Community Climate Action Plan

CITY OF BEND

BEND COMMUNITY TRANSPORTATION SYSTEM

BACKGROUND REPORT

City Manager's Office

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Bend Community Greenhouse Gas Emissions Inventory Transportation Emissions

Emissions from transportation are a significant portion of Bend's Community GHG emissions. These emissions occur both at the tailpipe of the vehicles driving around Bend and also in the production and transport of fuels used in vehicles. Taking into account just the tailpipe emissions, transportation accounts for 36% of Bend's sector based community emissions[1]. Local, on-road transportation of passengers is Bend's leading source of transportation-related emissions. Passenger vehicles account for 60% of these emissions[2]. These emissions originate from residential-owned passenger cars and trucks, which primarily use gasoline (assumes E10, which is a fuel blend of up to 10% ethanol and 90% unleaded petrol) and relatively small quantities of diesel (assumes B5, which is a common biodiesel blend of 5% biodiesel and 95% petroleum diesel that is approved by virtually all of the engine manufacturers).

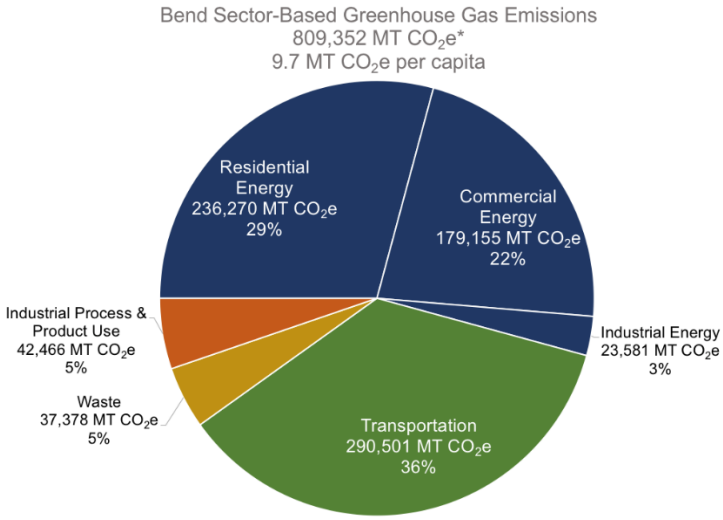

Figure 1. Summary of Bend's community sector-based GHG emissions[3]

The protocol used to calculate Bend's GHG emissions, the Greenhouse Gas Protocol's *Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC)*, includes emissions from trips that take place entirely within the City's boundaries and also emissions from trips that start or stop within the UGB. This means that both local emissions as well as emissions that occur from visitors or commuters are included in this inventory. Roughly 2/3 of these emissions are the result of trips inside the City's

[1] City of Bend, 2016 Community Greenhouse Gas Inventory, Prepared by Good Company, August 2018. https://www.bendoregon.gov/Home/ShowDocument?id=38856

[2] City of Bend, 2016 Community Greenhouse Gas Inventory, Prepared by Good Company, August 2018. https://www.bendoregon.gov/Home/ShowDocument?id=38856

[3] City of Bend, 2016 Community Greenhouse Gas Inventory, Prepared by Good Company, August 2018. https://www.bendoregon.gov/Home/ShowDocument?id=38856

boundaries, while the remaining 1/3 originate inside the City's boundaries, but have a destination outside the City or the inverse[4].

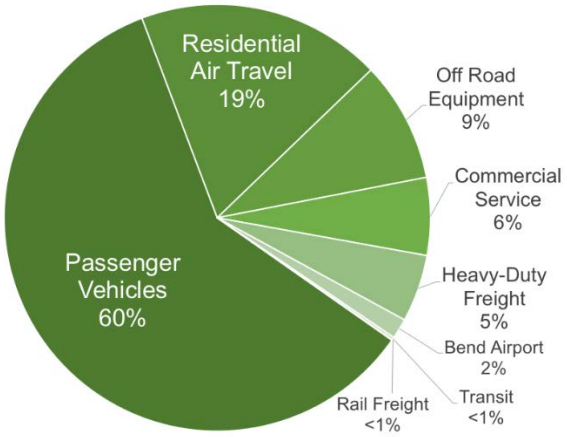

Figure 2 Summary of sources of Bend's GHG transportation emissions[5]

The next largest source is air travel by Bend households. While Bend does have a small municipal airport, the majority of these emissions are from Bend residents departing from airports outside of the Bend community.

Off road equipment, which is dominated by construction equipment and also includes recreational vehicles, is the next largest category representing 9% of transportation-related emissions.

Commercial service vehicles that represent 6% of transportation-related emissions include local freight, restaurant delivery, and service providers such as electricians, plumbers, etc. Heavy-duty freight vehicles operating within the UGB along with rail freight represent another 6% of transportation-related emissions.

In addition to greenhouse gas emissions from the tailpipe of vehicles described above, greenhouse gases are generated in the production and transport of the fuels that are used in the vehicles within the community. These emissions are captured in Figure 3 below in the community fuel production portion of the inventory[6].

[4] City of Bend, 2016 Community Greenhouse Gas Inventory, Prepared by Good Company, August 2018. https://www.bendoregon.gov/Home/ShowDocument?id=38856

[5] City of Bend, 2016 Community Greenhouse Gas Inventory, Prepared by Good Company, August 2018. https://www.bendoregon.gov/Home/ShowDocument?id=38856

[6] City of Bend, 2016 Community Greenhouse Gas Inventory, Prepared by Good Company, August 2018. https://www.bendoregon.gov/Home/ShowDocument?id=38856

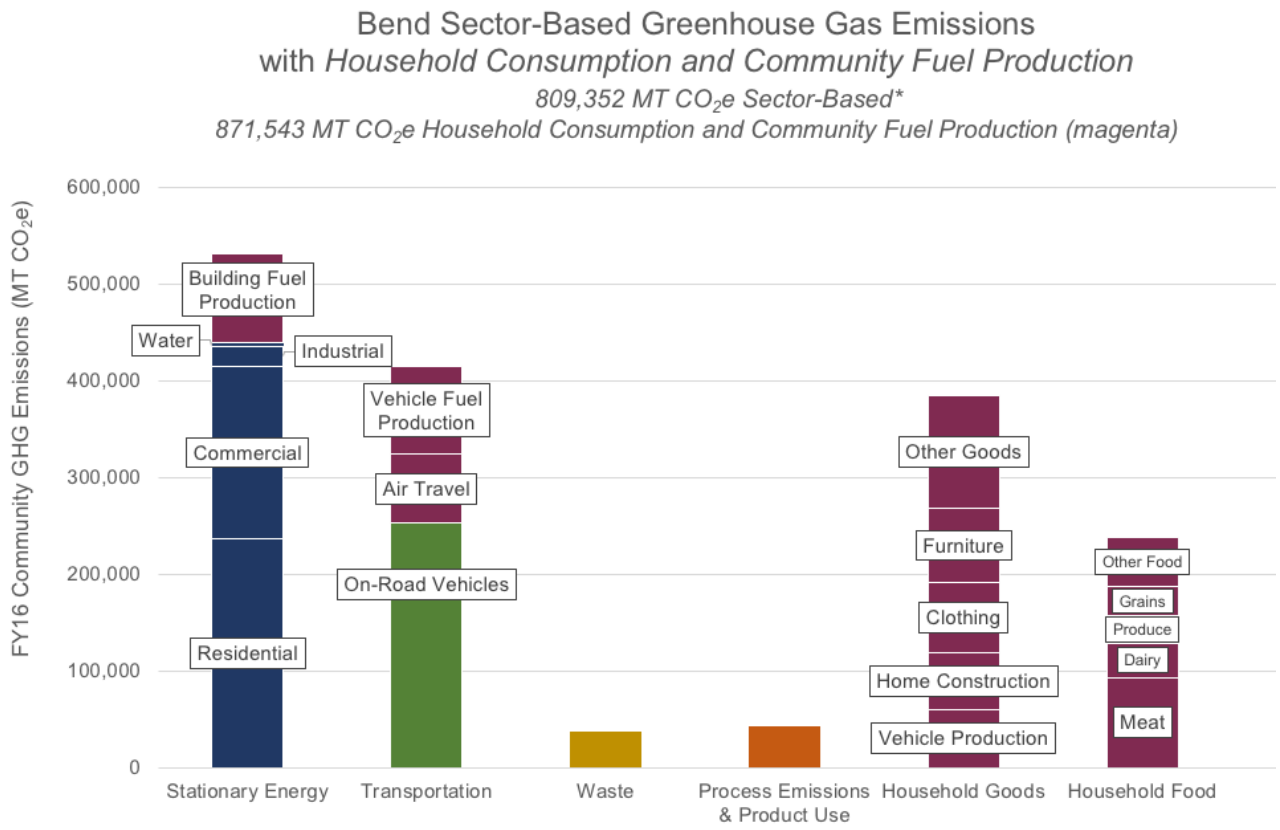

Figure 4. Bend's sector based GHG emissions with household consumption and fuel production emissions

Figure 4 compares 2016 DMV registration data on the percent of internal combustion engine vehicles (ICE)[7].

