decreased risk. Today, most owners and investors for existing buildings ignore the full range of potential value, instead basing their retrofit decisions on energy costs alone, with an average allowable payback period of only 3.4 years.[13] However, because the cost of energy is on average about one-tenth the cost of rent or mortgage and about one-hundredth the cost of employee-occupants, energy costs are just a small piece of the affected value when a building is upgraded.

Leading-edge building owners are beginning to shift how they value energy performance to align efficiency projects with core priorities for business. Past and emerging studies are helping to quantify the amount of value beyond energy cost savings, suggesting rent premiums of 3 to 6%, occupancy premiums up to 10%, and sales price premiums of 10% or more for investor owned LEED certified or Energy Star office buildings.[14] For example, the investor-owner of the Beardmore building in Priest River, Idaho not only enjoys the satisfaction of owning a highly sustainable property but also reaps the bottom-line benefit of increased tenant attraction, which in combination with the historic qualities of the building enables him to charge rent 35% above the local average (more than 10 times the value of the energy cost savings).[15]

Case studies identified years ago in Natural Capitalism show a 6 to 16% gain in labor productivity from better thermal comfort, visibility, and quiet. A study based on a survey of 534 tenants in 154 office buildings in 2009 found that tenants in LEED or Energy Star buildings reported, on average, 2.88 fewer sick days per year per person, resulting in average bottom-line cost savings of $1,228 per worker or $4.91 per square foot.[16]

MOVING TOWARDS IMPLEMENTATION

Even though the value proposition for increased energy efficiency in buildings is compelling, there are challenges to implementation at scale. Only a small portion of the cost-effective energy efficiency potential in the U.S. has been captured. So what is slowing adoption?

Fort Collins faces a number of challenges—some common to other municipalities and utilities and some specific to Fort Collins—with a few that rise to the top. Though some utilities have piloted successful programs that address one or more of these challenges, no community or utility has addressed all these barriers comprehensively. Fort Collins has the opportunity to lead by example, in some cases through applying best practices to date, in other cases developing a best practice required to achieve such aggressive levels of efficiency savings quickly.

Challenge 1: People have little awareness of energy issues and have competing priorities.

Beyond cost, financing, and information, efficiency is simply not a priority, or is too much of a hassle, for many people. Very little is possible without good data, yet there is a surprising lack of good information available to service providers and customers throughout the U.S. electricity sector.

[13] 2012 ENERGY EFFICIENCY INDICATOR, GLOBAL RESULTS, JUNE 2012, INSTITUTE FOR BUILDING EFFICIENCY, JOHNSON CONTROLS.

[14] OVER A DOZEN STUDIES PROVIDE EVIDENCE SUGGESTING A 3 TO 6 % RENT PREMIUM AND 10% OR MORE SALES PRICE PREMIUM (SEE CODES 15.71 AND 15.72 OF GREEN BUILDING FINANCE CONSORTIUM RESEARCH LIBRARY, WWW.GREENBUILDINGFC.COM)

[15] NEW BUILDINGS INSTITUTE, 2011. ELEVEN CASE STUDIES FROM: A SEARCH FOR DEEP ENERGY SAVINGS IN EXISTING BUILDINGS. HTTP://NEWBUILDINGS.ORG/PROJECT-PROFILES-SEARCH-DEEP-ENERGY-SAVINGS [15] MILLER, POGUE, GOUGH, & DAVIS, GREEN BUILDINGS AND PRODUCTIVITY, JOURNAL OF SUSTAINABLE REAL ESTATE, NO. 1-2009. ASSUMES AVERAGE OF 250 SQUARE FEET PER WORKER AND ACTUAL AVERAGE SALARY OF TENANTS OF $106,644.

[16] MILLER, POGUE, GOUGH, & DAVIS, GREEN BUILDINGS AND PRODUCTIVITY, JOURNAL OF SUSTAINABLE REAL ESTATE, NO. 1-2009. ASSUMES AVERAGE OF 250 SQUARE FEET PER WORKER AND ACTUAL AVERAGE SALARY OF TENANTS OF $106,644.

Strategy: Implement new approaches to increase motivation and enthusiasm, and provide relevant, timely, and compelling information.

A prerequisite for increasing motivation is to provide education, transparent information, and normative messaging to build a case for action. A wide range of useful information can help building owners and occupants alike, including: knowing exactly how much energy is being used by what end use at any given time, understanding how electricity prices change over the course of a day, the efficiency performance of a home before it is purchased, information about new technologies that could save more energy at less cost, and understanding how individual action contributes to community and societal goals.

In Fort Collins, the utility has begun to build this foundation by rolling out advanced meters that are needed to gather and communicate information and by promoting home energy audits to identify what homeowners can do to improve efficiency. Examples of additional strategies the City could take include mandating energy audits at times of sale, making relevant non-confidential customer data available to service providers to help target solutions, leveraging its smart grid investments to provide time-of-use data and pricing to customers, providing user-friendly reporting metrics, enabling smartphone real-time monitoring and feedback, and labeling of building energy performance.

Building on that foundation, one of—if not the—most significant actions Fort Collins can take is to develop approaches to support increased adoption of efficiency by making efficiency and conservation part of the community's culture. Examples of potential strategies include developing a community organizer approach, direct installations for customers, utilizing innovative approaches that make efficiency savings fashionable and a point of pride, increasing codes/standards, and gamification and neighborhood competition for energy savings and solar PV penetration. Furthermore, supporting the development of a residential energy services company (ESCO) model could help drive participation by simplifying the time and effort required by an individual homeowner.

Challenge 2: Fort Collins has a high percentage of historically hard-to-reach customers, yet a need to scale efficiency quickly.

There is no one-size-fits-all answer for efficiency. While not unique to Fort Collins, the community has a highly fragmented building population making a rapid, deep efficiency roll out difficult. For example, there are a high percentage of residential rental properties with a high churn rate, a high percentage of residential customers living in multi-family buildings, and a diverse small commercial sector. Achieving the target efficiency improvement means that the community cannot only target "low hanging fruit," or the largest customers, but must instead target greater adoption of both individual, incremental measures, and deeper, tailored approaches.

Strategy: Tailor and phase programs to specific leverage points in individual market segments.

Fort Collins Utilities has already increased annual efficiency savings from negligible levels a few years ago to 1.5% today, in part, by tailoring programs to specific targets. Recognizing the fragmented nature of the building population, the City should continue down this path by segmenting the market, aided by data newly available from its advanced meter rollout, and identifying the unique issues and leverage points in each segment. This approach will allow efficiency programs to most effectively drive scale in each segment.

While the majority of Fort Collins' existing efficiency programs are targeted at individual end-uses or technologies (for example, rebates for more efficient light bulbs), the community can achieve greater savings by understanding the total energy use profiles of specific customers and pursuing comprehensive energy savings. Often these "deep" savings can be most cost-effectively achieved when timed with a planned retrofit or system replacement. The City should also consider how to phase efficiency programs to be timed with expected capital expenditures in individual buildings (e.g. building permits, change of use, time of sale).

Examples of innovative, tailored approaches already being piloted by the City include: targeting efficiency programs for multi-family buildings that impact a large number of customers through fewer select projects, and developing a deep retrofit program that rewards whole-system savings.[17]

Challenge 3: There are high up-front costs and misaligned economic incentives.

Efficient technologies, like most renewable technologies, require an up-front capital expenditure to accrue savings later. That up-front cost can be a significant hurdle for some people, especially those with other priorities and limited capital.

Because efficiency requires a ***capital*** expenditure but results in ***operational*** cost savings, there is a misaligned incentive between owner and tenants in both residential rental properties and leased commercial properties. The owner is responsible for capital upgrades, but tends to invest in the lowest cost technology rather than the most efficient, since she doesn't pay the utility bills. The tenant bears the burden of high utility bills each month, but has little incentive to invest capital in a rental property. And though many efficiency measures are cost-effective, savings from an individual measure may only amount to a few dollars per month. The potential aggregate financial savings from efficiency are significant from a community perspective; from an individual perspective, they may not be.

[17] FOR EXAMPLE, SEE "GOING DEEPER: A NEW APPROACH FOR ENCOURAGING RETROFITS," KELLY SMITH AND MATHIAS BELL, INSTITUTE FOR BUILDING EFFICIENCY (JCI) AND ROCKY MOUNTAIN INSTITUTE, SEPTEMBER 2011. HTTP://WWW.INSTITUTEBE.COM/INSTITUTEBE/MEDIA/LIBRARY/RESOURCES/EXISTING%20BUILDING%20RETROFITS/ISSUE_BRIEF_DEEP_PRO-GRAMS_FOR_RETROFITS.PDF

Strategy: Provide new solutions to economic, financing, and misalignment issues.

Fort Collins Utilities has already begun to address these issues by providing efficiency incentives and an on-bill financing program. There are many other creative strategies that could be incorporated, including:

- Address the owner-tenant split incentive by driving increased adoption of programs that provide rebates directly to the property owner rather than the tenant, adopting an energy code for rental housing, or by developing financing options that offer a meter-based approach.
- Make investment more attractive to investors by aggregating small projects for scale, and adequately addressing term, interest rates, and transferability.
- Reassess and make explicit an approach for effectively setting incentives. Incentives should be optimized within the boundaries of a portfolio cost of conserved energy (CCE) approach, rather than a per measure approach.
- Leverage a combination of strategies by introducing new rate structures or incentive programs that encourage both efficiency and solar PV while generating the revenues Fort Collins Utilities needs to maintain financial stability. Provide access to low-cost financing through interest rate buy downs or loan loss reserves and incentives, while testing novel program designs and customer engagement strategies, some of which are described above.

Challenge 4: Fort Collins is small and not solely responsible for its energy system.

Fort Collins is small compared to many other cities and to other utilities that cover whole regions, so it is at a disadvantage in achieving economies of scale through strategies that work for larger utilities. This affects purchasing power, outreach and communications, and program implementation capabilities. Further, Xcel Energy rather than Fort Collins Utilities supplies natural gas for heating, cooking, and industrial process, so the City has less direct control over natural gas efficiency programs. Finally, the value of efficiency (and other distributed resources) is rarely accounted for in current practices for building valuation and appraisals, a constraint that needs to be tackled at the industry level.

Strategy: Build partnerships and coalitions to drive economies of scale in cost and in best practices.

Expand cooperative relationships with Platte River and other member cities to build greater economies of scale. In doing so, and in conjunction with Xcel Energy, plan for data sharing and develop complementary program rules. Build stronger connections with other public utilities and experts around the country to regularly share efficiency and industry best practices and to strengthen partnerships with national retailers. Establish Fort Collins as a test bed for the best ideas, attracting both leading technologists and financing.

Challenge 5: There are not enough adequately trained service providers.

Achieving target levels of efficiency requires not only increased demand for efficiency, but also adequate reserves of service providers who can meet that demand. In Fort Collins, contractor expertise and comfort with efficient technologies and design approaches remains a key hurdle.

Strategy: Create a highly trained, efficient workforce.

Work with contractors to ensure every renovation, remodel, and new construction project aligns with community goals for maximizing efficiency. Fort Collins Utilities already has a contractor training program for home energy upgrades. Potential strategies for growth include collaboration at the local, regional (e.g. Platte River cities), state (e.g. Colorado Energy Office), and national (e.g. Building Performance Institute) levels to align work standards, training, and certification approaches. The City could also consider partnering with Energy Service Companies (ESCOs) that can provide trained workers at scale.

SUMMARY

By 2030, Fort Collins could reduce its building energy use by 31% from efficiency, creating a net benefit of $140 million for the community in saved utility bills, spurring local job growth through onsite construction and building projects, and transforming Fort Collins' buildings into more comfortable and healthier places to live and work. By fuel switching from natural gas to electricity for building heating, Fort Collins could save an additional 7.8% in energy use.

The barriers to achieving dramatic energy savings are not technical—all the requisite technologies are already in place, and increasingly advanced building technologies continue to come to market. Rather, the challenge for Fort Collins is to drive landmark community adoption rates of existing and emerging efficiency programs, and to grow the available contractor and provider base to meet increased demand. Because buildings are responsible for 85% of Fort Collins' current electricity consumption, the benefits of increased efficiency adoption is not isolated to the buildings sector. The more Fort Collins can shrink the demands of its biggest user, the more viable a near-term future powered almost entirely by renewables.

RENEWABLE ELECTRICITY SUPPLY

04

Image courtesy of New Belgium Brewery

RENEWABLE ELECTRICITY SUPPLY

FORT COLLINS CAN ACHIEVE A CARBON NEUTRAL ELECTRICITY SYSTEM BY 2030.

Energy efficiency can go a long way towards lowering Fort Collins' energy costs and carbon emissions—but it is not sufficient. By integrating local and centralized renewables, the City can energize local economic development and innovation and enable the transition to cleaner and more secure energy options in other sectors of the energy economy, notably transportation. Today, electricity supply accounts for 55% of Fort Collins' CO_2 emissions, and from 2013 to 2030 will produce another 17 million metric tons, even after efficiency measures. The majority of these carbon emissions originate from just two coal-fired power plants that together provide 71% of Fort Collins' electricity.

Fort Collins' current dependence on coal-fired electricity exposes the community to rising fuel prices (the Energy Information Administration projects a 30% or more increase in coal prices from 2013 to 2030), security and reliability risks, and detrimental air pollution impacts to human health and the environment. Quickly incorporating more renewable energy at scale is critical to Fort Collins' accelerated clean energy strategy.