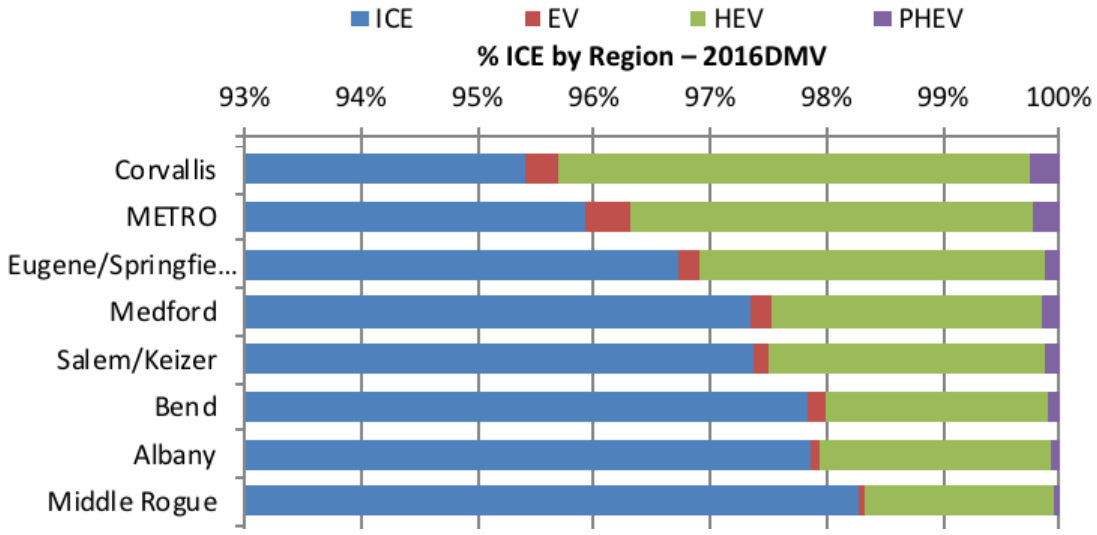

Figure 3. Comparison of vehicle types in Oregon cities

[7] City of Bend, 2016 Community Greenhouse Gas Inventory, Prepared by Good Company, August 2018. https://www.bendoregon.gov/Home/ShowDocument?id=38856

ICE are typically less efficient than electric vehicles (EV), hybrid electric vehicles (HEV), or plug in hybrid EVs (PHEV) for regions around Oregon.

Transportation System and Policy Framework

The transportation system in Bend is multi-faceted and includes:

- Roads and bridges (ODOT, city, county and private)
- Bike lanes (standard, buffered, protected)
- Sidewalks, crosswalks and median islands
- Trails (City and BPRD) and associated bridges
- Public transportation (Cascades East Transit and others)
- Bike share system (scooters coming?)
- Private providers (taxis, Uber, Lyft, shuttles)
- School buses
- Intercity buses services (Breeze, The Point)
- Overhead lights
- Traffic signals

The system is owned and operated by public entities (City of Bend, Oregon Department of Transportation, Bend Park and Recreation District, Deschutes County, and Cascades East Transit) and private entities (homeowners associations and for profit providers).

The vehicle fleet in Deschutes County has changed over the past 25 years. The percentage of light trucks (SUVs, pickup trucks, vans) has increased by 50 percent (from 42% of the fleet in 1995 to 63% of the fleet in 2015).

Driving alone is the predominant means of transportation to work in Bend (about 75%). That is followed by working at home (about 9%), carpooling (about 7%), walking (about 3%), bicycling (about 3%) and other means (public transportation, taxis, motorcycles). The City is actively collecting data for all forms of transportation to better understand how people move throughout the day.

Transportation planning and policy is regulated by federal and state laws. The Bend Metropolitan Planning Organization (MPO) is the federally designated regional transportation planning organization for Bend. The MPO is the lead agency for regional transportation planning and the decision making body for federal and state transportation funding for the Bend area. Federal code and regulations (23 CFR, Section 450) require MPOs to have a 20-year plan that considers a number of factors including safety, economic vitality, system efficiency, and financial capacity.

Oregon's Planning Goal 12 is to provide and encourage a safe, convenient and economic transportation system. The Transportation Planning Rule (OAR 660-12) implements Goal 12 by requiring cities to have a 20-year plan that:

- Supports the statewide, regional and local system
- Promotes choices
- Provides safe and convenient access and circulation

- Facilitates the flow of goods and services
- Provides adequate funding for needed projects

Related Legislation
SB 1059
The 2010 Oregon Legislature passed Senate Bill 1059, a statewide, comprehensive bill aimed at reducing greenhouse gas from transportation. SB 1059 names Oregon Department of Transportation (ODOT) and the Department of Land Conservation and Development (DLCD) as the lead agencies in implementing its requirements. Among the responsibilities established for ODOT and DLCD in this bill include:

- Coordinate and consult with stakeholders, local governments, Metropolitan Planning Organizations, or MPOs, and other state agencies to develop a state-level strategy to reduce greenhouse gases from transportation.
- Develop a toolkit to assist local governments and MPOs in reducing greenhouse gases from transportation
- Develop guidelines for scenario planning, and provide information to Land Conservation and Development Commission to set transportation-related greenhouse gas reduction targets for areas served by metropolitan planning organizations
- Work with local governments within areas served by an MPO to consider what actions they might take, transportation-wide, to reduce greenhouse gases in the short-term

HB 2001
HB 2001 requires Metro and Portland metropolitan area local governments to develop and select a preferred land use and transportation scenario that achieves the GHG emissions reduction targets. Eugene-Springfield metropolitan area is directed to conduct scenario planning and develop two or more alternative land use and transportation scenarios that achieve the targets. Scenario planning is not required for metropolitan areas other than these two, but is encouraged for all through SB 1059.

Oregon Sustainable Transportation Initiative (OSTI)
OSTI is an integrated statewide effort to reduce greenhouse gas emission from transportation while creating healthier, more livable communities and greater economic opportunity. OSTI must address how the energy landscape is changing, how Oregon will continue to power transportation and sustain a strong economy.

OSTI is being led by several state agencies: ODOT, DLCD in consultation with the Department of Environmental Quality (DEQ), the Oregon Department of Energy (ODOE), and many stakeholder committees made up of business people, elected officials, and residents of communities across the state.

Scenario Planning Tools and Guidelines
OSTI developed a scenario planning framework that includes tools and guidelines aiming to reduce greenhouse gas emissions from light vehicle travel, in support of SB

1059. These were developed as a resource to help Oregon MPOs and local governments conduct metropolitan land use and transportation scenario planning. The guidelines are presented in the form of six recommended steps that metropolitan areas can follow to ensure a successful planning process that will help achieve the GHG reduction targets. This scenario planning framework can be found on the ODOT website at https://www.oregon.gov/ODOT/Planning/Pages/Strategic-Assessment.aspx/.

The tools developed by OSTI to support these planning guidelines include the Metropolitan GreenSTEP transportation GHG model and sketch planning tools:

- **Metropolitan GreenSTEP** allows planners and decision makers to analyze the effects of a large number of factors on transportation GHG emissions (i.e. land use, transportation system, pricing, technology). Metropolitan GreenSTEP functions at a high level providing a regional view of likely effects of different policies or programs and has the ability to quickly test hundreds of high-level policy scenarios.

- **Sketch planning tools** use detailed information about different types of land uses in a community, both existing and planned, to estimate outcomes of different land use and transportation policies.

Metropolitan GHG Reduction Targets

In support of Oregon's statewide GHG reduction goals adopted in 2007, DLCD adopted targets for emissions reductions from light vehicles in 2011 to help guide metropolitan areas as they conduct scenario planning. These targets were set based on an assessment of what could be accomplished at the metropolitan level and what needed to be accomplished. The targets call for a 17-20% reduction statewide by 2035 for the state to be on track to meet its 2050 GHG reduction goals. Different targets were established for each metropolitan area, with Bend's reduction target set at 18% reduction by 2035.

2035 GHG targets for Oregon metropolitan areas

per capita light vehicle GHG emissions reduction

Metropolitan area	Adopted target[1]
Portland Metro[2]	20%
Salem-Keizer	17%
Corvallis	21%
Eugene-Springfield[3]	20%
Bend	18%
Rogue Valley	19%

[1] Adopted by the Land Conservation and Development Commission in May 2011

[2] Required scenario planning and adoption

[3] Required scenario planning

Integrated Land Use and Transportation Plans

Oregon's Transportation Planning Rule (TPR) requires Oregon's larger communities, including Bend, to plan transportation systems and land use patterns that increase transportation choices and reduce reliance on the automobile. This is measured primarily by vehicle miles traveled (VMT) per capita (the average distance driven in a day per person), which is considered an indicator of reliance on the automobile. When a City's adopted land use and transportation plans are expected to result in an increase in VMT per capita, the TPR requires preparation of an Integrated Land Use and Transportation Plan (ILUTP) that sets standards and policy direction to change that trend.

The City of Bend finalized its most recent ILUTP in 2016. As part of this update, VMT analysis was done for Bend. Key findings from the report were:

> As is true with most U.S. cities of Bend's age, urban form, and rapid growth, Bend's VMT per capita has been increasing in recent decades. Bend is measuring growth in VMT per capita against baseline years of 2003 (as specified in the Remand) and 2010 (which the project team believes is a better indicator of conditions in 2008 – the beginning of the 20-year planning horizon for the UGB work). Key conclusions and findings from the VMT analysis to date are summarized below.
>
> **From the UGB scenario evaluation**
>
> - Each of the six scenarios tested increased per capita VMT relative to 2010 (ranging from a 2.9% to a 5.1% increase) due to the amount of growth located outside the center of the city. The increase relative to 2003 ranged from 8.1% to 10.3%.
> - An emphasis on complete communities in expansion areas (and using expansion areas to complete existing neighborhoods) helps reduce VMT overall.
> - The downtown and core areas of Bend are key destinations and conducive to walking, biking and transit use, so trip lengths and household VMT are generally lower in the these areas of the city. Focusing growth close to the key transit and multimodal corridors that connect to downtown helps keep average trip lengths down.

Proposed strategies to reduce VMT were established during the creation of the ILUTP. These strategies included suggested policies and initiatives around land use, transportation demand management, transit, roadway improvement management, and complete streets and connectivity investment.

The ILUTP can be found at:
https://www.bendoregon.gov/Home/ShowDocument?id=31914

Local Transportation System Plans

Local Transportation System Plans, or TSPs, communicate local needs and priorities to justify the value of a project for state funding. Regional Transportation Plans, or RTPs, developed by MPOs, look at the connections between communities and facilities necessary for the transportation system to function at a regional level. The two are required to be consistent with each other and with the Oregon Transportation Plan. The City of Bend and the Bend MPO are in the process of developing updated 20-year plans now.

Best Practices for Climate Action Planning

Transportation is usually one of the top emitting sectors of a community, usually driven by the prevalence of single occupancy vehicles that run on fossil fuels. Many factors in a community contribute to this being the dominant choice of transportation, including population, economic activity, dominant demographics and their transportation preference, and the state of various transportation technologies. CAPs can include strategies that promote voluntary action such as promoting new mobility technologies and business models as well as promoting non-vehicle modes of transportation. Public investments can be directed at decarbonizing public transport and increasing alternative transit options to single occupancy vehicle travel. Cities that are leading in efforts to curb carbon emissions from their transportation systems have set goals around the following objectives:

- Dramatically changing the community mode share in favor of low carbon options
- Expanding and improving the accessibility of affordable, low carbon mobility choices
- Facilitating market dominance of clean technologies and clean fuels
- Ensuring complete, connected, and regionalized mobility systems
- Promoting an urban form that increases walkability and transit connectivity and affordable neighborhoods[8]

These goals take a combination of policy, infrastructure, and incentives that promote a transportation system that works differently than todays.

[8] Carbon Neutral Cities Alliance, Urban Sustainability Directors Network, C40 Cities, Kresge Foundation, 2016. *Framework for Deep Carbon Reduction Planning*.

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TRANSFORMING TRANSPORTATION SYSTEMS

Transportation is usually one of the city's top two carbon-emitting systems.

A city's transportation system moves people and goods throughout the city, and into and out of a city from nearby and distant places. In almost every city the dominant mode of mobility is fossil-fuel vehicles, and transportation usually is one of the city's top two carbon-emitting systems. In most major cities, the streetscapes, networks of roads, and parking and fueling infrastructures — the overall urban form — have been designed to promote and respond to the needs of cars and trucks at a massive scale. Public transit also contributes to carbon emissions, because fossil fuels are often the energy source for buses and trains or because electricity used to power transit systems is produced from fossil fuels. Finally, city government vehicle fleets and private taxi fleets licensed by cities, while usually just a small portion of a city's total mobility, are another important source of carbon emissions.

Transportation systems include many mobility modes:

MODES OF MOBILITY

TRANSIT SERVICE	WALKING AND BIKING	DRIVING AND PARKING
• Bus • Subway • Trolley bus • Light rail • Para-transit (non-fixed route) • Heavy rail • Regional bus • Ferry • Streetcar • Cable car	• Private bicycles • Bike sharing • Pedestrian access	• Commercial: • Taxi • Car sharing • Ride sharing • Private automo-biles • Commercial/ freight fleets • Emergency responders • Public & private parking

Cities may have extensive roles to play in the transportation system, including:

- Operating transit services
- Designing and planning transportation modal networks, providing long-range forecast analysis of fleets, facilities, and right of way infrastructure
- Regulating commercial vehicles and parking
- Partnering with regional transit operators & agencies
- Building and maintaining city-owned public rights-of-way and infrastructure, including streets, sidewalks, and public spaces
- Guiding development on private property through land use and urban design policies and guidelines

- Managing how streets are used through rules, regulations, and pricing
- Educating and empowering citizens to make sustainable transportation choices

Importantly, a city's transportation system is closely linked to city land use decisions; the two interact with and impact each other. The linkage occurs in five categories:

The "5 D's of Transportation and Land Use"[68]

Destinations	Locating major destinations and centers at rapid transit stations or along corridors makes them easy to serve efficiently by frequent transit
Distance	A well-connected, fine-grained pedestrian network enables shorter, more direct walking and biking connections and is easier to serve cost-effectively with transit
Density	Higher levels of residential and employment density support more local amenities within walking and cycling distance, and justify high levels of transit service
Diversity	A diverse mix of land uses and housing types makes it easier to live, work, shop, and play without having to travel far
Design	Well-designed buildings and public realms create places that feel interesting and safe to walk or cycle

When transportation systems pursue carbon emission reductions, they see potential co-benefits from various strategies, including encouraging healthy lifestyles; supporting vibrant public spaces that encourage a culture of walking, cycling, and social interaction; and increased economic development and services located around public transit stations.

- **SEATTLE'S** plan calls for residents to "meet many of their daily needs by walking, bicycling, or riding transit also benefit from lower overall household costs, improved health, thriving local business districts, and increased opportunities for housing and jobs."[69]

The International Energy Agency described the characteristic of four types of urban transportation systems, which may reflect differences between cities.

Different Types of Urban Transportation Systems

Developing	Developing cities are experiencing increased demand for transport services and rapid growth in private motorization. They frequently have relatively low densities, inadequate travel infrastructure and are often characterized by weak public transit services (e.g. unregulated, poor quality bus operators).
Sprawling	Sprawling cities tend to have low densities and high urban and suburban sprawl. They often have weakly-defined urban cores with commercial and business hubs spread intermittently throughout the urban and metropolitan areas.
Congested	Congested cities often experience heavy roadway traffic, especially during peak travel hours. They generally have medium to high densities and strong urban cores, although urban sprawl may exist in surrounding metropolitan areas.
Multi-Modal	Multi-modal cities have high densities, strong urban cores, and high public transit and non-modal transport shares. Multi-modal cities generally have strongly interconnected, well-developed travel networks, which facilitate and encourage more efficient travel.

68 Robert, Cervero, "5 Ds of Urban Development & Rapid Transit Performance."

69 Seattle CAP p16

Although the specifics of control of transportation systems vary among cities, it is not unusual for control to be distributed among multiple city government agencies, state/province and national government agencies, as well as private companies and nonprofit organizations. For instance, a 2013 analysis of transportation in **BOSTON** found control spread among four city agencies, five state agencies, and about a dozen private or nonprofit entities — each with different responsibilities. Cities especially lack much control over the marketplace for cars and trucks and the degree to which energy efficiency and renewable energy fuels are used. These markets are controlled mainly at the national level, although cities may play important roles in supporting market change, for instance by building local infrastructure for electric vehicles.

- **VANCOUVER** described its sphere of control over transportation: "The City has a number of ways in which we can influence travel behaviour and effect change in transportation. Transportation is complex, as issues often extend beyond municipal or even regional boundaries, and many players are involved through overlapping jurisdictions. Some things are largely within the City's control, like our public rights-of-way, street infrastructure, land use, and much of the built environment. Other things fall under regional, provincial, or federal jurisdiction — like transit, ports, and regional infrastructure planning. In this latter case, the City is a partner, stakeholder, and advocate for local transportation issues."
- **YOKOHAMA** formulated its "eco-mobility" program with an eye toward creating a low-carbon city, prioritizing the use of public transportation, making walking and bicycling accessible and enjoyable, advancing the commercialization of low-carbon, "next-generation" transportation, providing information about alternatives at transport nodes, providing attractive transport modes for tourists (such a LRT and articulated buses), and introducing emerging mobility technologies amphibious bus and water transportation.