2013–2030 ELECTRICITY SYSTEM SUPPLY PORTFOLIO

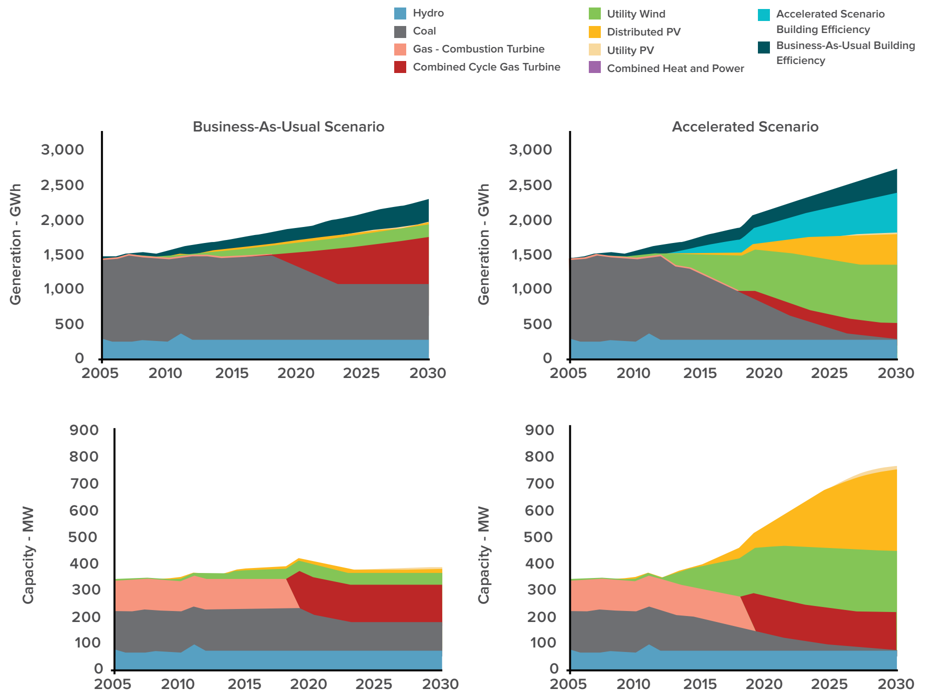


Figure 1: Fort Collins' accelerated clean electricity pathway (right) reflects 100% net electricity emissions reduction by 2030. The business-as-usual pathway (left) is a projection of 2005–2012 trends to 2030. Capacity is much higher for the accelerated case due to renewables' lower capacity factors relative to fossil-fueled generation sources. Excess renewables are generated to offset remaining natural gas generation.

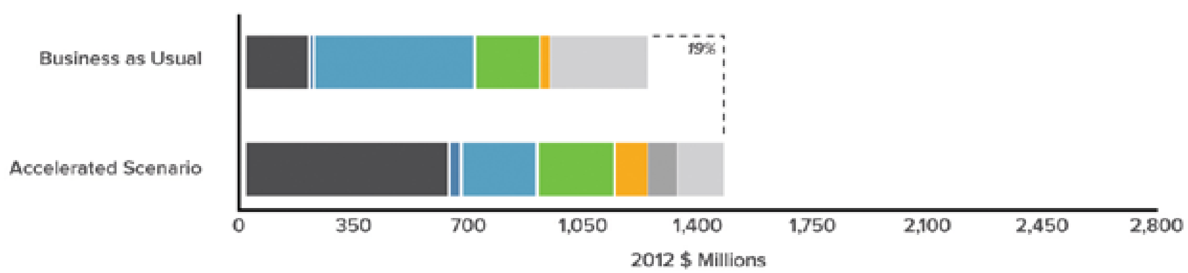
Given the abundant renewable resources available in Colorado—together with rapidly improving technology to access these resources—Fort Collins electricity supply could be made carbon neutral by 2030. Achieving this accelerated goal would require:

- meeting the building efficiency savings described in the previous chapter;
- driving landmark adoption rates of distributed solar and centralized wind, including enough to offset remaining natural gas generation; and
- providing sufficient resource diversity and flexibility (e.g., flexible natural gas generation, demand response, storage, etc.) to ensure robust and resilient grid operations.

The portfolio of resources modeled in this study to drive an accelerated carbon goal is shown in Figure 1 (p. 31), compared to *business as usual,* for both energy generation and capacity.

In fact, Fort Collins is already taking initial steps along this path. Platte River Power Authority (Platte River), the generation and transmission utility that provides electricity to Fort Collins Utilities, is currently considering additional wind generation that would roughly double the city's wind supply, along with strategies it could employ to facilitate integration of variable renewables (e.g., new gas capacity). Fort Collins Utilities is rolling out advanced meters throughout the community, has established an on-bill financing program, and is actively engaged in designing programs to support rooftop solar financing and smart grid technology.

2013–2030 ELECTRICITY SYSTEM PRESENT VALUE COST



2013–2050 ELECTRICITY SYSTEM PRESENT VALUE COST

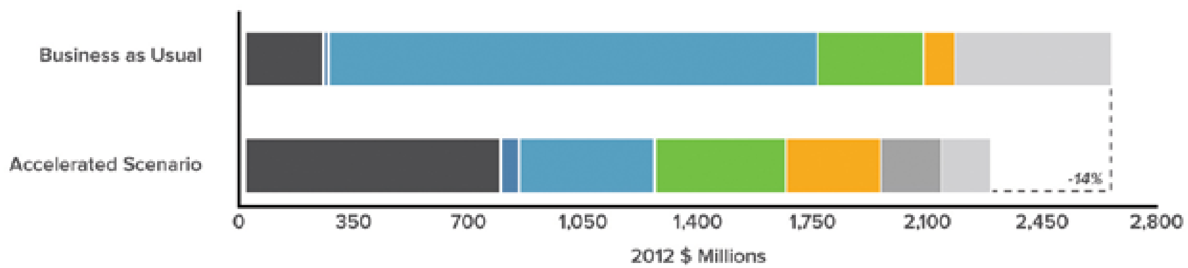
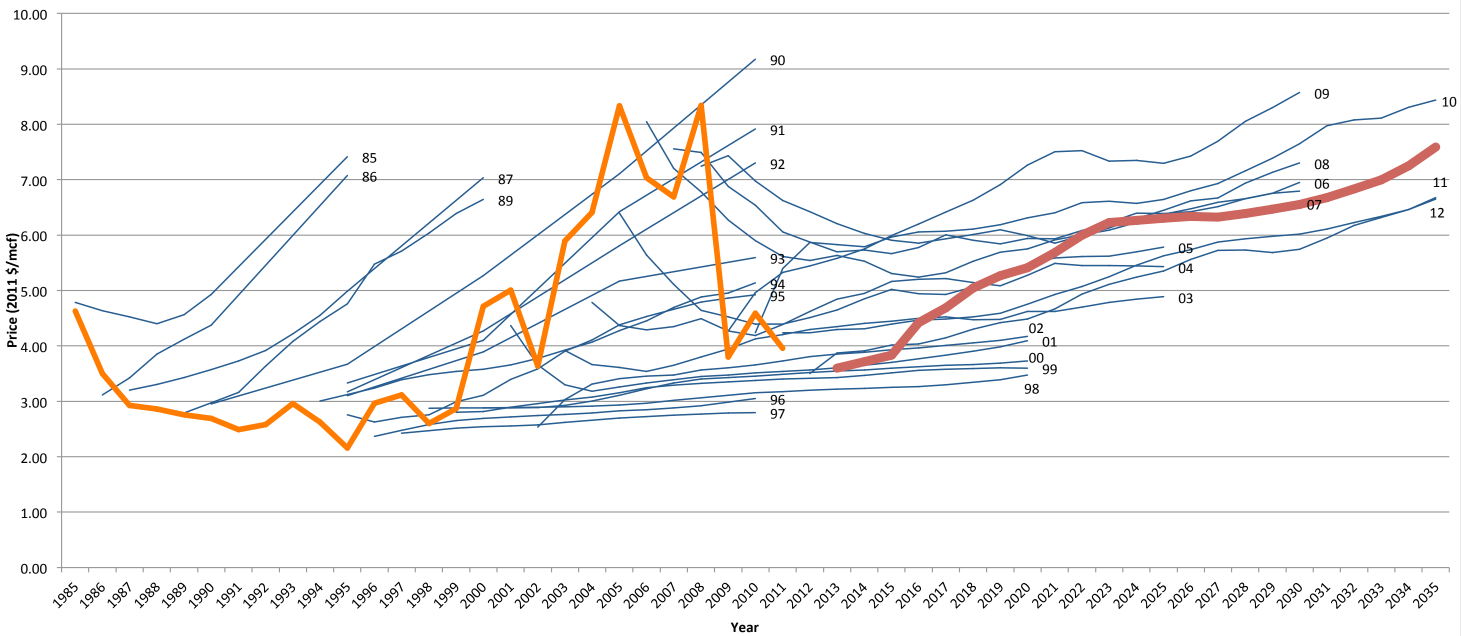


Figure 2: The total present valued costs reflected here include investment in the electricity system and also in the building efficiency that influences total electric load. While the accelerated case has significantly higher capital costs, those costs are largely offset by avoided fuel costs over time.

Initial analysis indicates that the total present valued cost of an *accelerated* electricity scenario would be 19% higher compared to *business as usual.* By 2050, accrued fuel savings, reduced exposure to carbon costs, and continued efficiency savings could make the present valued cost of the *accelerated* electricity scenario 15% less expensive than *business as usual.*

A number of key assumptions shape the economics of this transition. Two of those—natural gas prices and the cost of carbon—are consistent sources of debate and variability around the country and therefore sensitivity-tested here. As seen in the chart below, natural gas price forecasts are constantly changing, and actual prices often deviate far from forecasted. Both the *business-as-usual* and the *accelerated* scenarios above use the Energy Information Administration's mountain region reference case for natural gas prices. As a sensitivity, we modeled scenarios in which gas prices are 30% higher or lower than the reference case in all years. Given that the *accelerated* case relies on less natural gas than *business as usual*, higher gas prices would reduce the 2013–2030 present value cost premium from 19% to 15%—supporting the case for accelerated renewables deployment further. Should gas prices be lower than the reference case—persisting at or below recent historic lows—the

EIA PROJECTIONS VS. ACTUAL U.S. AVERAGE WELLHEAD NATURAL GAS PROJECTIONS



Sources: Annual Energy Outlooks 1985-1987, 1989-2011 (see http://www.eia.gov/forecasts/aeo/archive.cfm for an archive of reports through 2012.); Early AEO 2012 BEA GDP Implicit Price Deflator

Figure 3: Historical natural gas price forecasts compared to actual. Thin blue lines depict the U.S. Energy Information Administration's expectation for future natural gas prices, as projected in the EIA Annual Energy Outlook (AEO), 1985-2012 (numbers following each line indicate the year of publication for each AEO report). The orange line depicts the average gas price that actually resulted in each year. The red line shows the 2013 AEO Mountain Region gas forecast, the reference case assumed for Fort Collins in this report.

present value cost of the *accelerated* case through 2030 would be 25% higher than *business as usual*. Either way, the impact of natural gas prices is limited given the low level of gas in both scenarios.

Today, leaders like the state of California are already making energy investment choices based in part on a carbon price, and the federal government has recently issued a report that assesses the social cost of carbon starting today. We use a conservative figure of a "penny a pound" (approximately $22 per metric ton in 2012$) to value carbon emissions in both scenarios, with no escalation to 2030. As a sensitivity, we tested a 2013 White House interagency working group forecast that starts at $35/metric ton (2007$)[18] in 2013. Doing so would reduce the cost premium associated with the *accelerated* scenario from 19% to 8%.

Audaciously shifting Fort Collins to a carbon neutral electricity system would have important and compelling outcomes, including:

- Lowering cumulative CO_2 electricity emissions by 30 million metric tons between now and 2050 compared to *business as usual*, the equivalent of removing 600,000 cars from the roads for ten years.
- Supporting local economic development by (i) creating a long-term market for rooftop solar PV (and energy efficiency) requiring local skilled labor, and (ii) solidifying Fort Collins' reputation as an innovation and sustainability hub, attracting businesses and high-quality jobs.
- Building off of Fort Collins' already notable electric reliability to create a truly resilient electric system that will sustain the community into the future.

DESIGNING THE ELECTRICITY PORTFOLIO OF TOMORROW

Creating a Diverse Portfolio of Central and Distributed Resources

Achieving carbon neutrality in Fort Collins' electricity system is not just a matter of driving investments into expanded renewable supply from Platte River. It is critical for centrally sourced renewables, notably wind, to be scaled quickly. But local distributed resources like commercial and residential rooftop PV, community PV, and even local energy storage and electric vehicles are key enablers of a more vibrant and thriving energy future for the community. Because of rapidly falling costs of distributed renewable technologies, increased personal awareness and demand, and innovative financing and business models, it's feasible today for distributed PV and other sources to provide a large share of the renewable resources required to achieve carbon neutrality. Creating a diverse portfolio that includes both central and distributed resources will diversify Fort Collins' supply, ensuring the community's electricity system will be not only cleaner but more secure and resilient than it is today.

Fort Collins has a variety of renewable supply options, each with its own attributes and implications. Creating an optimized portfolio requires an understanding of what each supply option offers in terms of affordability, technical feasibility, reliability, environmental performance, and public acceptability. The following table provides a high-level qualitative comparison of various renewable options including distributed and utility-scale solar photovoltaics (PV), wind,

[18] "TECHNICAL SUPPORT DOCUMENT: TECHNICAL UPDATE OF THE SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS - UNDER EXECUTIVE ORDER 12866," INTERAGENCY WORKING GROUP ON SOCIAL COST OF CARBON, UNITED STATES GOVERNMENT, MAY 2013. HTTP://WWW.WHITEHOUSE.GOV/SITES/DEFAULT/FILES/OMB/INFOREG/SOCIAL_COST_OF_CARBON_FOR_RIA_2013_UPDATE.PDF

and biomass. Combined heat and power (CHP), although generally natural-gas fueled, is included as well because of its high efficiency and potential to be fueled by renewable sources such as biomass.

IMPORTANT CRITERIA TO CONSIDER FOR DIFFERENT ENERGY GENERATION OPTIONS	DISTRIBUTED PV Commercial & residential rooftops, community solar	UTILITY PV Large-scale, ground mount solar arrays	WIND Large-scale windfarms	BIOMASS I.e. Wood, pulp, agricultural residue for cogeneration	CHP/CCHP Combined heat and power or combined cooling heat and power
Operations (Variable Output) Power from renewable resources can fluctuate with the weather, adding variability, and requires smart integration to best shape output system needs.	Y	Y	Y	N	N
Siting (Distributed or Centralized) Smaller, more modular energy resources can be installed by disparate actors outside of the purview of centrally coordinated resource planning.	D	C	C	C/D	D
Potential to Provide Value Beyond Energy Generation Value beyond energy generation can include benefits to grid operations and total system efficiency. For example, distributed resources can reduce line losses, defer capacity investments, and minimize land impacts. Renewable resources can act as a hedge against volatile natural gas prices. Combined heat and power increases efficiency by utilizing waste heat.	●	◐	◐	◐	◕
Potential for Cost Reduction Different technologies are expected to see on-going cost reductions to a greater or lesser extent. For example, scale and technology development continues to drive rapid solar cost reductions, whereas wind is a more mature technology and costs are expected to decline less rapidly.	●	●	◐	◔	○
Potential to Support Local Economic Development Different forms of energy generation can bring local jobs, attract outside investment, and further the city's standing as a beacon of innovation. For example, local resources like distributed PV may foster a local base of knowledge and jobs associated with installation, operations, maintenance, and management, whereas centralized resources may not to the same extent.	●	◐	◐	◔	◔
Potential for Improved Environmental Performance, Beyond CO_2 Emissions Environmental impacts of energy generation can extend beyond emissions to health impacts, degradation in land use, erosion, soil, water, and wildlife.	●	◕	◕	◐	◔

Figure 4: Identifying the right mix of energy generation options requires weighing a variety of factors. In this qualitative comparison between different options, a completely black circle signifies "high" and a completely white circle signifies "low" qualitative ability to meet certain criteria.

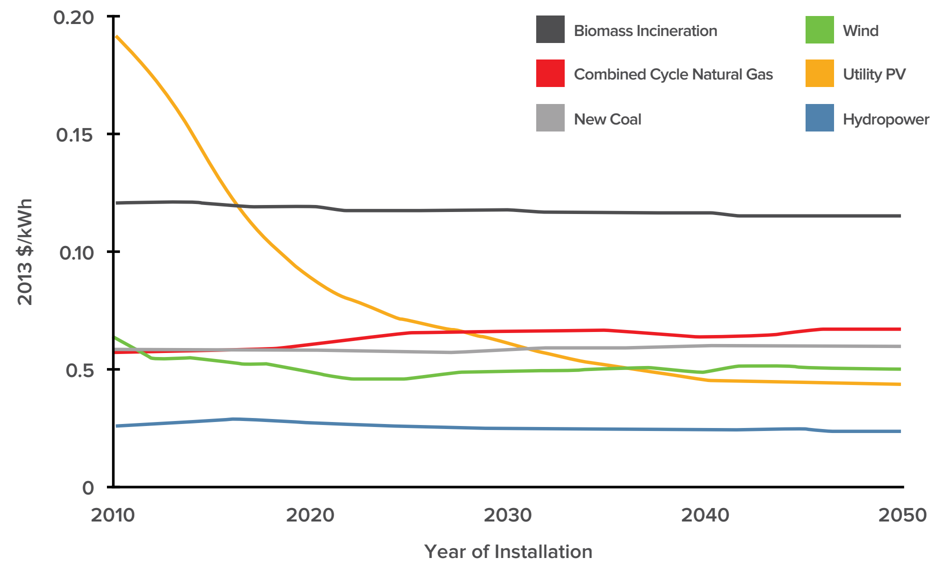
AFFORDABILITY

Fort Collins Utilities provides its customers with very low cost power—in 2012, the utility's residential customers paid average monthly bills that were lower than 46 of Colorado's 53 electric utilities and 40% lower than the national average. That sets a high bar for renewables to compete on cost. The good news is that renewables' fuel is free, their energy price is locked in for decades, and their capital costs are either already low or falling quickly. The following chart shows a levelized cost comparison between utility-scale resources, reflecting both current and forecasted costs.

In 2011, Rocky Mountain Institute forecasted that the levelized costs of utility-scale solar PV would decline 13% to 19 cents/kWh by 2015, yet actual installed projects in 2013 have already achieved and surpassed that forecast. In June, 2013, the City of Palo Alto signed a contract for 80 MW of utility-scale solar PV at a levelized cost of just 6.9 cents/kWh (including the Federal Investment Tax Credit).[19] Recent wind projects in the Mountain West report prices below 4.0 cents/kWh.[20]

Distributed solar PV has a similar story, with reported installed prices having fallen 6%–7% per year from 1998 to 2011.[21] Along with the advent of solar financing models that, for example, allow customers to put solar on their roof for zero dollars down, this has resulted in a rapidly accelerating distributed solar market. In Fort Collins, residential rooftop solar PV now costs approximately 12 cents/kWh for a homeowner-owned system, including federal, state, and local incentives. These costs are approaching Fort Collins'

WHOLESALE LEVELIZED COST OF ELECTRICITY (LCOE) COMPARISON



Source: Q1 2013 LCOE Ranges, Bloomberg New Energy Finance, 2013; Annual Energy Outlook 2011, Energy Information Administration, 2011; "Reinventing Fire: BOLD BUSINESS SOLUTIONS FOR THE NEW ENERGY ERA," Amory Lovins and Rocky Mountain Institute, White River Junction, Vermont: Chelsea Green, 2011.

Figure 5: Levelized Cost of Electricity (LCOE): The renewable costs shown exclude tax credits and similar subsidies. Centralized sources of renewable electricity offer attractive pricing in the near term. Utility PV becomes competitive with new coal around 2030 and joins the ranks of the most cost-effective sources of non-hydro renewable electricity over a longer time horizon. Distributed resources such as rooftop and community PV are not shown because they do not compete in the same space.

[19] WESOFF, ERIC. "PALO ALTO GOES SOLAR, 80 MEGAWATTS AT 6.9 CENTS PER KILOWATT-HOUR". GREENTECHMEDIA. HTTP://WWW.GREENTECHMEDIA.COM/ARTICLES/READ/PALO-ALTO-CA-GOES-SOLAR-CHEAPLY-80-MEGAWATTS-AT-6.9-CENTS-PER-KILOWATT-HO

[20] LBNL. 2012 WIND TECHNOLOGIES MARKET REPORT. AUGUST 2013. HTTP://NEWSCENTER.LBL.GOV/NEWS-RELEASES/2013/08/06/NEW-STUDY-FINDS-THAT-THE-PRICE-OF-WIND-ENERGY-IN-THE-UNITED-STATES-IS-NEAR-AN-ALL-TIME-LOW/

[21] WISER ET AL. TRACKING THE SUN VI. LBNL. JULY 2013.

average residential rate of 8.6 cents/kWh, with some systems already reporting lower costs and continued cost reductions likely in the next few years. More importantly, by developing a city-wide strategy to deploy solar PV at scale, even greater reductions in cost can be achieved, especially in so-called "soft costs" of solar systems including costs of finance, customer acquisition, permitting, inspection, and interconnection.

FLEXIBILITY

Beyond cost, any future electricity system scenario must also be able to provide power at least as reliably as Fort Collins' current system. Because electricity cannot be easily or cheaply stored, utilities must maintain a delicate balance of supply and demand at each moment to keep the lights on. This becomes more difficult with the addition of variable renewable resources that produce power when the sun shines or when the wind blows, not when the utility necessarily wants it. Therefore, a critical part of an electricity system transformation in Fort Collins is the addition of flexibility resources—devices or resources whose output can be adjusted to match variability produced by the combination of load and renewables.

Beyond Platte River's existing natural gas peaking plants and any new combined cycle natural gas capacity that could be developed, local sources of flexibility that may be available in Fort Collins include demand response (already available in Fort Collins in limited quantities), customer-sited thermal or electrical storage, and electric vehicles (EVs), as well as the grid intelligence needed to access those resources.

Demand response—the ability to modulate when energy is demanded, not just when it is supplied—has the potential to provide a significant source of flexibility to Fort Collins. Fort Collins Utilities' recent DOE-funded Renewable and Distributed Systems Integration (RDSI) project demonstrated the capability of a portfolio of demand- and supply-resources, including demand response, to reduce peak demands on a distribution circuit by 20%. Elsewhere in the country, demand response is now allowed to bid into wholesale markets, providing a significant portion of new capacity needs.

Aggressive adoption of electric vehicles as discussed in this report's transportation chapter could result in electrification of up to 30% of Fort Collins' light duty vehicle transportation fleet by 2030 (about 20,000 vehicles). If unmanaged, this sizable fleet could present challenges for the grid when large numbers of electric vehicle owners plug in their cars after work, rapidly driving up Fort Collins' peak demand and therefore costs. But actively managed, electric vehicles can be staged to manage peak impacts and potentially even provide services back to the grid.

Another critical lever in enabling a more optimized, localized electricity system is grid intelligence—smart grid technologies that enable two-way communication between the utility and customers, supporting real-time information and signals as well as more effective control and coordination of distributed resources. Smart meters and smart grid infrastructure form the foundation for more distributed grid operations and ultimately a more granular grid, enabling the kind of results Fort Collins has tested with its RDSI project and other on-going initiatives.

MOVING TOWARD IMPLEMENTATION

This analysis shows that eliminating carbon emissions from Fort Collins' electricity system by 2030 can be affordable, but that does not mean it will be easy. Very few communities in the country have set such ambitious goals, and successfully overcoming inherent challenges would put Fort Collins among an elite group of leaders.

Challenge 1: Success requires driving unprecedented levels of adoption of distributed resources, and customers have historically been largely uninvolved in the electricity system.

Eliminating fossil fuels from Fort Collins' electricity supply by 2030 is an ambitious goal, and meeting that goal largely with local resources makes it even more challenging. In the *accelerated* scenario modeled in this report, Fort Collins would need to achieve landmark levels of adoption of distributed resources, primarily solar. Rooftop solar adoption in Fort Collins has grown with the availability of solar leasing offers over the last several years but overall penetration remains low compared with leading states such as California.

Strategy: Implement new approaches to increase customers' motivation and enthusiasm; and provide relevant, timely, and compelling information.

Understanding what motivates people and how they make decisions can help ensure that policy-oriented measures to increase solar adoption are effectively implemented and conveyed to their intended beneficiaries. Fort Collins Utilities can facilitate greater adoption through more targeted marketing based on individual customers' solar potential, costs, applicable incentives, and broad dissemination of program information to customers. Further, an approach to "right-time" rooftop solar installations with re-roofing could be developed.

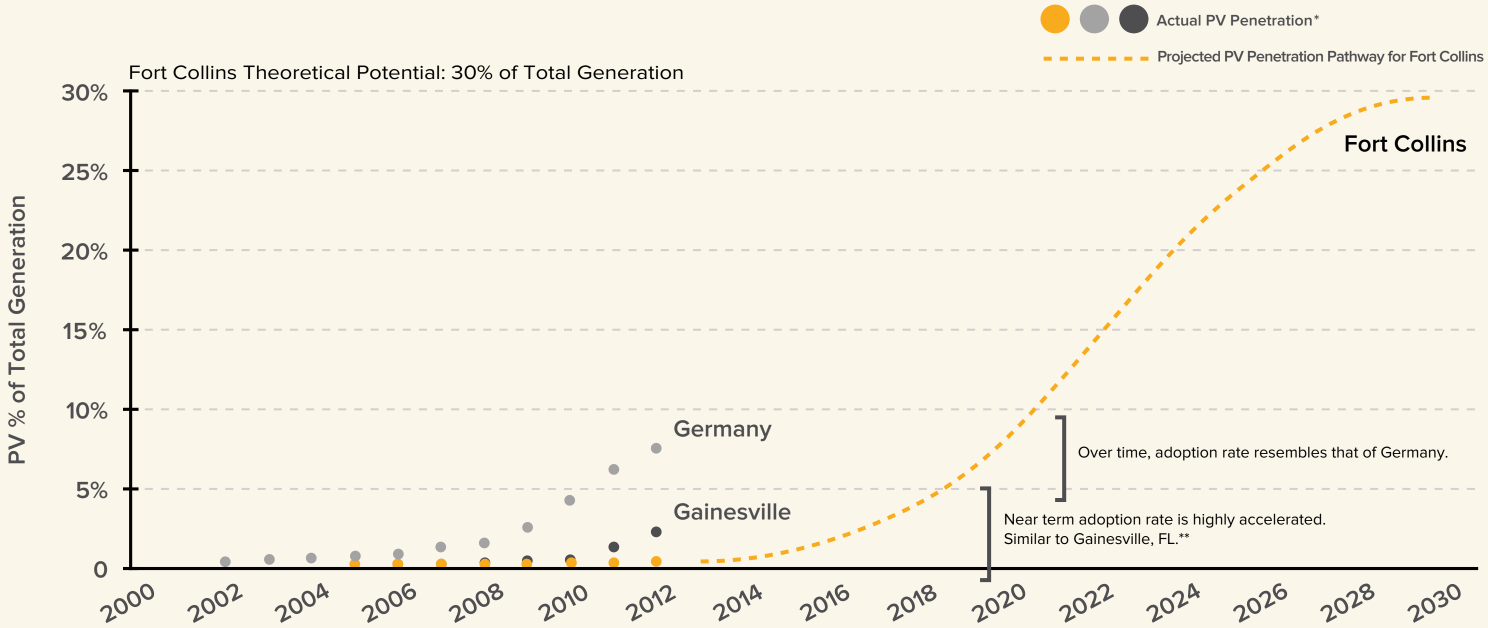
Solar is a uniquely visible resource whose adoption can be driven by peer effects more than other sources of renewable power. Carefully targeting highly visible installations across the city (possibly including an educational exhibit with information on the incentives that make such installations cost-effective) can serve as a good starting point to propagate early adoption.

DISTRIBUTED SOLAR PV ADOPTION IN FORT COLLINS

In the first few years of the accelerated scenario, Fort Collins' solar adoption would resemble that of Gainesville, Florida, a city with about the same population as Fort Collins that instituted a feed-in tariff incentive in 2008 to kick-start implementation. In later years up to 2030, Fort Collins' adoption would be equivalent to sustaining Germany's solar growth on a logistic S-curve that tails off at 30% of generation.

The Germany analog for PV adoption entails two conservatisms: first, Fort Collins needs 30% less installed capacity to generate each kilowatt hour of electricity because sunny Fort Collins enjoys more annual solar resource than cloudy Germany. This will allow Fort Collins to either exceed Germany's rate of adoption, or meet it with less capacity, or both. Secondly, locally applying a nationwide trend overlooks the ability of well-coordinated and well-positioned communities such as Fort Collins to achieve ***accelerated*** local rates of adoption.

FORT COLLINS ACCELERATED SOLAR ADOPTION PATHWAY



*Creti et al 2013, Bonnefoy 2009, Guldolin and Mortarino 2010: Distributed solar adoption is well-approximated by a logistic S-curve. Incentives and feed-in tariffs help catalyze acceleration and can impact the steepness parameter of the curve.
**FC curve reflects more moderate adoption than Gainesville, which is now considering sunsetting the program due to upward rate pressure from faster-than-expected adoption.