Prevailing Transportation System Conditions

- **Vehicles Rule** — The system's most notable relevant feature is the dominance of private vehicles (car/trucks) as the preferred mobility mode over public transit and other modes.
- **Congestion** — Many cities' streets and roads are chronically congested, creating other problems for the cities.
  - **SYDNEY:** "Major public transport routes are at capacity and it can be difficult to move efficiently around the City. Congestion inhibits economic development and private vehicle use is a major source of green house emissions. Buses and taxis are impacted by congestion and make pedestrian movement and cycling unpleasant and sometimes dangerous."[70]
- **System Drivers.** There are a number of hard-to-manage drivers for the design and operation of urban transportation systems:

Population & Economic Activity	Increases/decreases in population and jobs drive increases/decreases in transportation use.
Demographics	Age of population drives needs/preferences for transportation and accessibility, security, comfort issues. E.g., a growing percentage of the urban population is elderly; the percentage of 16-24 year olds who have driver's licenses has been declining.
Smart Technology	Various technology applications — to integrate mobility choices, control efficiency of vehicle travel, etc. — are maturing for widespread use.

70 City of Sydney, "Sustainable Sydney 2030: The Vision," p. 44.

Inter-government Funding Levels	A pattern of decline in national and state/province government funding increases the importance of regional and local funding, new funding sources and funding partnerships. This is particularly important when it comes to funding expansion of transit options.
System "Legacies"	The design and condition of system assets drives the need for major overhaul and investment. E.g., making existing fleets more family-friendly; inefficient parking systems create congestion and slower transit speeds.

- **Misaligned Policies** — There tends to be a lack of policy alignment at the municipal, metropolitan, state/province, regional, and national government levels about goals for the transportation system, with cities exercising a fairly small amount of independent control over assets and operations.
- **The Potential in Freight** — In many cities the degree to which freight — the movement of goods — contributes to carbon emissions is not well understood, nor is the degree to which cities can change patterns of freight movement.
- **STOCKHOLM'S** analysis concluded that transportation of goods "accounts for approximately 35 percent of greenhouse gas emissions from road traffic in Stockholm. A rise in population will lead to greater needs, not only for goods to be brought into the city, but for the proportionately larger amounts of waste they generate to subsequently be driven away. Emissions resulting from the distribution of goods can be reduced by 20-25 percent. There is great potential to make goods distribution more efficient, first and foremost by increasing the coordination of deliveries and optimising delivery routes and times."[71]
- Broad Set of Goals/Priorities — Most transportation systems embrace a set of goals beyond carbon-emissions reduction, including:
  - Increasing the use of pubic transit
  - Improving the performance of public transit (affordability, service delivery efficiency, customer satisfaction)
  - Increasing the efficiency of service delivery
  - Increasing the satisfaction of transit customers
  - Increasing safety
  - Reducing noise and waste
  - Improving the use of parking
  - Improving the system's financial sustainability
- **Chronic Financial Deficits** — Public transit systems historically operate with deficits, deferred maintenance, and insufficient capital investment. As a result, they may not offer an attractive and competitive mobility choice and are subject to political and budgetary ups and downs.
- **Unconnected, Underserved Neighborhoods** — **PORTLAND** has done extensive analysis of the "completeness" of its neighborhoods when it comes to various factors including transportation. "Portland's land use plan calls for growth to be concentrated in a network of centers and corridors of different sizes, serving multiple neighborhoods. These 'healthy connected neighborhoods' are places that support the health and well-being of residents. In these neighborhoods, people of all ages and abilities have safe and convenient access to more of the goods and services needed in daily life — grocery stores, schools, libraries, parks and gathering places — reachable on foot or by bike.... They are well-connected to jobs and the rest of the city by transit. They have a variety of housing types and prices so households of different sizes and incomes have more options." The city's analysis found that "40 percent of Portlanders do not have safe and convenient access to transit, commercial services, jobs, or in many areas, even sidewalks. This is especially critical in East Portland, which is home to many low-income households and a large youth population."[72]

71 City of Stockholm, "Roadmap to a Fossil-Fuel Free Stockholm 2050," March 2014, p. 9.

72 City of Portland, "Climate Action Plan," June 2015, p. 72.

Some Portland neighborhoods are more complete than others

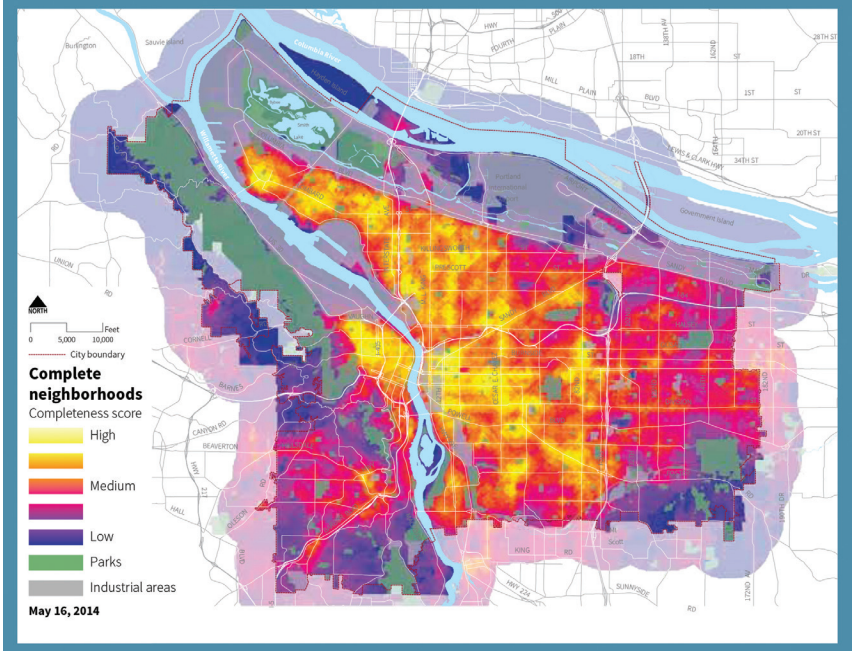


Figure 29. Complete neighborhoods. *Source: Portland Bureau of Planning and Sustainability*

The City developed the 20-minute neighborhood index to measure access to community amenities, products and services. The areas shown in yellow have the highest levels of access to services and amenities. The areas shown in purple have the lowest levels of access.

Source: City of Portland, "Climate Action Plan," June 2015, p. 20.

Vision for Redesigned Transportation Systems

- **Radically Different Mode Share**—Up to 66-75 percent of all trips in the city will be by walking, bicycling, or public transit. Leading-edge cities set ambitious targets for mode shift:
- COPENHAGEN: By 2025, 75 percent of all journeys in city will be on foot, by bicycle, or public transit.
  - VANCOUVER: By 2040, two-thirds of all trips on foot, bicycle, or pubic transit.
  - BOSTON: By 2030, increase walking, bike and transit trip share to 66 percent.
- **An Array of Affordable, Accessible Mobility Choices**
  - SAN FRANCISCO: "Expanding transit, walking, and bicycling infrastructure and services to provide effective choices for getting around."

- **SYDNEY:** "A sustainable and integrated transport network requires planning for the right mode of transport in the right place with easy transfer and suitable, accessible pricing."[73]
- **BOSTON:** "Provides users with real transportation choices that are affordable, connected, safe and convenient."
- **COPENHAGEN** emphasized time-saving and convenience:[74]
- **OSLO** makes it much more convenient to drive, park and fuel an electric vehicle than a conventional one. The city's policies complement policies at the national level that exempt e-cars from vehicle taxes that average more than $12,000 per car.

▶ **Market Dominance of Clean Technologies and Fuels**

- **COPENHAGEN:** 20-30% of all light vehicles and 30-40% of all heavy vehicles will use "new fuels" (electricity, hydrogen, biogas, bioethanol)
- **SAN FRANCISCO:** "Green, Clean, and Quiet Mobility — Use the greenest, most efficient, and quietest technologies available."

▶ **Complete, Connected, Regionalized Mobility System**

- **VANCOUVER:** "Linking key destinations throughout the region, with convenient and attractive connections between lines."
- **BOSTON:** "Allows everyone to have equitable access to a region's important goods, services and destinations."
- **COPENHAGEN**, which set a goal of 50 percent of trips made by bicycle: "Cycling infrastructure is central to urban planning and design." This requires "investments in dedicated, uninterrupted cycle lanes" and "easy transfer to public transport services.

▶ **Alternative Urban Form** — Cities will have transitioned to a prevailing "urban form" — walkable, transit-connected, and affordable neighborhoods — that leverages density and livability.

- **SAN FRANCISCO:** "Complete and Green Streets — Streets are designed and managed to be attractive, inviting public spaces for people."
- **SEATTLE:** "Meeting the growing demand for conveniently located homes and businesses in walkable neighborhoods with a variety of recreation and service opportunities."
- **BERLIN:** "A significant amount of traffic can be successfully avoided if future urban development is consequently oriented towards the Leitbild of a 'city of short distances'. Berlin's polycentric city structure is a very good starting point for this. Furthermore, newly developed urban logistics concepts offer ways of avoiding the transportation of goods."[75]

Barriers to Transportation System Change

Obstacles to transforming transportation systems include:

▶ **Lack of Jurisdictional Authority** — Most cities do not have jurisdictional control over transit systems and funding sources; these are most often controlled at the regional and/or national level.