Source: Clean Coalition, accessed 2013, http://www.clean-coalition.org/unleashing-clean/success-stories/; Gainesville Sun, Feb 2013, http://www.gainesville.com/article/20130220/ARTICLES/130229936

Figure 6: Fort Collins' projected technically and economically feasible solar adoption rate in the accelerated scenario draws from two best-in-class examples, applying a logistic "S-curve" projection for how adoption would evolve.

Challenge 2: Distributed resources have high up front costs.

A renewable portfolio has higher capital costs but lower operating costs (since the fuel is free) compared to conventional resources. While the higher capital investment associated with the ***accelerated*** scenario pays back over a longer time horizon, it still presents a challenge for customers with respect to up-front financing.

Historically, solar PV's total installed cost was dominated by the technology—the photovoltaic module and inverter. But these hardware costs have dropped so much in recent years that the "balance of system" (BOS) costs—all cost components other than the inverter and module—now comprise the majority of total installed cost. BOS costs include installation labor; overhead costs, including office administration, property-related expenses, and insurance; customer acquisition costs, including marketing and advertisement; installation hardware such as racking and mounting brackets; and permitting, inspection, and interconnection costs.

Unlike PV modules that are a global commodity, BOS costs vary from community to community because of different approaches to permitting, installation, and other processes. Furthermore, given the nascent stage of most regional U.S. solar markets, many installers often operate at low efficiency, have poorly configured supply chains, or have great difficulty accessing financial solutions for their customers.

Strategy: Drive down distributed resources' costs and provide new solutions to financing issues.

The City needs to be innovative in employing a full array of financing mechanisms based on methods used in other communities, other industries, and the financial sector to ensure stable electricity prices during this transformation. Already moving in this direction, Fort Collins implemented an on-bill financing (OBF) program in January 2013, although it has thus far seen limited uptake.

Third-party financing has proven to be a market accelerant for residential and commercial building solar PV markets, nationally and in Fort Collins. A further market accelerant are Feed-in-Tariffs (FiTs), which have resulted in solar PV booms in several European countries as well as in a limited set of U.S. jurisdictions, since they provide clear price signals to customers and lower financing costs due to long-term, predictable credit dynamics.[22]

Affordability and accessibility are two key criteria for successful financing programs. One solution that enhances both attributes is on-bill repayment (OBR), which, unlike OBF, enables equity ownership of systems by third-parties, with the accessibility benefit of a single power bill, not available in typical third-party solar PV leases and power purchase agreements. Solar PV financing is highly dependent on the monetization of its considerable tax benefits, thus generally relying on for-profit, third-party (tax equity) investors to enable the lowest customer

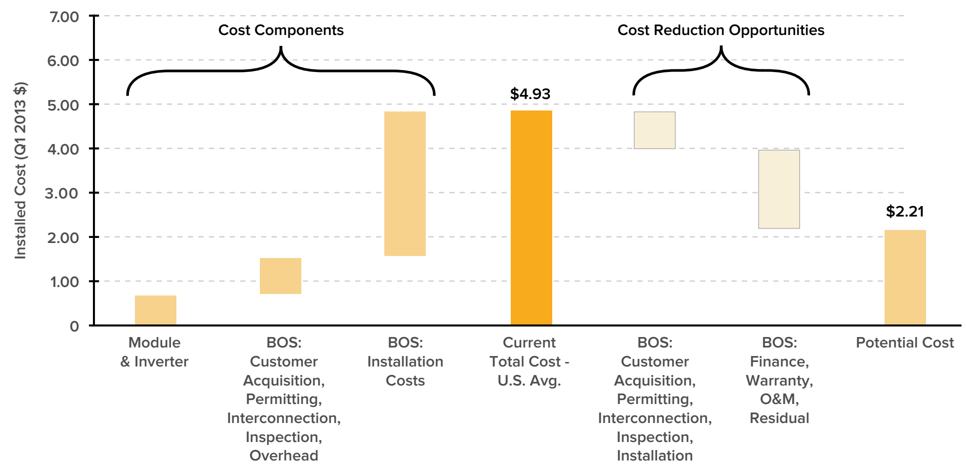
[22] "THE TRANSFORMATION OF SOUTHERN CALIFORNIA'S RESIDENTIAL PHOTOVOLTAICS MARKET THROUGH THIRD-PARTY OWNERSHIP," EASAN DRURY ET AL, ENERGY POLICY, 2012. HTTP://CLEANTECHNICA.COM/2011/11/22/GAINESVILLE-FLORIDA-BIGGER-PER-CAPITA-SOLAR-PRODUCER-THAT-CALIFORNIA/ (ACCESSED 8/22/2013)

pricing. When OBR for solar includes limited loss reserve protection by the utility, cost of capital is lowered and thus affordability further improved. OBR, particularly with a utility loss reserve, lays a foundation for deeper relationships with the utility, which can become more valuable over time.
A further accessibility benefit of OBR can be achieved by layering on virtual net metering (community solar or otherwise) opportunities and credit against-the-meter. Both virtual net metering and against-the-meter credit determinations enhance accessibility to renters and building owners with poor solar or other distributed resource access.
Better financing solutions should allow Fort Collins Utilities to phase back incentives over time, and focus budgeting decisions on stabilizing utility economics. Budgeting determinations for the utility are best served by offering volumetric capped FiT offerings, but with enough forward-market certainty to avoid boom-bust cycles for the local distributed resource supplier and investor base.
Beyond financing, Fort Collins can directly and substantially influence solar balance of system (BOS) costs, with the potential to reduce them enough to bring the levelized cost of rooftop solar PV in line with residential rates. Germany has set a precedent for capitalizing on this type of opportunity. There, soft costs—customer acquisition, installation labor, and permitting, interconnection, and inspection—are 73% lower than in the U.S.

Achieving significant BOS cost reductions in the U.S. requires first adopting best practice recommendations from the Solar America Board for Codes and Standards' *Expedited Permit Process for PV Systems and Emerging Approaches to Efficient Rooftop Solar Permitting*[23] and IREC's *Sharing Success: Emerging Approaches to Efficient Rooftop Solar Permitting.*[24] Best practices include over-the-counter, same-day permit review; clear, accessible webpages focused on the permitting process; exempting small systems from requiring building permit review; and providing consistent and current training for inspectors. Further, Fort Collins could develop a "cookie cutter" solar design, combine building department permitting with the utility interconnection process, and leverage the City to aggregate demand and resulting purchasing power up the hardware supply chain.

[23] SEE HTTP://WWW.SOLARABCS.ORG/ FOR MORE INFORMATION.
[24] SEE HTTP://WWW.IRECUSA.ORG/WP-CONTENT/UPLOADS/SHARING-SUCCESS-FINAL-VERSION.PDF FOR MORE INFORMATION.

OPPORTUNITIES FOR REDUCING THE COST OF ROOF-MOUNTED SOLAR PV



Source: Bloomberg New Energy Finance. July 2013 Solar Spot Price Index. August 2013; GTM/SEIA Q1 2013 Solar Market Insight; Friedman et al.; Second Annual Benchmarking Non-Hardware Balance-of-System (Soft) Costs for U.S. Photovoltaic Systems, Using a Bottom-Up Approach and Installer Survey. NREL. Pre-Release. July 2013; Seel et al. "Why Are Residential PV Prices in Germany So Much Lower Than in the United States?" LBNL. February 2013.

Figure 7: Installed prices for sub 10 kilowatt rooftop PV systems are being installed in the $2.21/Wdc range in Germany as of the first quarter of 2013. Over 90% of the cost difference between the U.S. and Germany is attributable to differences in "soft costs" as depicted above. Achieving such low costs is possible in the U.S., as evidenced by the Department of Energy's currently funded competition that awards companies able to install 5,000 new rooftop solar systems for an average price of $2.00/W or less.

These approaches have been successfully implemented elsewhere in the U.S. and are proven to reduce costs: Massachusetts successfully implemented a bulk purchasing "solarize" program in several communities that lowered installed costs from the state average by over 25%.[25] The City of Denver, together with other partners, recently offered its employees a group-discounted rate for solar PV installation of $3.80/W,[26] a remarkably low rate secured through a scaled group purchase. Fort Collins, too, has revised its processes, earning gold level recognition from the Solar Friendly Communities initiative; the City now has an opportunity to move towards platinum recognition.

Finally, a proven method for reducing BOS costs is to optimize the number of days spent installing a system, since every reduction in installation cost has a corresponding reduction in overhead costs.[27] To meet this goal, specific strategies and tactics need to be developed, such as employing a revamped PV system inspection protocol allowing for self-certification of PV installs by certified solar installers.

These BOS cost reductions in combination with on-going module and inverter price reductions can propel Fort Collins toward the U.S. Department of Energy's SunShot target of a total installed cost of $1.50/W by 2020,[28] which would allow Solar PV to be installed well under the cost of grid electricity in Fort Collins without local subsidy.

Challenge 3: Distributed resources have different benefits and costs compared to centralized resources, and the system is not set up to measure or monetize those values.

Distributed resources have unique siting, operational, and ownership characteristics compared to conventional centralized resources. The value of distributed resources is temporally, operationally, and geographically specific and because of that, existing pricing mechanisms are not in place to recognize or reward service that is being provided by either the utility or the customer.

It is critical to better understand the services that distributed resources can provide, and the benefits and costs of those services as a foundation for more accurate pricing and market signals. The categories of benefit and cost are broadly agreed on, but some are not readily quantifiable or are not generally monetized in electric rates. For example, distributed solar coupled with storage could potentially provide voltage regulation services to the grid, but the value of that service does not accrue to the customer who made the investment.

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[25] PRESENTATION BY YOUNGBLOOD, ELIZABETH. "THE SOLARIZE MASSACHUSETTS PROGRAM". MASSACHUSETTS CLEAN ENERGY CENTER, 2013.

[26] SEE HTTP://WWW.SUSTAINABLEBUSINESS.COM/INDEX.CFM/GO/NEWS.FEATURE/ID/1920 FOR MORE INFORMATION.

[27] RMI'S SIMPLE BOS PROJECT IS WORKING TO CHARACTERIZE THE BOS COST DIVIDE BETWEEN GERMANY AND THE U.S. THROUGH A LEAN PROCESS APPROACH, ON-SITE TIME-AND-MOTION STUDIES, INDUSTRY INTERVIEWS, AND SURVEY-BASED DATA COLLECTION. THE PROJECT HAS FOUND LEADING INSTALLERS ARE ALREADY VERY CLOSELY APPROACHING GERMANY-CALIBER BOS COST LEVELS.

[28] U.S. DEPARTMENT OF ENERGY. SUNSHOT VISION STUDY. FEBRUARY 2012. HTTP://WWW1.EERE.ENERGY.GOV/SOLAR/PDFS/47927.PDF

Strategy: Assess distributed resources' benefits and costs, and develop appropriate mechanisms to value them.

Fort Collins can ensure accurate accounting for the additional values distributed energy resources provide—including environmental benefits, avoided generation capacity, avoided transmission and distribution capacity, avoided line losses, and fuel price hedging—by first conducting a study to assess the magnitude of these values on the Fort Collins system, then by adapting pricing and incentive mechanisms accordingly. An example of how these values are being recognized elsewhere is Austin Energy's Value of Solar Tariff (VOST).[29] In Austin Energy's case, fully-valued distributed solar PV is actually worth more than its retail price, creating an appealing value proposition for the utility and, in turn, for the community. Of course, the total value that distributed solar PV would provide to Fort Collins varies from this example, based on factors such as the quality of the solar resource and the future need for electricity capacity. Fort Collins has a foundation from

[29] RABAGO, K., NORRIS, B., HOFF, T., DESIGNING AUSTIN ENERGY'S SOLAR TARIFF USING A DISTRIBUTED PV CALCULATOR. CLEAN POWER RESEARCH & AUSTIN ENERGY, 2012.

PROPERLY VALUING DISTRIBUTED SOLAR

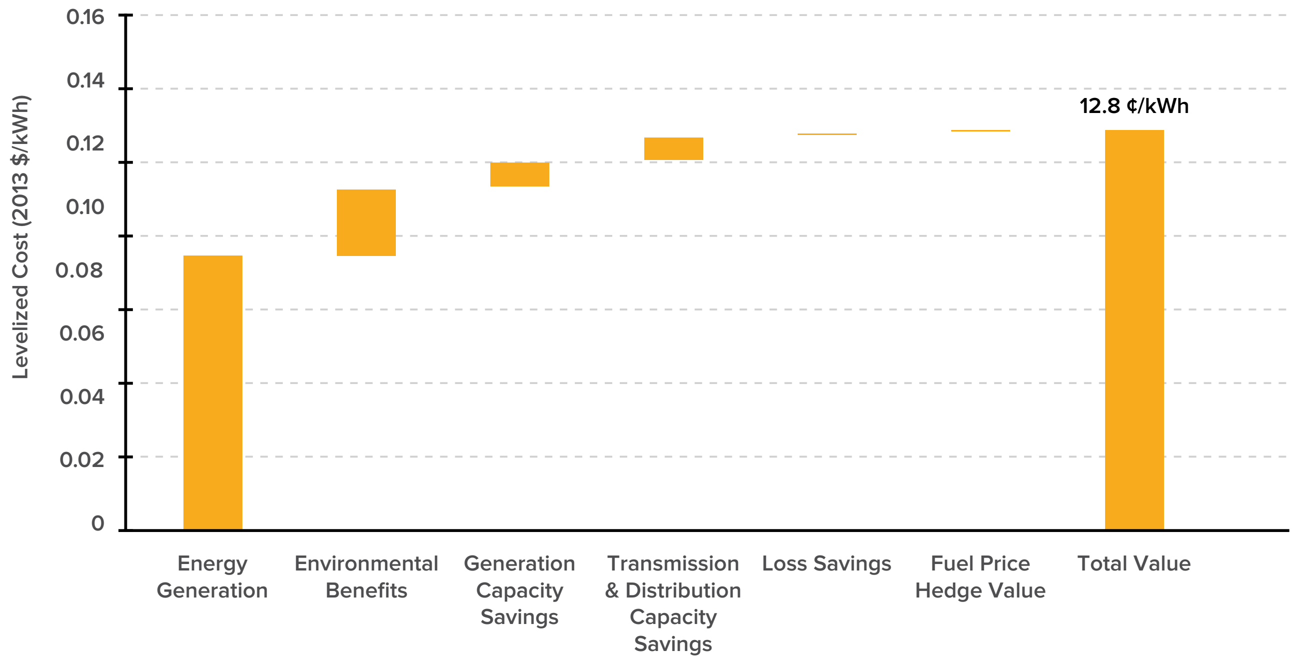

Figure 8: Austin's Value of Solar Tariff provides a tangible—if incomplete—proxy for distributed solar PV valuation.

Source: Rabago, K., Norris, B., Hoff, T., Designing Austin Energy's Solar Tariff Using A Distributed PV Calculator. Clean Power Research & Austin Energy, 2012.

which to build such an approach—Platte River now purchases energy from Fort Collins' solar power purchase program based on specific valuation factors.

Challenge 4: Operating a more distributed, diverse system requires integrating new sources of flexibility and developing new coordination and communications approaches.

Unlike almost any other consumer product, electricity has no shelf life—it cannot be easily or cheaply stockpiled or stored. Electricity demand and supply must be perpetually balanced, and when that balance is disrupted, brownouts and blackouts result. Introducing renewables such as wind and solar makes maintaining that balance more challenging because unlike coal, natural gas, or hydro plants, output from wind and solar varies with the weather. Further, the electricity system vision presented here is much more dispersed—25% of generation is from distributed sources by 2030. This provides advantages, but only if the mechanisms for deploying and managing these variable and distributed resources are in place alongside the hardware to generate them.

The need for flexibility will require use of available natural gas generation, incorporation of a broad array of storage resources (like demand response, electric vehicles, thermal storage, and potentially even battery storage), and real-time grid monitoring and dispatch that is much more responsive.

Strategy: Support the integration of flexibility resources including smart grid, demand response, and electric vehicles; and begin to implement advanced coordination and communications strategies.

In part because of a decades-old decision to underground Fort Collins' electricity distribution lines, Fort Collins has just one third the system interruptions compared to the national average. Effectively and reliably operating Fort Collins' electric system with very high levels of renewables requires innovative new approaches, including full utilization of the utility's smart grid capabilities, expanding demand response potential, and integrating electric vehicles with smart charging capabilities. Fort Collins already has efforts underway in a number of these areas, is home to several leading smart grid technology companies, and has completed one successful demonstration project (the RDSI project). The City should leverage these strengths to remain at the leading edge of flexibility resource adoption and integration.

The key to maintaining reliability is developing a portfolio of resources that work together seamlessly. There are several reasons why Fort Collins is well positioned to manage this issue smoothly and maintain reliability. Fort Collins does not have to balance its system alone; it is part of a larger balancing area operated by Xcel Energy, providing significant operational benefits and ancillary services, and easing the integration of renewables. Platte River is also considering new strategies for providing flexibility in the form of load following to support higher integration of variable renewable resources.

Further, Fort Collins Utilities' on-going smart grid rollout will provide more granular, timely data about electricity usage and eventually enable the utility to send signals to customers to provide additional grid flexibility. Finally, there is active support and engagement around demand response and electric vehicles, each of which can provide grid flexibility. Fort Collins Utilities is procuring a new state of the industry demand response system as part of the Advanced Meter Fort Collins projects and continues to participate in research and development following up on the RDSI project. The Electrification Coalition recently launched an initiative to support widespread adoption of electric vehicles.

Challenge 5: Fort Collins Utilities' has a contractual relationship with Platte River that disallows purchases from other entities.

Except for a very small quantity of distributed generation from rooftop solar, all city electricity currently originates from large, centralized sources operated by Platte River and Western Area Power Administration. Fort Collins is currently under contract with Platte River for all its electricity requirements, although under its feed-in tariff (FIT) program, Fort Collins Utilities will purchase local solar output as an agent of Platte River.

Platte River, in turn, is committed to coal power from the Yampa Project and Rawhide Plant 1, which are set to retire in 2030 and 2050, respectively. As Fort Collins implements its accelerated strategy for carbon neutral electricity, it will demand significantly less coal-based electricity from Platte River. Identifying and preemptively addressing any potential impacts on the Fort Collins/Platte River partnership will be key to ensuring a seamless and mutually beneficial clean energy transition for both organizations.

Strategy: Enhance collaborations with Platte River to develop effective strategies that enable more renewables.

While much of this chapter has focused on distributed resources like rooftop solar, community solar, and energy efficiency due to their unique benefits and implementation challenges, centralized renewables—particularly wind and utility scale solar—will be a similarly critical resource in Fort Collins' energy future. The wind resource that Fort Collins Utility has access to via Platte River is extremely cost-competitive and available in the near-term. Fort Collins should continue to collaborate with Platte River to develop strategies to bring more centralized wind into the mix as quickly as possible. Fort Collins' carbon neutral electricity system by 2030 strategy calls for nearly half of generation from wind, ramping from 7 MW of capacity today (Fort Collins' effective share of Platte River's capacity) to more than 230 MW in 2030.

SUMMARY

With concerted effort, Fort Collins can have a carbon neutral electricity system by 2030. Realizing this vision would require $240 million present value added investment, but by 2050 would save $380 million present value, and would energize local economic development and innovation. It would reduce Fort Collins' carbon emissions 10 million metric tons from *business as usual* by 2030, and would build off of Fort Collins' already notable electric reliability to create a truly resilient electric system that will sustain the community into the future.

Further, a transformed electricity system would enable the transition to cleaner and more secure energy options in other sectors of the energy economy, notably transportation. The City, Fort Collins Utilities, and the community all play crucial roles in enabling this transition by aligning pricing and incentive structures with the community's goals and by employing new, creative approaches to accelerating adoption of customer-sited resources.

ADVANCED TRANSPORTATION

05

Image courtasy of Shutterstock

ADVANCED TRANSPORTATION

BY 2030, FORT COLLINS COULD REDUCE GASOLINE AND DIESEL CONSUMPTION BY 48% FROM BUSINESS-AS-USUAL, SAVING $480 MILLION IN FUEL COSTS AND AVOIDED VEHICLE MAINTENANCE.

The Fort Collins community consumes 58 million gallons of gasoline and diesel each year driving to work and school, delivering products and services, running errands, or just recreating and getting away. Driving enables business and life to run smoothly, but today's transportation paradigm comes with costs.

Transportation accounts for 36% of Fort Collins' total energy consumption, running mostly on gasoline and diesel fuels. Almost all of Fort Collins' oil use is used for transportation. The consumption of these fuels has wide-ranging impacts on the local environment—it's a major contributor to local criteria air pollutants like NO_X, SO_2, and particulate matter, and on fuel costs to the community. Because liquid fuels like gasoline and diesel are more expensive than other primary energy sources, they account for over half of Fort Collins' energy expenditures. Transportation energy accounts for 24% of Fort Collins' total contribution to global CO_2 emissions, thereby also playing a role in Fort Collins' contribution to broader global climate issues, including political and security risks from importing oil.

The good news is that aggressive new national fuel economy standards and, to a lesser extent, modest increases in electric vehicle adoption will help to curb Fort Collins' future transportation energy demands, even with projected population increases.[30] Together, these two developments help to reduce transportation energy use by 22% from today, and comprise the business-as-usual trajectory analyzed in this report.

This analysis suggests, however, that there is a potential to reduce Fort Collins' transportation energy use even further—to about half that of *business as usual*—while also providing greater transport options, ease, and convenience to the community. As described in Fort Collins' 2011 Transportation Master Plan,[31] the City is already pursuing a number of interventions to capture these benefits. Building on this strong foundation, Fort Collins can utilize two broad policy and planning levers. First, it can reduce the need to drive in the first place by implementing strategies like improved urban planning and access to pedestrian, bicycle, and public transport options. Doing so has the potential to reduce transportation energy consumption by 30% from *business as usual*. In tandem, Fort Collins could work to dramatically increase adoption levels of more efficient and electric vehicles so that when people do drive, they use less oil. This strategy could further lower energy consumption by 18% from *business as usual*. Between 2013 and 2030, investments in both strategies would amount to a net savings of $480 million in fuel costs and avoided vehicle maintenance for the community.
The benefits of pursuing Fort Collins' full potential for transportation energy savings extend beyond costs savings. With enhanced urban planning and smart growth, people can get places faster and more conveniently. Less driving means less congestion, and consequently, improved local air quality. Continuing the work the City has already

[30] AGGRESSIVE NEW NATIONAL FUEL ECONOMY STANDARDS SET IN 2012 REQUIRE 54 MPG AVERAGE GAS MILEAGE FOR NEW VEHICLES BY 2025. IN ORDER TO MEET THESE TARGETS, ALL CARS AND TRUCKS WILL BECOME MORE AERODYNAMIC, LIGHTER, AND HAVE IMPROVED ENGINE TECHNOLOGY.

[31] "FORT COLLINS TRANSPORTATION MASTER PLAN," CITY OF FORT COLLINS, 2/15/11. HTTP://WWW.FCGOV.COM/PLANFORTCOLLINS/PDF/TMP.PDF

started will also continue to build on one of the community's greatest strengths—being a bikable, walkable city. Finally, as was discussed in the electricity chapter, increased electric vehicle adoption can support the integration of renewable electricity resources by providing demand response.

UNDERSTANDING THE FULL POTENTIAL

By adapting national estimates for transportation energy reduction potentials to Fort Collins, we can get a sense for "how far" and "how fast" Fort Collins can accelerate its own transportation energy reductions. The analysis presented here focuses largely on personal vehicles, which account for the lion's share—97%—of Fort Collins' total transportation energy use. Figure 1, below, summarizes our findings.

FORT COLLINS TRANSPORTATION ENERGY REDUCTION POTENTIAL

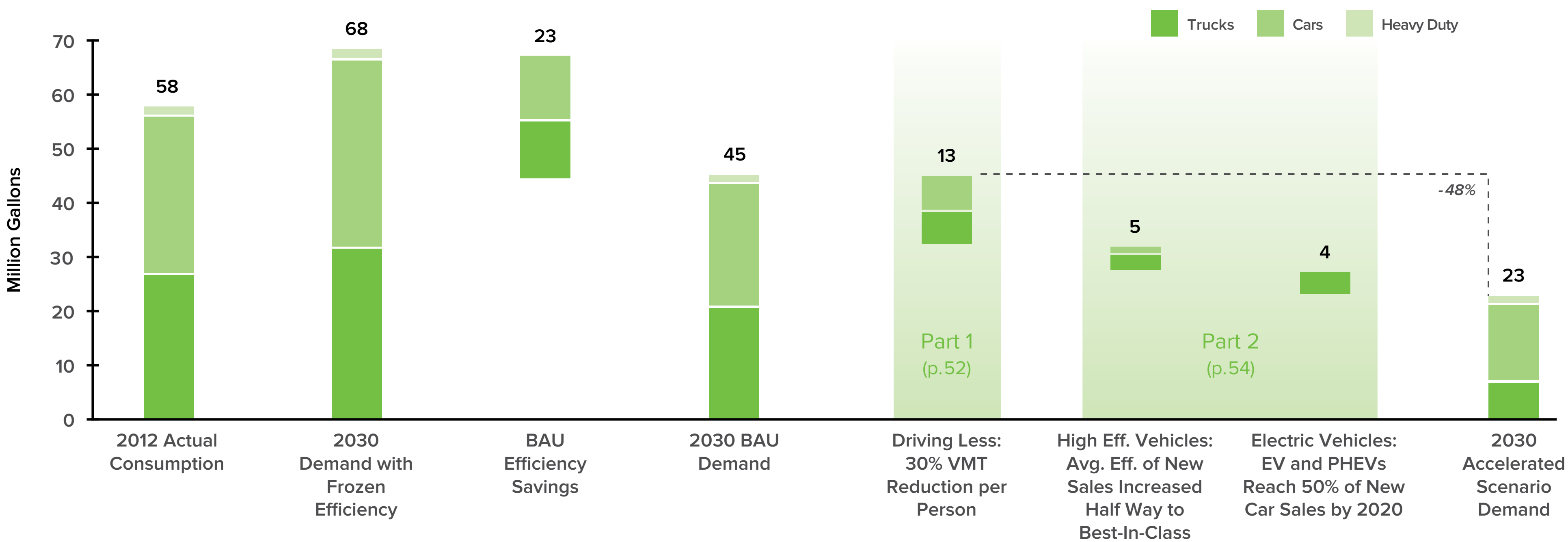

Figure 1: This transportation energy reduction potential estimate for Fort Collins is based on a detailed, national-level analysis conducted by Rocky Mountain Institute for Reinventing Fire.

Part 1: Strategies that make it easier for Fort Collins to drive less can save an estimated 30% of energy from business-as-usual by 2030.

On average, Fort Collins' residents drive 7,500 miles per person each year, about 30% less than the national average.[32] This is a testament to Fort Collins' large university population (that tends to drive less) and to the great success Fort Collins has to date in developing a vibrant, multiuse core with pedestrian and bicycle friendly infrastructure. Considering Fort Collins' size, projected growth, and ongoing transportation initiatives, we estimate annual vehicle miles traveled (VMT) per person could be reduced 25%-40% from *business as usual* by further:

- increasing smart growth,
- improving multimodal and alternative commuting options,
- creating and evolving intelligent transportation systems, and
- implementing pricing signals and strategies.

These tactics are not intended to infringe on the community's prerogative to drive. Rather, they aim to reduce the need in the first place by improving access to destinations and goods, and by providing other benefits that result in fewer, more timely, and shorter trips. On average, driving 30% less would save Fort Collins' residents about $1500 per year per person in avoided fuel and maintenance costs alone.[33]

a. *Smart Growth*

Smart growth is an approach to urban and transportation planning that emphasizes increased urban density, mixed use development with commercial, residential, and recreational destinations in close proximity, and interconnected, walkable and bikeable streets. People drive less when the things they need are closer and more easily accessible. A 2007 Urban Land Institute study concludes that this type of high-density, multi-use space could lead inhabitants to drive 20%-40% less.[34]

Fort Collins' City Plan is predicated on smart growth and development. The City has consistently incorporated smart growth criteria into its development decisions; impacting codes, zoning, and transportation master planning. But certainly not all growth in Fort Collins follows smart growth tenets, so there remains significant opportunity to expand smart growth. Because Fort Collins' near term projected population growth rate is 1.9% per year (almost three times the national average), there is likely to be more new growth than in some other places, and smart growth is easier to implement at first development rather than in retrofit. Therefore, further emphasizing smart growth could represent an important opportunity for future reductions in transportation energy use.