▶ **Slowness of Change in Vehicles Market** — In many cities there are persistent cultural norms about the importance and value of car ownership and driving. At the same time, fossil-fuel vehicles continue to enjoy a sales price advantage over alternative-fuel vehicles, which have limited driving range, and the infrastructure of alternative-fuel vehicles is only just beginning to be built within some cities.

- **STOCKHOLM:** "Despite a large proportion of 'clean' vehicles, more than 90 percent of vehicles on the road today run on fossil fuels. It is, however, technically possible to replace these fuels with biofuels."

▶ **"Stranded" Transit Assets** — Public transit equipment and infrastructure are huge investments, both in terms of equipment, such as buses, streetcars and subway trains, and infrastructure, such as train/subway stations, overhead or underground power lines, etc. Once a city makes such purchases, it is difficult to suggest strategies that do not take advantage of such sunk costs.

▶ **Deferred Maintenance Costs** — Similarly, the planning process for addressing deferred maintenance on

73 City of Sydney, "Sustainable Sydney 2030: The Vision," p. 44.
74 City of Copenhagen, "Copenhagen: Solutions for Sustainable Cities," p. 11.
75 City of Berlin, "Climate-Neutrality Berlin 2050: Results of a Feasibility Study," March 2014, p. 13.

broken transit equipment and infrastructure is often backlogged for several years.

- **Political Influence** — The automobile/fossil fuel/road building industries have substantial political influence.
- **Traditional Government Funding Formulas** — In much of the world, government funding formulas typically favor roads over public transit, while fuel subsidies mask the true costs of travel choices.
- **Analytic Gaps** — The lack of life-cycle cost analysis for transportation system investments tends to favor road-related investments.
- **Automobile-Driven City Form** — City land use plans and regulations historically have been skewed toward accommodating vehicle/truck movement and parking.
- **Weak Government Standards** — There is a lack of transportation system-level commitments and binding government standards to reduction of GHG emissions — partly because of the newness of the carbon reduction imperative, competing goals and priorities of the system, and political resistance within the system.
- **Concerns About Alternative Mobility Modes** — A barrier to increasing the use of bicycles, for instance, can be concerns about safety when riding in the city's streets.
  - **COPENHAGEN:** "The goal is to create a network of bicycle lanes throughout Copenhagen. This will reduce traveling time and increase safety for their cyclists. Safety, convenience, comfort, timesaving and livability are the keywords in designing a city where cycling is the norm. More and broader bicycle lanes, improved design of intersections and behavioral campaigns are the means of achieving a safer city for the cyclists. With those types of initiatives, Copenhagen wishes to achieve a rise in the proportion of inhabitants feeling safe while biking (from 67% in 2010 to 80% in 2015 and further to 90% in 2025)."[76]

76 City of Copenhagen, "Copenhagen: Solutions for Sustainable Cities," p. 8.

Levers, Strategies and Actions for **Transforming Transportation Systems**

LEVER	STRATEGIES	ACTIONS
Voluntary Action	Promote Non-Vehicle Modes of Transportation	• Promote the recreational and health benefits of bicycling and walking • Promote household financial benefits (disposable income) of reduced reliance on automobile • Promote tele-working as an alternative to commuting • Promote car pooling and High Occupancy Vehicle lanes • Partner with employers to encourage employee commuting using public transit, biking, or walking
	Promote New Mobility Technologies and Business Models	• Support pilots and address regulatory barriers for on-de-mand busing, shared use mobility, driverless vehicles, etc. • Support on-demand parking software • Implement smart-transit systems to provide up to the minute transit/parking/travel information to residents • Encourage private investment in street cars, highways, shared use systems
Price Signals	Increase the Cost of Using Fossil-Fuel Vehicles Reduce the Cost of Carbon-Free Vehicles	• Establish congestion/climate taxes on fossil-fuel vehicles in designated areas • Establish taxes/fees on fossil-fuel vehicles (at purchase and/or registration) • Set taxes on gasoline/petroleum purchase (can be done on VMT basis)
	Increase the Cost of Driving in Certain Places	• Institute new parking pricing models (performance-based parking, off-street parking tax, dynamic pricing, etc.) • Establish regional road pricing (toll roads, dynamic pricing) • Promote automobile insurance options that reward drivers for driving less • Tax off-street parking

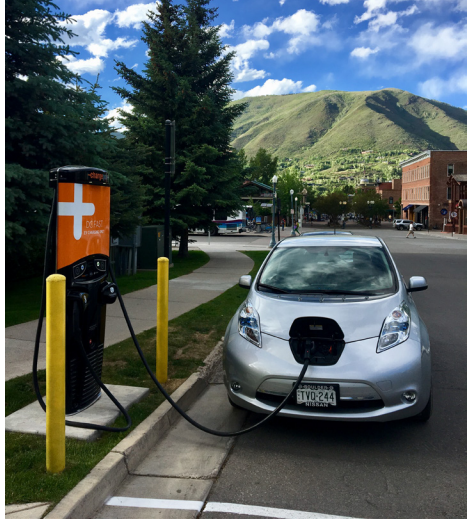
Public Investments	Invest in Decarbonizing Public Transit	• Convert public transit, government fleets, and taxi fleets to no- to low-carbon energy (electric, hybrid, natural gas, hydrogen)
	Invest in Increasing Non-Vehicle Share of Mobility	• Invest in public transit capacity (modernization, expansion), choices (e.g., streetcars, light rail lines), reliability, speed, accessibility, convenience, way-finding, and reduced waiting times • Convert bus lines into high-capacity transit lines • Expand rapid transit for job centers • Invest in bicycle sharing programs and public bicycle parking (coupled with requirements for buildings to provide bicycle space) • Invest in infrastructure for low- to no-carbon mobility: electric vehicle charging, hydrogen, fuel cell infrastructure (including incentives for real estate owners to install charging stations) • Support shift of freight transportation from road to rail and ship
	Invest in Redesigned Urban Form/Density to Promote Less Use of Vehicles	• Develop bicycle/walking infrastructure (citywide network) • Develop “complete”/green streets, walkable neighborhoods, and complete/green public spaces • Use transit-oriented development (TOD) planning and investments to increase neighborhood density and use of public transit • Develop an integrated, multi-modal mobility system at regional scale • Redesign parking system regulations and infrastructure (e.g., eliminate/reduce parking spaces in high density/traffic areas) • Redesign goods movement in city
Mandates	Mandate Vehicle Fuel Efficiency	• Establish reduced idling ordinances • Increase fuel efficiency targets for vehicle producers

Resources

Good, Better, Best 2011-2025	Copenhagen	Copenhagen's Bicycle Strategy, which promotes a better cycling city and further helps Copenhagen achieve their carbon dioxide neutral goal by 2025
Action Plan for Green Mobility	Copenhagen	Includes 25 initiatives that encourage extending public transportation, becoming the world's best cycling city, reducing traffic and providing more urban development areas in Copenhagen.
SFMTA Strategic Plan 2013-2018	San Francisco	The SFMTA Strategic Plan includes future goals to create safer transportation, make walking, bicycling, taxi ridesharing and carsharing the preferred means of transportation and improve the environment and quality of life in San Francisco.
Seattle Transit Master Plan	Seattle	
Energy and Transportation in the U.S	Marc Ross	This is a concise overview of transportation energy use in the U.S. The paper includes an analysis of the historical changes in energy intensity by transportation mode.
Millennials in Motion	U.S. PIRG Education Fund	Now is the time for the nation's transportation policies to acknowledge, accommodate and support Millennials' demands for a greater array of transportation choices.
Pew Says Us Can Reduce Transportation GHGs By 65% By 2050	International Society of Sustainability Professionals	The report by the Pew Center on Global Climate Change lays out three plausible scenarios of actions that could significantly reduce the carbon footprint of the transportation sector, which is responsible for more than a quarter of U.S. GHG emissions."
Quality of Life, Equality of Place	CNT and Open Communities	Rail transit anchors downtowns and neighborhoods in communities throughout Chicago's northern suburbs and across the region, but many of these communities are falling behind in creating mixed-income transit-oriented development. This guidebook offers case studies, policy recommendations, and public participation tools to help suburbs build affordable, accessible housing around transit.