[32] SOURCE: ORNL TRANSPORTATION ENERGY DATABOOK, EDITION 31

[33] TRANSPORTATION IS THE SECOND BIGGEST EXPENDITURE FOR THE AVERAGE AMERICAN (MORE THAN FOOD, HEALTHCARE, OR ENTERTAINMENT). ONLY HOUSING ACCOUNTS FOR A LARGER SHARE OF PER CAPITA EXPENSES. OAK RIDGE NATIONAL LABORATORY TRANSPORTATION ENERGY DATABOOK, TABLE 8.3

[34] "GROWING COOLER: THE EVIDENCE ON URBAN DEVELOPMENT AND CLIMATE CHANGE," REID EWING ET AL, URBAN LAND INSTITUTE, 2007. HTTP://WWW.MWCOG.ORG/UPLOADS/COMMITTEE-DOCUMENTS/U1ZBXLK20070921140031.PDF

b. *Alternative and Multimodal Commuting*

Smart growth brings destinations closer and makes walking or taking public transportation easier. This, in turn, makes it more feasible and appealing for residents to switch from single passenger vehicles to alternative commuting (e.g. bicycling, walking, public transit carpooling, etc.) or to multimodal commuting (using several alternative modes to get to a single destination).

Fort Collins' current progress towards alternative and multimodal commuting is encouraging. The community is already a demonstrated leader in bike ridership (6.8% ridership compared with the 2009 national average of 0.6%).[35, 36] Public transit use has also increased rapidly, and now exceeds two million riders per year. The City is currently building the first of several planned Enhanced Travel Corridors to create multimodal transit links with one of Colorado's first Bus Rapid Transit systems. Continuing to improve and invest in these options is an essential complement to the other levers for driving less.

c. *Intelligent Transportation Systems*

As personal mobile devices like smartphones become more commonplace and costs for gathering and synthesizing transportation data become cheaper, cities can integrate real-time information from the transportation system into streamlined and convenient user interfaces. Doing so would enable commuters to easily access schedule and traffic updates for all transportation modes including cars, taxis, bicycles, public transit, and car sharing. Driving less then becomes easier, as the ability to find and confirm alternate modes of transportation becomes more reliable and trips can be planned "on the go."

Some cities (like New York City) are capitalizing on this opportunity by investing and developing intelligent transportation software themselves; others (like Chicago) are making transportation data available for third-party app designers to develop useful and marketable products.[37] Fort Collins will be developing the next version of its FC Trip trip-planning website functionality for handheld or tablet applications, enabling people to more easily access travel information.[38]

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[35] "FORT COLLINS' TREK TO BICYCLE NIRVANA DEPENDS ON MORE RIDERS, FEWER ACCIDENTS: ELITE DESIGNATION IS NEXT GOAL FOR CITY THAT JUST ACHIEVED 'PLATINUM' AWARD," DAVID YOUNG, COLORADOAN.COM, 6/13/13. HTTP://WWW.COLORADOAN.COM/ARTICLE/20130613/NEWS01/306130074/FORT-COLLINS-TREK-BICYCLE-NIRVANA-DEPENDS-MORE-RIDERS-FEWER-ACCIDENTS

[36] "ANALYSIS OF BICYCLING TRENDS IN LARGE NORTH AMERICAN CITIES: LESSONS FOR NEW YORK," JOHN PUCHER AND RALPH BUEHLER, UNIVERSITY TRANSPORTATION RESEARCH CENTER, 2011. HTTP://WWW.UTRC2.ORG/SITES/DEFAULT/FILES/PUBS/ANALYSIS-BIKE-FINAL_0.PDF.

[37] "BY THE NUMBERS: CITIES ARE FINDING USEFUL WAYS OF HANDLING A TORRENT OF DATA," THE ECONOMIST, 4/27/13. HTTP://WWW.ECONOMIST.COM/NEWS/UNITED-STATES/21576694-CITIES-ARE-FINDING-USEFUL-WAYS-HANDLING-TORRENT-DATA-NUMBERS

[38] EMAIL CORRESPONDENCE WITH MARK JACKSON, DEPUTY DIRECTOR OF FORT COLLIN'S PLANNING, DEVELOPMENT AND TRANSPORTATION, 8/22/2013.

d. *Pricing Signals*

As multimodal transport options become more plentiful and convenient, price signals can help the City manage variegated traffic flows from personal vehicles, public transport, cyclists, and pedestrians, especially in congested areas and those with persistent parking issues. Fees for parking and congestion, implemented at rush hour and in the busiest areas, will encourage drivers to look for alternatives. The City's current Parking Plan (adopted in January 2013) identifies prominent existing parking shortages in downtown and other heavy traffic areas, as well as future parking issues in other locations. The Parking Plan includes future options to incorporate fees for parking.[39]

Replacing free parking with paid parking is often controversial, but there are some significant benefits to commuters and business owners. Because pricing discourages some commuters from driving, paid parking reduces idling and circling, which accounts for up to a third of downtown traffic and congestion in some cities.[40] Paid parking has also been shown to relieve parking constraints in retail areas, making it easier for people who do need to drive to access shops, increasing business. For example, enforcing pricing on streets like College Avenue distributes parking to less busy side streets and parking garages, while also increasing customer turnover.[41] "Free" parking comes with high hidden costs that are passed through to the public, business owners, and others for associated land and construction fees. These range between $500 and $800 per year per space, or an estimated $10,000–$20,000 total for Fort Collins.[42]

Part 2: An additional 18% of energy could be saved from business-as-usual by accelerating adoption of fuel-efficient autos and electric vehicles.

Programs to maximize the adoption of fuel efficient autos and electric vehicles can ensure that when people do drive, they're consuming less oil—or better yet, substituting oil with cleaner energy sources like renewable-powered electricity.

Because there is a common perception that hybrid and electric vehicles are more expensive than conventional cars, general consensus is that more time needs to pass before these cars become affordable. But with rapid advances over the last few years, this perception no longer holds true. Sticker prices for high efficiency vehicles, hybrids, and electric vehicles (with incentives) are already competitive today with typical mid-sized vehicles sold in the U.S. After factoring in fuel cost savings, high-efficiency, hybrid, and electric vehicles can all be cheaper to own today than conventional vehicles.

Planning a transportation future that minimizes emissions and other environmental impacts also requires an understanding of vehicle options in terms of potential for:

- Further near-term reductions in cost of ownership
- Environmental impact mitigation
- Long range, which has been a highly visible limiting factor for the adoption of battery electric vehicles (BEVs)

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[39] "PARKING PLAN FORT COLLINS: NEIGHBORHOODS," CITY OF FORT COLLINS, 1/15/13. HTTP://WWW.FCGOV.COM/ADVANCEPLANNING/PARKINGPLAN.PHP

[40] "CRUISING FOR PARKING," DONALD SHOUP, ACCESS, NO. 30, 2007. HTTP://SHOUP.BOL.UCLA.EDU/CRUISINGFORPARKINGACCESS.PDF

[41] "PARKING PLAN FORT COLLINS: DOWNTOWN AND SURROUNDING NEIGHBORHOODS," PP. I-1–I-3.

[42] "TRANSPORTATION COST AND BENEFIT ANALYSIS II — PARKING COSTS," VICTORIA TRANSPORT POLICY INSTITUTE, 2/22/12. HTTP://WWW.VTPI.ORG/TCA/TCA0504.PDF. SEE ALSO: "THE HIGH COST OF FREE PARKING," DONALD SHOUP, JOURNAL OF EDUCATION AND RESEARCH, VOL. 17, NO. 1, FALL 1997, PP. 3–20, AND "THE HIGH COST OF FREE PARKING," DONALD SHOUP, CHICAGO: PLANNERS PRESS, 2011.

Table 1 lists and describes the vehicle types assessed in this report, along with a qualitative summary of important considerations for each. Figure 2 compares the current cost of ownership for these vehicles, which includes an analysis of purchase price plus three years of fuel expenses.

VEHICLE DESCRIPTION	CONSIDERATIONS
High efficiency vehicles like the Nissan Versa Powered by conventional internal combustion engines burning gasoline or diesel, but with improved mileage due to better aerodynamics, lower weight, and improved engine technology.	• Do not cost more upfront than conventional vehicles in most cases • Use significantly less fuel (up to 30%–75% less than conventional vehicles) — resulting in significant cost savings and CO_2 emissions reductions
Hybrid vehicles like the Toyota Prius Rely solely on gasoline or diesel for energy supply but use a combined combustion and electric motor to improve overall efficiency and reuse otherwise wasted braking energy.	• Can offer further efficiency gains beyond non-hybrid high-efficiency vehicles • Cost-effective and technologically mature today
Battery Electric Vehicles (BEVs) like the Nissan LEAF Run solely on electricity, offering two to three times higher efficiency than gasoline or diesel vehicles.	• Including incentives, have an equivalent or lower total cost of ownership than other options today. Even without incentives, the LEAF is cost-competitive today against an average midsize car. • Sticker price will likely continue to fall as batteries get cheaper and automakers gain increased technological experience. • Do not emit local CO_2 or other emissions while operating, and will be responsible for little or no emissions as the grid is increasingly powered by renewables. • Currently limited by battery range (e.g. 115 miles for the LEAF), a significant constraint in current adoption rates. • Could benefit from investments in public charging stations, but commonly available 120 and 240V outlets are sufficient for most early applications.
Plug-in Hybrid Electric Vehicles (PHEVs) like the Chevy Volt Operate as electric vehicles, but with a smaller gasoline generator that continues to power the vehicle once the battery surpasses its range.	• Purchase price for these vehicles can be cost-prohibitive without incentives, but prices are expected to fall dramatically in coming years as batteries get cheaper and automakers gain technology experience. Considering state and federal incentives, these vehicles can be cost-competitive. • Avoid the range constraint of BEVs. • Offer the same emission benefits as BEVs when operating in electric-only mode.
Compressed natural gas vehicles (CNG) like the Honda Civic Natural Gas Vehicle Natural gas is stored in a pressurized tank and combusted to fuel the vehicle instead of gasoline or diesel.	• Have become cheaper to operate as a result of recent low gas prices, but purchase price and first costs for home refueling stations are still prohibitive. • Can be more cost-effective for centralized fleets—e.g. taxis—that share refueling stations and accumulate higher annual mileages. • Responsible for approximately 30% lower CO_2 emissions than conventional gasoline-fired vehicles, as a result of natural gas' comparatively more benign emissions profile, on a per unit energy basis.
Hydrogen fueled vehicles (not yet commercially available for light duty personal vehicles) Hydrogen is used to fuel the vehicle, either by fuel cell or by combustion engine.	• Only offered by a few manufacturers today, as test vehicles in limited numbers • Cost two to five times more than a conventional vehicle. • Also requires a potentially large investment for hydrogen distribution and refueling infrastructure.

Table 1: Vehicle Options

TOTAL COST OF OWNERSHIP FOR VARIOUS VEHICLE TYPES

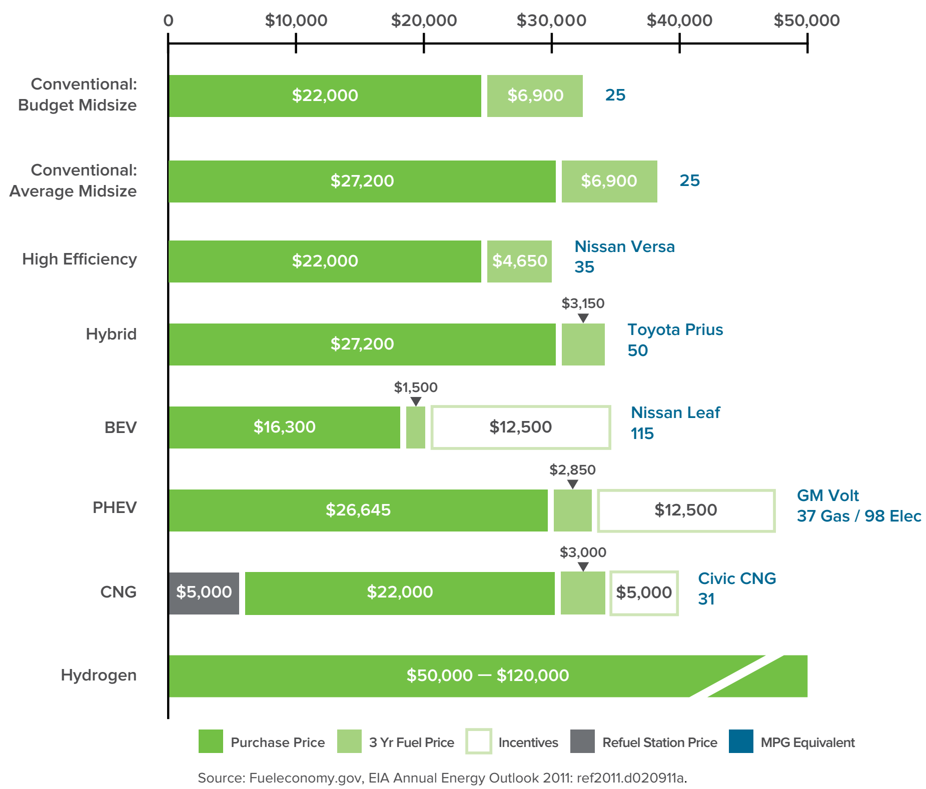


Figure 2: Total cost of ownership for various vehicle options ($), includes purchase and three years of fuel. Includes state and federal incentives and assumes adequate tax appetite. Note: Volt and Civic are compact cars while all others depicted are midsize class.

The future 2030 scenario we analyzed is driven by an accelerated adoption of cost effective fuel-efficient autos and electric vehicles, shaped by projected vehicle turnover rates, trends in future vehicle cost reductions, and a limited near-term BEV market due to range constraints. To explore the potential for transportation sector energy reductions we have assumed the following: by 2030, the average fuel economy of new vehicle sales can be raised halfway to best-in-class; on top of that, 50% of all new sales are electric vehicles (BEV and PHEV).

As a benchmark, the state of California has achieved hybrid vehicle sales roughly twice the national average, and within some zip codes hybrids exceed 20% of auto sales—four to five times the national average.[43]

Part 3: Additional energy reductions from business-as-usual can be achieved by transitioning heavy-duty trucks to compressed natural gas and biofuels.

As shown in Figure 1, heavy-duty trucks account for a significant share of remaining energy consumption as car and light trucking stocks become less oil-dependent. While strategies for reducing this contribution were not explored fully in this analysis, there are several options the City can pursue. The City has been converting public buses to run on compressed natural gas; reducing CO_2 emissions and saving fuel costs in the process. Other heavy-duty truck fleets (like garbage trucks) could be good candidates for conversion to natural gas, because they can take advantage of the economies of scale from investing in central fueling stations. Biofuels are also a viable alternative, especially for longer-range applications like freight, because they don't require as significant fuel tank or fueling station changes.

[43] PHONE CONVERSATION WITH UC DAVIS PROF. THOMAS TURRENTINE, JUNE 10, 2013.

MOVING TOWARDS IMPLEMENTATION

The transformation of the transportation system—both in infrastructure and in vehicle mix—proposed here is significant. Addressing the following formative challenges will be critical for implementing a 2030 target.

Challenge 1: Tactics for driving less must be implemented over a long timeframe, are harder to measure, and are sometimes unpopular.

While smart growth, public transportation, multi-modal transportation, and other strategies to drive less have been proposed for decades around the country, adoption remains low and changing that requires an on-going cultural and behavioral shift in the community. Strategies do not reach their full potential unless integrated well together.

Strategy: Double down on all four driving-less tactics, plus focus on effective integration to maximize benefits.

The City has recognized the value of smart growth for some time. Capturing the full opportunity will require continued planning and discipline—any new development that is not based on smart growth principles will essentially be locked in for several decades. Opportunities to retrofit smart growth through infill or redevelopment are less common, but need to be identified and executed as they arise. Smart growth will encourage alternative and multimodal commuting by bringing destinations closer and improving access to transit hubs. Continued investment in public transit, business commute trip reduction programs, and fleet driver training, combined with seamless integration into the rest of the Intelligent Transportation System will help users take full advantage of the infrastructure. With strong alternatives to driving in place, paid parking can help provide feedback to users.

Challenge 2: Many customers aren't motivated to prioritize fuel efficiency and don't understand the value proposition of high efficiency or alternatively fueled vehicles.

Most people don't consider fuel cost when they're at the dealership, and perceived environmental benefits weigh in among a long list of other important shopping criteria. Tax rebates that may make these vehicles more economically attractive can be confusing and a hassle. EVs, including both BEVs and PHEVs, have additional challenges: most customers don't know much about EVs and dealerships aren't always sure how to sell the value proposition.

Strategy: Implement new approaches to increasing customers' motivation and provide education and outreach around value proposition, drawing from the latest behavioral science insights.

The City can help citizens better understand their options, how federal and local incentives work, and perhaps most importantly that they are contributing to shared community and environmental goals. Many of the same behavioral science insights discussed with respect to building efficiency and solar adoption in the Efficient Buildings and Renewable Electricity Supply chapters are applicable here as well. Research has shown that purchasing a vehicle is as much a statement of identity or values as it is about function and utility. The City could even reinforce a citizen's choice to participate in community environmental goals with a sticker or license plate frame that then also serves to spread program awareness.

The Electrification Coalition is working with Fort Collins and local dealerships through its Drive Electric Northern Colorado program to help reach out to customers, raise awareness, and better communicate the EV value proposition. The City is also working to lead by example, purchasing EVs for its own fleet where they make sense, and this program could potentially be expanded. Finally, Fort Collins can work with its local dealerships to provide education about the EV value proposition in the same way that building efficiency programs work with local contractors and hardware stores to educate customers.

Challenge 3: First cost of alternate vehicles is perceived to be prohibitive, especially before incentives.

While this analysis shows that high efficiency vehicles and EVs can be cost-competitive today, not many car buyers are aware of that. In addition, some models are more expensive, the range of models is limited, and they generally have a high up front cost in exchange for fuel savings later.

Strategy: Incentivize the purchase of electric vehicles.

Fort Collins could potentially drive cost reductions by facilitating bulk purchases, perhaps partnering with other like-minded communities (Governor Hickenlooper has taken a similar approach at the state level, but focused on natural gas vehicles).

The City can offer additional incentives and benefits to sweeten the deal and further influence behavior. Because the city has limited control over vehicles coming in and out of the city, any incentives or fees must be tightly tied to residency of the purchaser, to avoid gaming the system. Implementing property tax or utility-bill-tied incentives are one option. Beyond direct incentives, Fort Collins Utilities could also motivate EV purchase through rate design. The city is already exploring a time-of-use rate for customers who charge their EVs at night. Finally, Fort Collins could reward alternative vehicle owners with favorable parking.

Challenge 4: BEVs have a limited range compared to gasoline or diesel-fueled vehicles.

Perhaps the biggest challenge to BEV adoption is the limited range of all-electric vehicles. There is a perception that this is a challenge in general, but especially for infrequent longer trips—e.g. to the mountains or for a vacation.

Strategy: Find alternative methods of meeting long-range transportation needs.

Importantly, most daily commutes fall well within the range of all-electric vehicles (over 90% of commuters travel less than 60 miles round trip to work), limiting the scale of the problem day-to-day.[44] Further, more than half of all households have two or more vehicles—making two-car households perhaps the best market for EVs today since they would have a non-BEV available for longer trips. If 50% of these households were to purchase an EV as one of their vehicles the next time they went to the dealership, Fort Collins would have 20,000 EVs on the road by 2030, comprising almost 30% of Fort Collins' light duty vehicle fleet.

PHEVs offer another solution to the electric vehicle range problem by offering consumers an electric vehicle for city driving, but without the range limitations for longer trips. Bloomberg, McKinsey, and others predict these vehicles will be cost-competitive by around 2020.[45]

Fort Collins can also build out local charging infrastructure at workplaces and businesses to both address any range challenges and build awareness. The City might also explore partnering with rental and car sharing companies to streamline or subsidize access to long-range vehicles for citizens with only a BEV.

SUMMARY

By 2030, Fort Collins could reduce its transportation energy use by 48% from *business as usual*, leading to a net benefit of $480 million in reduced vehicle fuel costs and maintenance for the community while improving transport options; lessening congestion; improving local air quality; and creating more walkable, bikeable, vibrant neighborhoods. The electrification of Fort Collins' transportation fleet will drive much deeper integration of the community's energy system—creating new demands on the electricity system but also new capabilities to support the integration of renewable electricity resources. Achieving this goal requires, particularly, a consistent, disciplined drive towards changing perceptions of driving and alternative transportation throughout the community, and making driving less and smart growth the norm.

[44] "TRANSPORTATION ENERGY DATABOOK: EDITION 32," STACY C. DAVIS, SUSAN W. DIEGEL, AND ROBERT G. BOUNDY, JULY 2013, OAK RIDGE NATIONAL LABORATORY, FIGURE 8.4. HTTP://CTA.ORNL.GOV/DATA/DOWNLOAD32.SHTML

[45] "BATTERY TECHNOLOGY CHARGES AHEAD," RUSSELL HENSLEY, JOHN NEWMAN, AND MATT ROGERS, MCKINSEY WEBSITE, ACCESSED 8/19/13. HTTP://WWW.MCKINSEY.COM/INSIGHTS/ENERGY_RESOURCES_MATERIALS/BATTERY_TECHNOLOGY_CHARGES_AHEAD SEE ALSO: BNEF 4/17/13 ELECTRIC VEHICLE BATTERY PRICES REACHING NEW LOWS, BNEF 12/3/13 ARE ELECTRIC VEHICLES BECOMING MORE AFFORDABLE?

IMPLICATIONS

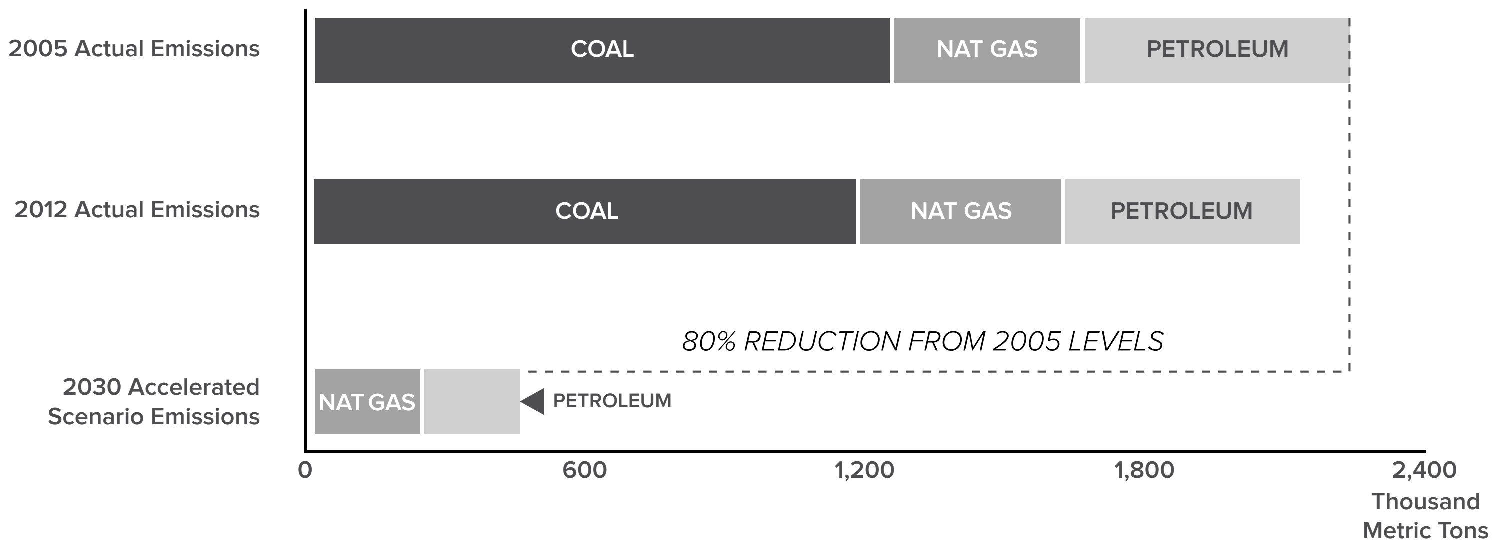
06

Image courtesy of Shutterstock

IMPLICATIONS

Efficient buildings, advanced transport, and renewably sourced electricity are interconnected; meeting each of the sector goals has reflexive impacts on the other components of Fort Collins' energy system. By making buildings more efficient, we shrink demand for electricity. This reduces the expense and effort required to meet loads with 100% renewables. At the same time, transitioning cars away from oil and towards electric vehicles adds demand back on the electricity system (albeit to a much smaller degree). Finally, even as buildings and vehicles draw power from renewables, they can provide demand response and other modulating services to enable the renewable system to meet the needs of the community. Together, the sector assessments presented here indicate that Fort Collins has the potential to achieve an 80% reduction (from 2005 levels) in Scope 1 and Scope 2 CO_2 emissions by 2030, essentially speeding its current climate goal by 20 years. By 2030, this would save 11 million tons more CO_2 emissions compared to Fort Collins' existing climate goal and 15 million tons more CO_2 emissions compared to *business as usual*. Achieving this *accelerated* goal has a net present value savings of $260 million to 2030 compared to *business as usual*, and a $2.0 billion net present value savings by 2050.

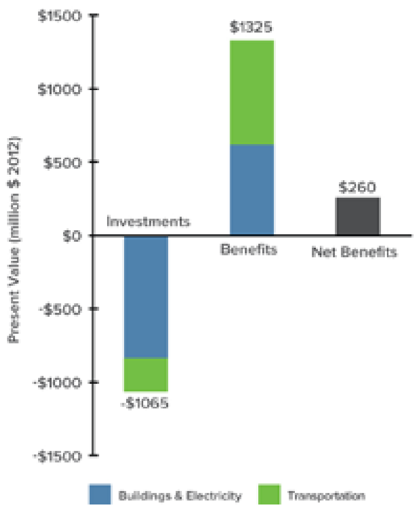
COMPARISON OF 2030 ACCELERATED SCENARIO EMISSIONS PROFILE VS. ACTUAL 2005 EMISSIONS



Source: "FC GHG and RE Data 2005-2012.xls"; City of Fort Collins, 2012. "Community Greenhouse Gas Emissions Inventory Quality Management Plan 2005-2011," City of Fort Collins, Environmental Services, October 2012. Available at http://www.fcgov.com/climateprotection/FC GHG Quality Management Plan

Figure 1: Fort Collins has the potential to achieve an 80% reduction (from 2005 levels) in Scope 1 and Scope 2 CO_2 emissions by 2030, thereby accelerating its current climate goals by 20 years.

NET PRESENT VALUE OF ACCELERATED SCENARIO, 2013–2030



NET PRESENT VALUE OF ACCELERATED SCENARIO, 2013–2050

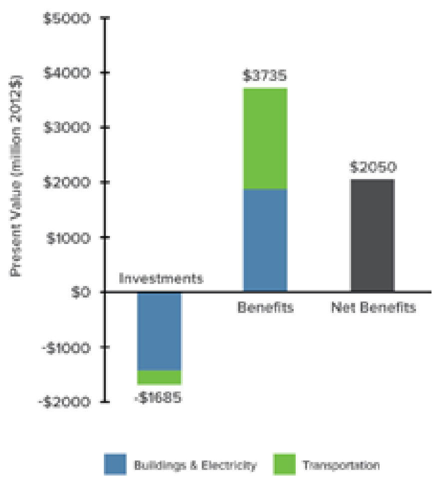


Figure 2: While transitioning the electricity system to renewables has a net cost, the net savings of aggressive building efficiency and advanced transportation improvements bring the accelerated scenario to a combined net present value of $260 million to 2030. By 2050, the accrued net present benefit is $2.0 billion.