Transportation and Global Climate Change	Edited by Danilo Santini and David Greene, Argonne & Oak Ridge National Laboratories	The book attempts to put the problem of the U.S. transportation system into perspective among worldwide systems. In addition, the effects of engine technology improvements, fuel choice and production, vehicle design, commercial transportation requirements, transportation choices by consumers, and government policies are examined.
What Cities Can Do to Increase the Use of Alternative Transportation	Maxwell Young	100 Resilient Cities received ~ 125 responses from 26 countries, offering ideas (10 themes) on how cities can better encourage alternate transportation.
Interactive Transit Tools	Center for Neighborhood Technologies (CNT)	CNT Tools: research tools to help planners, developers, and community leaders make smart, data-driven decisions.
Planning and Design for Sustainable Urban Mobility: Global Report on Human Settlements 2013	UN-Habitat	This new report of the United Nations Human Settlements Programme (UN-Habitat), the world's leading authority on urban issues, provides some thought-provoking insights and policy recommendations on how to plan and design sustainable urban mobility systems.
Strategising sustainable urban mobility in EU Neighbour Countries	ICLEI — Local Government for Sustainability	This report intends to be an initial exposure for local governments (LGs) to the subject of sustainable mobility: an introductory urban sustainable mobility guide for LGs.
Changing Habits for Urban Mobility Solutions (CHUMS)	European mission — Intelligent Energy Europe	The aim of the project is to apply a composite CHUMS behavioral change campaigns in 5 'champion' cites that represent the scale of carpooling and the diversity of mobility mind-sets in Europe: Craiova (RO), Edinburgh (UK), Leuven (B), Toulouse (F) and Perugia (IT).
Impact of Carpooling on Fuel Saving in Urban Transportation: Case Study of Tehran	Seyedehsan Seyedabrishamia, Amirreza Mamdoohia, Ali Barzegarb, Sajjad Hasanpourb (Procedia-Social and Behavioral Science)	In this paper, the factors which persuade travellers to choose carpooling are investigated for Tehran city, capital of Iran. Considering the data, carpooling impacts are analyzed in different situations. The results show that if appropriate strategies like carpooling websites are designed to help travellers for identifying appropriate rideshares, carpooling would increase by 30 percent and this increase will reduce annual fuel consumption about 240 million litres. Results also show that high occupancy vehicle lanes (HOV) that reduce travel time for ridesharing may not highly influence on carpooling tendency of travellers.

Innovative Transportation Index	U.S. PIRG Education Fund	This report reviews the availability of 11 technology-enabled transportation services — including online ridesourcing, carsharing, ridesharing, taxi hailing, static and real-time transit information, multi-modal apps, and virtual transit ticketing — in 70 U.S. cities. It finds that residents of 19 cities, with a combined population of nearly 28 million people, have access to eight or more of these services.
Parking Management for Smart Growth	Richard W. Wilson	This book offers a set of tools and a method for strategic parking management, so that communities can better use parking resources and avoid overbuilding parking.
Parking Solutions	American Planning Association	This PAS Essential Info Packet provides articles and reports on the background, importance, and range of parking strategies available to planners.
Peer to Peer Car Sharing Study	Ingrid Ballús-Armet, Susan A. Shaheen, Kelly Clonts, and David Weinzimmer	Exploring Public Perception and Market Characteristics in the San Francisco Bay area, California
Public Bike Sharing in North America	Mineta Transportation INstitute	Evaluates public bikesharing in North America, reviewing the change in travel behavior exhibited by members of different programs in the context of their business models and operational environment.
Sustainable Railway Futures: Issues and Challenges	Becky P.Y. Loo, Claude Comtois	This in-depth overview places the importance of railways in the wider context of comprehensive sustainability, which encompasses sustainable development, social and economic equity and community livability. This book offers the latest research insights on the renewed interest about railway expansions and their wide-ranging environmental, socio-economic and even political implications.



GREENHOUSE GAS REDUCTION TOOLKIT

How to Take Action in Your Community

TABLE OF CONTENTS

INTRODUCTION TO THE GREENHOUSE GAS REDUCTION TOOLKIT

The Greenhouse Gas Reduction Toolkit (Toolkit) is designed to support cities, counties, and regions as they work to advance their emissions reduction programs. It identifies best-practices, strategies and actions that reduce greenhouse gas (GHG) emissions while enhancing quality of life and helping create thriving communities.

The menu of over 250 actions from six emission sectors reflect input from a diverse group of experts. The actions are adaptable to fit the unique needs of communities and vary in terms of carbon reduction potential, feasibility, cost, associated co-benefits and more.

HIGH-IMPACT SECTORS

The Toolkit provides readers with ideas to reduce emissions stemming from the six GHG sectors common to most Colorado communities[1]:

Full descriptions of these sectors are provided in their respective chapters.

ENERGY SUPPLY

How electricity powering the community is generated

RESIDENTIAL ENERGY

How energy is used in residential buildings

COMMERCIAL ENERGY

How energy is used in commercial buildings

VEHICLES & TRANSPORTATION

The on-road movement of people, goods and services in private, transit and fleet vehicles

WASTE & LANDFILL

The solid waste generated by the community and how it is transported to the landfill

AVIATION & AIRPORT

Aircraft operations as well as energy use and transportation directly attributable to airport operations and passengers

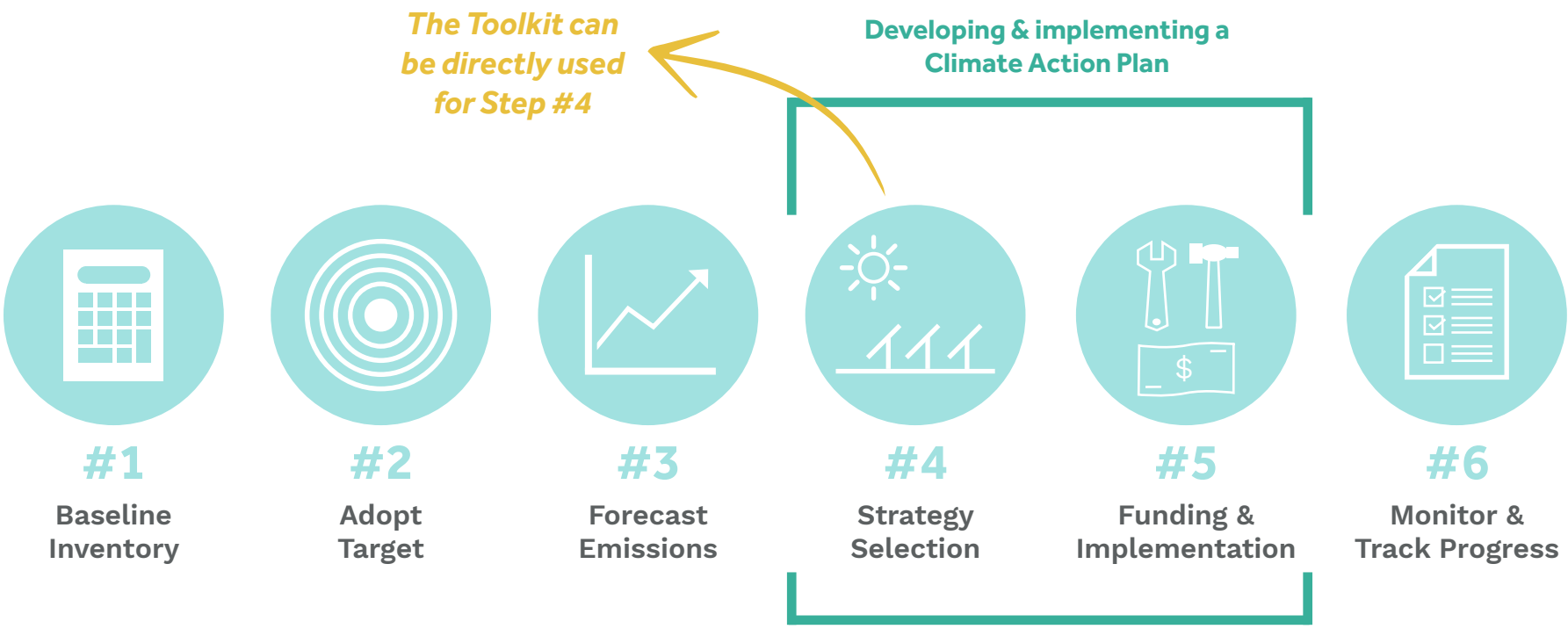
[1] These sectors also align with national and international best practices. Both the *US Community Protocol* and the *Global Protocol for Communities* suggest tracking and mitigating emissions associated with these activities.

HOW TO USE THE TOOLKIT

Fundamentally, the Toolkit is a shortcut and resource communities can use to develop climate action plans that fit their unique conditions. By listing potential actions in addition to defining the associated GHG reduction potential and co-benefits of each one, the priorities that are most important to a given community are identifiable.

The most effective way to use the Toolkit is to identify actions for implementation during the "strategy selection" phase of the climate action planning process[2]. Once actions have been selected, communities can get into the detailed deliberation necessary to move selected actions towards implementation. The Toolkit itself is a type of workbook and provides the user with space to take notes and brainstorm key considerations like implementation timeframe and partners. Since the actions detailed throughout the document are generalized, it is likely that communities will choose to modify, customize and specify Toolkit language into their own.

As actions are identified and moved towards implementation, a wide variety of considerations will likely be evaluated. Among these, it is especially beneficial to compare preferred climate actions with other strategic planning documents to identify complementary priorities. It is also especially helpful to consider opportunities for regional collaboration, given that efforts at the multijurisdictional scale can lead to efficiencies and greater impact.