2030 ACCELERATED SCENARIO ENERGY SOURCE PROFILE

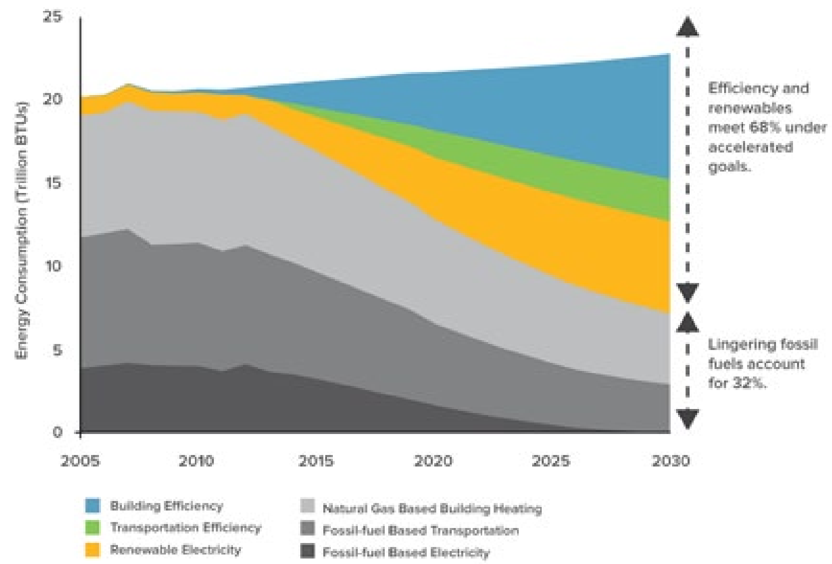


Figure 3: In the accelerated scenario, efficiency and renewables meet the majority of future energy demand. Lingering fossil fuels, (mostly natural gas for building heating, and oil and natural gas for transportation), account for 32% of the remaining energy consumption, and all CO_2 emissions. Remaining natural gas generation for electricity is offset by increased renewable generation.

The *accelerated* scenario represents a fundamentally different paradigm for investment in energy-related assets and infrastructure compared with *business as usual*, providing greater local job creation, economic development, and stimulus for innovation and growth of local businesses. Investments in energy efficiency and distributed energy resources along the lines of the path already envisioned for FortZED contribute to the local economy and reduce cash flows out of the community. By investing now in efficiency and renewables, the City can reduce outflows of cash for decades to come.

In the *accelerated* scenario, the amount of money spent on coal and natural gas to generate electricity supplied to the community is lower by an average of $16 million per year compared with *business as usual*. Investment in efficiency, distributed solar power, smart grid, and other local energy assets is higher by $20 million per year. This shift in investment—from distant to local resources—would generate an additional 400–500 jobs within Fort Collins over the entire period from 2013–2030.

At top of mind for many are three outstanding questions:

- What about the remaining 20% carbon emissions?
- What is the role for natural gas in this vision?
- Why can't we get there by purchasing Renewable Energy Credits (RECs)?

WHAT ABOUT CARBON EMISSIONS REMAINING AFTER 2030?

Targeting an 80% CO_2 reduction by 2030 puts Fort Collins in a good position to achieve net carbon neutrality across the sectors in the years to follow. In our analysis, the lingering 20% emissions come from end uses that are challenging to wean entirely from fossil fuels in the near-term for both cost and implementation reasons. Creating explicit efforts and programs targeting these end uses will be critical to achieve carbon neutrality in the following years. By and large, the solution will necessarily come from a combination of electrification and bio-based sources.

- Natural gas used for industrial process heat: While some reduction can be made through individual, deep engagements with industrial energy users in the study period, some natural gas will linger due to the lack of readily-available, cost-effective alternatives to producing process heat. On-going strategies for reduction include integrative design approaches to these industrial processes, and potentially fuel switching.
- Natural gas used for building heating and domestic hot water: This study assumes some efficiency improvement and some fuel switching for these end uses, but due in part to the long replacement cycles of heating and hot water equipment, such replacement will need to continue, timed with natural replacement cycles. District heating could also be considered.
- Natural gas used for electricity generation: The *accelerated* scenario includes a combined cycle gas turbine, built in the first few years of the study period to facilitate lessening Fort Collins' dependence on coal and integrating variable renewables. Carbon emissions from this plant are offset by over-generating renewable energy, but eventually this plant could be replaced entirely with renewables.
- Oil used for transportation: Despite rapid implementation of smart growth strategies and customer adoption of efficient and alternatively fueled vehicles, gasoline and diesel use will continue beyond 2030 because of the nascent state of alternatives, complexity of consumer choice, and long timeframe to fully realize the benefits of smart growth. A continued push towards adoption of alternative vehicles beyond 2030 will ultimately reduce this lingering fossil fuel.

WHAT IS THE ROLE OF NATURAL GAS IN THIS VISION?

Natural gas is the subject of ongoing national debate, on one hand held up as a critical transition fuel and replacement for coal and oil, and on the other hand, criticized for the environmental, health, and climate impacts of shale gas hydraulic fracturing. Proponents cite falling prices, significant domestic shale gas reserves with the potential to keep prices low, and comparatively low carbon intensity. Opponents cite the environmental and health risks of improper management in the extraction process, skepticism that low prices will persist in the long run, and a view that future price volatility is not only a cost but also a potential major threat to long-term planning around the resource.

In Fort Collins, natural gas is a convenient option in the short-term to supply those end uses listed above, which are the hardest or most expensive to shift to renewables. In electricity, Platte River's existing natural gas combustion turbines were designed to provide peak power, so running them significantly more is likely cost-prohibitive. On the other hand, new combined cycle natural gas capacity could be built not primarily to supply new load but rather to manage the variability of renewable resources by providing additional flexibility to the system, in conjunction with more local sources of flexibility.

From a transportation perspective, Fort Collins' bus fleet runs on biodiesel and compressed natural gas (CNG) today, and will soon be converted to all CNG. Natural gas can continue to make sense as a fuel source for other community fleets (e.g. garbage trucks, taxis) where economies of scale can be achieved from centralized fueling stations. For passenger vehicles, though, electricity is likely to win out.

WHY CAN'T WE GET THERE WITH RENEWABLE ENERGY CERTIFICATES (RECS)?

When the City adopted its original climate action goals in 2008, it stipulated RECs should not be counted in the community's progress towards its GHG goals. In fact, Fort Collins could meet the same numerical carbon reduction targets with RECs as would be achieved by the accelerated goals, and in doing so, support the demand for clean renewable energy development and ensure that more certified renewable energy is being generated to meet the nation's energy needs. If it chose to, Fort Collins could even purchase enough RECs to become carbon neutral tomorrow (as the City of Palo Alto has done), and thereon after through 2050 and beyond.

However, the cost required to purchase RECs to match the accelerated carbon reduction path, or to meet and maintain carbon neutrality, is significant. That money flows out of the community to support renewable generation elsewhere, without securing the local innovation, job growth, and other economic benefits that Fort Collins seeks from investing in efficiency and renewables locally. Those costs would recur annually, with no positive returns generated and no long-term investment in the community itself, resulting in significant negative net present values through 2030 and 2050. Therefore, rather than serving a primary role in Fort Collin's climate strategy, RECs are likely best used in a support role in the future to help offset lingering fossil fuels.

NET PRESENT VALUE OF PURCHASING RECS TO...	(IN MILLION 2012 $)	
	Paid Thru 2030	Paid Thru 2050
...match the ***accelerated*** goal of achieving a carbon neutral electricity system by 2030	($342)	($714)
...achieve a carbon neutral electricity system tomorrow	($596)	($966)

MOVING FORWARD

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Image courtesy of Shutterstock

MOVING FORWARD

FIRST, SET A PUBLIC TARGET

Fort Collins can accelerate its climate goal by twenty years to achieve a 2030 outcome in which its buildings use 31% less energy,[46] its vehicles 48% less energy, and its electricity system is carbon neutral. While it is essential to further develop an actionable implementation plan, not every aspect of execution needs to be vetted before a revised goal is adopted. This year, through the review process outlined in the "About this Report" section, the City of Fort Collins should consider the merits of ratifying the accelerated goal articulated here.

A statement of the City's commitment would, in itself, play a major role in enabling acceleration. This commitment is backed by the significant decision-making power and implementation capabilities of the community's municipal utility and power supply partner. A public target would send a credible signal to interested stakeholders to engage. For those who are on the fence, ratification would give a directive to act. A bold public target would alert the nation that an energy transformation is underway in Fort Collins, drawing energy leaders, funders, and researchers to participate.

NEXT, CONCENTRATE ON THREE KEY LEADERSHIP ROLES

The City is poised to lead in three key areas necessary to achieve an accelerated goal. While all are critical to meeting 2030 targets, the extent to which the City concentrates on each is likely to evolve as progress is made.

1. ***Build needed partnerships and coalitions***

Multi-stakeholder partnerships are important for all cities endeavoring to take on aggressive climate targets. With a 2030 acceleration target, Fort Collins needs to create these partnerships quickly, establishing coalitions that can create and execute initial implementation plans as early as this year, and that are structured to nimbly course-correct over the next decade to ensure programs are meeting the 2030 objective.

The City already has established relationships with private and public entities committed to reducing Fort Collins' energy use and transitioning its electric supply to renewables. Through its municipal utility, transportation and master planning responsibilities, and other civic duties, it is in a prime position to coordinate the efforts of these multiple parties. In particular, the City could take the lead by:

- Determining the kinds of organizations—and identifying the specific organizations—that should be coordinated to orchestrate this energy transformation.
- Partnering with Platte River to create a shared vision for Fort Collins' centrally sourced energy supply going forward. Platte River will continue to be the primary centralized supplier to Fort Collins, and the community's climate targets require Platte River to shift, over time, from being dependent on fossil fuels to renewables. A successful partnership with Platte River

[46] 39% AFTER ACCOUNTING FOR FUEL SWITCHING

would ensure an increased supply of renewables and develop approaches to secure the continued financial health of Platte River, Fort Collins Utilities, and the community.

- Expanding the existing partnership base already formed through FortZED to support community wide accelerated targets, by leveraging the support of stakeholders who are already committed and mobilized to execute on aggressive energy goals.
- Identifying common goals and strategies of other local and regional partners to leverage investment and combined action.

2. *Accelerate customer adoption*

Achieving the sector goals presented in this report requires landmark community adoption rates for energy efficiency measures in buildings, for solar PV, and for reduced driving and efficient or electric vehicles. To get a sense of the scale of adoption required to meet these goals, consider that by 2030, (1) all residential and commercial buildings will have reduced energy use by close to 30%, (2) 30%–50% of all commercial and residential buildings in Fort Collins will have installed solar PV, and (3) close to 50% of all new car sales will be either efficient or electric vehicles. Acceleration will require new adoption initiatives that:

- ***Send the correct pricing signals to participants:*** ensure that price structures motivate adoption while fairly distributing costs and savings across participating stakeholders.
- ***Overcome the cost hurdle:*** provide low-cost financing options and incentives that can be delivered simply and equitably to participants.
- ***Find effective ways to entice high-levels of participation:*** appeal to the motivations and decision-making criteria of all segments of the population.
- ***Be able to deliver services to meet that increased adoption:*** engage with providers to deliver services effectively, and at a deployment rate that can match increased adoption.

The utility, which already serves a diverse customer base, can take a leading role in designing and implementing these initiatives. In fact, Fort Collins Utilities is already exploring new program options including a set of initiatives that can be piloted in the FortZED district to drive increased energy efficiency in buildings and greater adoption of solar PV and other distributed resources.

3. *Coordinate and sequence efforts over time*

In addition to its role in creating and communicating clear goals for the benefit of the community, the City can play a critical role in tracking and reporting progress toward achieving goals. This will entail periodic reporting on progress and assessing the usefulness of programs and initiatives led by the City. For example, as adoption of efficiency and solar PV increases, Fort Collins Utilities will need to continue the rollout of smart grid technologies in order to manage a more distributed energy system. In other areas, the City's role may entail greater focus on coordination with private sector partners to facilitate change. Taking the lead on coordination can help verify that different initiatives in and across the three sectors are designed and timed to meet the accelerated goals.

CONCLUSION

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Image courtesy of Google

CONCLUSION

Many cities can point back to the formative moments or events that shaped where they are today. Perhaps it was when the local university or factory opened or closed. Or when a nearby airport was built, or a zoning law passed. Looking back, it's easy to see how these events triggered what followed next: an uptick in population as more people came to study and work, a mass exodus as real estate prices dropped, or the densification of downtown. In hindsight, it's easy to recognize decisive moments that shape the health and vibrancy of a community and set the horizon for its growth and prosperity.

Increasingly, cities like Fort Collins are recognizing decisions they make around energy are integrally tied to the livelihood of their people. A recent report published by the Carbon Disclosure Project, "Wealthier, Healthier Cities: How climate change action is giving us wealthier, healthier cities", includes results from 110 major national and international cities who report that 62% of climate actions their cities are taking have the potential to attract new business and economic opportunities. The largest share of these emission reduction efforts are energy efficiency and building retrofit activities, followed by a variety of transportation-related and waste-management initiatives. Among the reporting cities:

- New York expects its energy efficiency initiatives will lead directly to new clean-tech ventures in the city;
- Dallas is seeing an inverse relationship between the fall in greenhouse gas emissions and a rise in green jobs;
- Cleveland views investment in clean energy projects as a "centerpiece of economic development efforts in Northeast Ohio."[47]

Few communities in the nation have the combination of factors that align to make Fort Collins a community that can lead in creating forward-looking energy policy for community benefit. These factors include strong and pragmatic civic leadership, manageable size, an innovative and well-positioned municipal utility, workable options for creative transportation policy, and low cost options for clean and affordable electricity supplies. It is no surprise that Fort Collins' innovative energy programs and policies, notably the FortZED project, have already attracted national and international attention. By stepping forward to pioneer new approaches, Fort Collins has galvanized the support of community leaders and attracted the participation of leading businesses and other institutions in the area.

Now, the City has an opportunity to sustain and advance its leadership position by taking up new goals that leverage existing achievements and opportunities. With bold, decisive action today, Fort Collins tomorrow will be able to look back and see a turning point at which it pivoted from a business-as-usual energy system dependent on fossil fuels to a healthy, vibrant system that runs on efficiency and renewables, putting itself at the forefront of innovation nationally—stimulating local economic development, reducing outflows of money from the community, improving security, and reducing risk.

[47] "WEALTHIER, HEALTHIER CITIES: HOW CLIMATE CHANGE ACTION IS GIVING US WEALTHIER, HEALTHIER CITIES," CARBON DISCLOSURE PROJECT, 2013. HTTPS://WWW.CDPROJECT.NET/CD-PRESULTS/CDP-CITIES-2013-GLOBAL-REPORT.PDF