[2] Detailed information and resources for completing each of these steps is available at http://www.coolcalifornia.org/local-government/toolkit and http://icleiusa.org/programs/emissions-management/5-milestones.
Page 4 figure is based on the Climate Action Resource Guide graphic on CoolCalifornia.org from the California Air Resources Board, http://www.coolcalifornia.org/local-government/toolkit.

TOOLKIT PROCESS

The Toolkit emerged as a by-product of the City of Aspen's most recent climate action planning (CAP) process. During 2016 and 2017, Aspen convened experts under the auspices of an official Advisory Committee (AC) to develop a robust strategy aimed at achieving its long-term GHG reduction goals (30% below 2004 levels by 2020 and 80% below 2004 levels by 2050). This AC is comprised mostly of leadership-level staff, specialists, and elected officials or board members[3].

The deliberative, yearlong process of GHG analysis, stakeholder meetings, and community surveys, led the leadership team to the realization that the refined yet comprehensive list of 250+ actions was far beyond the scope of a 3-5 year CAP. Further, the group realized that the list of actions could be relevant to other communities. Not wanting to limit the accessibility and impact of this impressive body of work, compiling the Toolkit became the solution to provide Aspen and others with an immediate-, mid- and long-term planning resource.

KEY RECOMMENDATIONS FOR COMMUNITY LEADERS

As community members convene to determine which actions to prioritize and refine for implementation, it is important that leaders create a supportive culture and provide resources for success. These recommendations for decision-makers will help ensure success of the overall climate planning and implementation process:

1. **Secure and prioritize the necessary organizational capacity.** This could involve assigning existing staff, hiring new staff, convening advisory commissions or otherwise.

2. Ensure that **stakeholders from all relevant sectors** are included in selecting Toolkit actions for the community's plan.

3. **Identify champions** to guide implementation when the plan is finalized.

4. **Identify and allocate funds** for plan development and implementation. This could include using existing funds, securing a new funding mechanism, or incremental multi-year budgeting. Funding is needed for projects, infrastructure, outreach, and staff capacity.

5. **Develop technical capacity** to do the work and an understanding of the linkages between climate and other local priorities. Joining the Compact of Colorado Communities[4] provides training for all levels of staff from specialists to senior leadership.

6. **Engage in state policy discussions.** Often, local priorities can be bolstered by enabling legislation at the state level. Groups such as Colorado Communities for Climate Action[5] enable municipalities to collectively represent their interests at the state capital.

7. **Collaborate across jurisdictional boundaries.** Regional collaboration in all sectors enhances efficiency and magnifies impact.

8. **Track performance, celebrate successes, and adjust course** when necessary. By measuring progress, building off what works, reevaluating when necessary, trying new things and maintaining a long-term commitment, communities are more likely to be successful in achieving their climate-related goals.

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[3] List of Advisory Committee members provided in the Acknowledgments section of this document.
[4] http://www.compactofcoloradocommunities.org/
[5] http://cc4ca.org/

GHG REDUCTION TOOLKIT: Key & Definitions

In addition to presenting a wide range of options for reducing GHG emissions in each sector, the Toolkit presents a 'GHG reduction potential' ranking and a list of potential co-benefits of each 'Objective' and 'Action'. The schematic below explains the elements of the tables throughout the rest of the document.

OBJECTIVE:

The broad and big picture things that need to happen to make significant progress in reducing community-wide and regional GHG emissions.

ACTION:

The programs, policies and steps that help achieve each Objective.

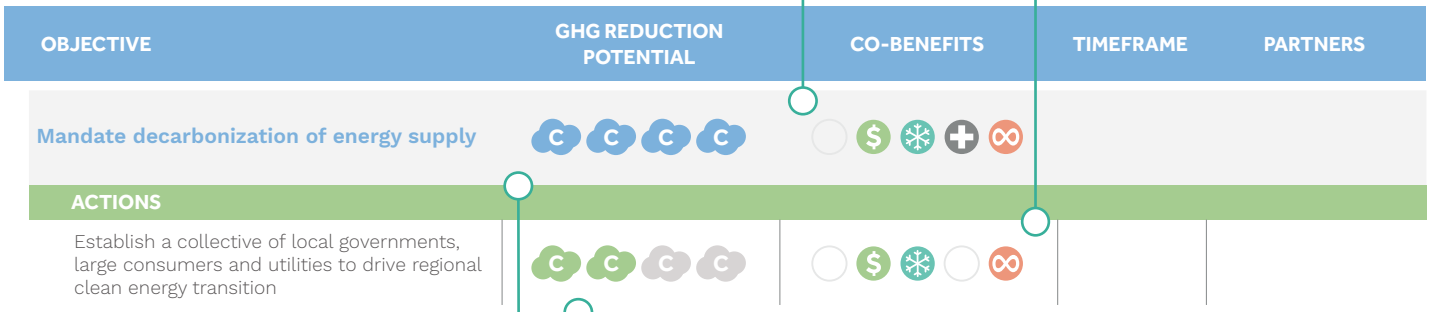
CO-BENEFITS:

Co-benefits are the additional positive benefits related to the reduction of greenhouse gases. Nearly all of the Objectives and Actions in this toolkit have co-benefits that achieve at least one of these measures:

Objective co-benefits:
The primary co-benefits of accomplishing the Objective.

Action co-benefits:
The specific co-benefits of implementing the Action.

- Promotes Equity
- Fosters Economic Sustainability
- Improves Local Environmental Quality
- Enhances Public Health & Safety
- Builds Resilience



GHG REDUCTION POTENTIAL (BLUE):

GHG reduction potential for each **Objective** represents how much it could reduce GHG emissions in the context of the sector it is a part of if fully and successfully implemented. Reduction potential was quantified using a proprietary model and simplified to a scale of 1 to 4 for presentation in the Toolkit:

Marginal

Small

Medium

Large

GHG REDUCTION POTENTIAL (GREEN):

GHG reduction potential for each **Action** represents how much it could reduce GHG emissions in the context of the Objective it is a part of. Reduction potential was approximated and is presented using a 1 to 4 scale:

Marginal

Small

Medium

Large

TIMEFRAME:

Defines whether the action is happening now or whether it should happen in the near, mid- or long-term future.

PARTNERS:

Describes which individuals, groups or organizations are leading and collaborating on implementation.

These columns have been left blank and are to be filled out by Toolkit users to help choose Actions for prioritization and implementation.

GHG REDUCTION TOOLKIT:

Energy Supply

GHG emissions in the **Energy Supply** sector are associated with purchased electricity and the use of natural gas and propane in residential and commercial buildings. The carbon intensity of a given electricity supply is the result of the resources used to generate the power; fossil resources are significantly more carbon intensive than renewable energy sources. Opportunities to reduce emissions in this sector range from fuel switching to decentralizing production. The co-benefits of successfully reducing Energy Supply sector GHGs include widespread improvements to environmental quality and the unleashing of wealth creation and employment opportunities.

GHG REDUCTION TOOLKIT: Energy Supply

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Mandate decarbonization of energy supply	C C C C	Primary Co-Benefits: $ ❄ ✚ ∞		
ACTIONS				
Participate in regional collaborative of governments, businesses, and utilities to drive clean energy transition	C C C C	$ ❄ ∞		
Establish regional market-based mechanism favoring low-carbon energy (e.g., a price on carbon or a carbon tax and fee)	C C C C	= $		
Pursue retirement, conversion or sale of fossil-fuel plants serving area	C C C C	❄ ∞		
Remove barriers to local renewable energy generation	C C C C	∞		
Establish a local renewable energy generation target	C C C C	$ ❄ ∞		
Communicate to utilities the importance of reducing the carbon content of electricity	C C C C	$ ❄ ∞		
Enable consumers to purchase and produce renewable energy	C C C C	Primary Co-Benefits: = $ ❄ ✚ ∞		
ACTIONS				
Install renewable systems on municipal facilities	C C C C	$ ❄ ∞		

C Level of Potential GHG Reduction
= Promotes Equity
$ Fosters Economic Sustainability
❄ Improves Local Environmental Quality
✚ Enhances Public Health & Safety
∞ Builds Resilience

GHG REDUCTION TOOLKIT: Energy Supply

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Enable consumers to purchase and produce renewable energy				
ACTIONS				
Expand municipal renewable energy power purchasing when on-site renewables are unsuitable	C C C C	$ ❄		
Pilot microgrid infrastructure to create districts that produce the same amount of energy they consume	C C C C	$ ∞		
Enable consumers to participate in wholesale clean power market (e.g., feed-in tariffs, net metering)	C C C C	= $ ∞		
Promote access to rooftop solar for homes and businesses through code and utility policy	C C C C	= $ ∞		
Assist large entities in implementing clean energy purchasing (e.g., virtual PPAs)	C C C C	$		
Use Property Assessed Clean Energy (PACE) and other financing mechanisms to fund renewable installations	C C C C	= $ ❄ ∞		
Address the soft costs of solar energy installations such as permitting and interconnection fees	C C C C	= $ ∞		
Change land use codes to encourage regional solar development	C C C C	$ ❄ ∞		

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GHG REDUCTION TOOLKIT: Energy Supply

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Reduce the cost of renewable energy	C C C C	Primary Co-Benefits: = $ ∞		
ACTIONS				
Expand Advanced Metering Infrastructure (AMI)	C C C C	= $		
Facilitate solar PV and/or solar thermal bulk purchase program	C C C C	= $ ❄ ∞		
Provide funding and incentives for residential and commercial solar projects	C C C C	= $ ❄ ∞		
Expand solar programs for low-income households (e.g., GRID Alternatives)	C C C C	= $ ❄ ∞		
Streamline and incentivize rooftop solar installation process (e.g., sales tax legislation)	C C C C	= $ ❄ ∞		
Incentivize local utility owned and operated renewable capacity	C C C C	$ ❄ ∞		
Incentivize community solar	C C C C	= $ ❄ ∞		

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GHG REDUCTION TOOLKIT: Energy Supply

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Invest in renewable generation at the community and utility scales	C C C C	Primary Co-Benefits: $ ❄ ∞		
ACTIONS				
Develop goal to self-generate a given percentage of government, public, and nonprofit buildings' energy needs and install corresponding renewable capacity	C C C C	$ ❄ ∞		
Develop geothermal energy	C C C C	$ ∞		
Develop local hydropower capacity (ideally micro, pico-hydro or run of the river)	C C C C	$ ❄ ∞		
Site and develop utility-operated renewable capacity in local service area	C C C C	$ ❄ ∞		
Advance regional grid flexibility to enable a predominantly renewable electricity supply	C C C C	= $ ❄ + ∞		
Invest in energy storage to address the intermittency of wind and solar	C C C C	= $ ❄ + ∞		
Install methane digesters	C C C C	$ ❄		
Encourage customers of electric cooperatives to vote in board elections	C C C C	=		

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GHG REDUCTION TOOLKIT: Energy Supply

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Support relevant federal and state policies through active legislative and regulatory engagement	C C C C	Primary Co-Benefits: = $ ❄ + ∞		
ACTIONS				
Promote and share success of local climate initiatives as local narrative for broader climate action	C C C C			
Cultivate elected officials as local champions for state and federal climate and energy policy	C C C C	$ ❄ + ∞		
Track state and federal climate and energy policy and engage when appropriate	C C C C	= $ ❄ + ∞		
Advocate for grid modernization and flexibility policies	C C C C	$ ❄ ∞		
Support continuation and strengthening of Colorado's Renewable Energy Standard	C C C C	$ ❄ ∞		
Support State Energy Office	C C C C	= $ ❄ + ∞		
Become a member of Colorado Communities for Climate Action to support state climate/ energy policies	C C C C	=		

C Level of Potential GHG Reduction

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❄ Improves Local Environmental Quality

+ Enhances Public Health & Safety

∞ Builds Resilience

GHG REDUCTION TOOLKIT: Energy Supply

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Support relevant federal and state policies through active legislative and regulatory engagement				
ACTIONS				
Join coalition of communities advocating for federal climate/energy policies (e.g., Mountain Pact)	C C C C	= $ ❄ + ∞		
Support state or national price on carbon	C C C C	= $ ❄ + ∞		
Help defend the Clean Air Act and continued EPA regulation of CO_2 as a pollutant	C C C C	= $ ❄ + ∞		

Notes:

C Level of Potential GHG Reduction

= Promotes Equity

$ Fosters Economic Sustainability

❄ Improves Local Environmental Quality

+ Enhances Public Health & Safety

∞ Builds Resilience

GHG emissions in the **Residential Energy** sector are associated with the use of electricity, natural gas and propane in ownership and rental units. These units vary widely in age, quality, size and occupancy, and include single-family homes, multifamily properties, mobile homes and residences in mixed use buildings. Residential units are typically served by both electric and natural gas utilities, and opportunities to reduce GHG emissions are tied to decarbonizing the supply of energy flowing to the unit and consuming less of it. The co-benefits of successfully reducing Residential Energy sector GHGs include direct consumer savings and improved dwelling comfort and safety.

GHG REDUCTION TOOLKIT:

Residential Energy

GHG REDUCTION TOOLKIT: Residential Energy

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Increase the efficiency of natural gas space and water heating, and convert to electric	C C C C	Primary Co-Benefits: ○ ○ ❄ ✚ ∞		
ACTIONS				
Convert natural gas heating system to electric or renewable energy	C C C C	○ $ ❄ ✚ ∞		
Convert natural gas water heating systems to electric or renewable energy	C C C C	○ $ ❄ ✚ ∞		
Heat buildings with geothermal heat pumps, air source heat pumps, or other heat exchange technology	C C C C	○ $ ❄ ○ ∞		
Integrate space and water heating equipment standards into building codes	C C C C	○ ○ ❄ ○ ∞		
Promote energy efficiency improvements such as adding insulation and pipe wrap to water heaters	C C C C	= $ ○ ✚ ○		
Offer technical assistance to determine natural gas heating alternatives	C C C C	= ○ ○ ○ ∞		
Encourage integration with air conditioning systems if future AC need is anticipated (e.g., dual ground/air-source heat pumps)	C C C C	○ ○ ○ ✚ ∞		

C Level of Potential GHG Reduction
= Promotes Equity
$ Fosters Economic Sustainability
❄ Improves Local Environmental Quality
✚ Enhances Public Health & Safety
∞ Builds Resilience

GHG REDUCTION TOOLKIT: Residential Energy

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Mandate no- to low-carbon standards for new construction and major remodels	C C C C	Primary Co-Benefits: = $ ❄ + ∞		
ACTIONS				
Incentivize above-code buildings	C C C C	$ ∞		
Adopt the latest energy codes with specific local requirements to exceed minimum standards	C C C C	$ ❄ + ∞		
Adopt net zero (or similar) building and energy conservation codes	C C C C	= $ ❄ + ∞		
Require net zero (or near net zero) for all new development	C C C C	= $ ❄ + ∞		
Require net zero (or near net zero) for houses over a certain square footage	C C C C	$ ❄ ∞		
Strengthen building codes and standards to move toward net zero energy	C C C C	$ ❄ ∞		
Conduct community trainings on updated code requirements	C C C C	= +		

C Level of Potential GHG Reduction
= Promotes Equity
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GHG REDUCTION TOOLKIT: Residential Energy

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Improve the energy efficiency performance of existing buildings	C C C C	Primary Co-Benefits: = $ ❄ + ∞		
ACTIONS				
Retrofit buildings to meet current building codes	C C C C	= $ ❄ + ∞		
Provide incentives for energy efficiency retrofits (e.g., tax abatement, rebates, etc.)	C C C C	= $ ❄ + ∞		
Enact ordinances to drive and support deep energy retrofits and align regionally	C C C C	$ ❄ ∞		
Facilitate education and accreditation for contractors, architects and property managers	C C C C	= ∞		
Require and incentivize measurement and verification (to gauge efficacy of energy efficiency programs)	C C C C	= $ ❄ + ∞		
Mandate sleep mode technology for second homes when unoccupied	C C C C	❄ ∞		
Encourage adoption of building automation systems	C C C C	❄ +		
Conduct energy efficiency challenges and provide incentives to drive energy retrofits	C C C C	$ ∞		
Expand number of cool roofs (white coating on rooftops) to reduce cooling needs	C C C C	= $ ❄ ∞		
Expand number of green roofs (covered in soil and vegetation) to reduce heating and cooling needs	C C C C	$ ❄ ∞		

C Level of Potential GHG Reduction

= Promotes Equity

$ Fosters Economic Sustainability

❄ Improves Local Environmental Quality

+ Enhances Public Health & Safety

∞ Builds Resilience

GHG REDUCTION TOOLKIT: Residential Energy

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Improve the energy efficiency performance of existing buildings				
ACTIONS				
Facilitate peer-to-peer information sharing among building owners	C C C C	= ∞		
Improve access to Property Assessed Clean Energy (PACE) and other specialized financing mechanisms	C C C C	= ❄ ∞		
Provide regulatory and zoning relief for projects that meet verifiable high energy standards (e.g., LEED, Net Zero Energy Building, etc.)	C C C C	= $ ∞		
Provide energy consulting services	C C C C	= $		
Support low-income households with energy upgrades and onsite renewable energy (e.g., Colorado's Affordable Residential Energy program, GRID Alternatives)	C C C C	= $ ❄ ✚ ∞		
Reduce energy consumption in rentals, apartments and multifamily buildings	C C C C	**Primary Co-Benefits:** = $ ❄ ✚ ∞		
ACTIONS				
Encourage and incentivize energy efficiency retrofits in rental housing	C C C C	= $ ❄ ✚ ∞		
Partner with seasonal housing providers to deploy large-scale energy efficiency retrofits	C C C C	= $ ❄ ✚ ∞		

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GHG REDUCTION TOOLKIT: Residential Energy

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Reduce energy consumption in rentals, apartments and multifamily buildings				
ACTIONS				
Partner with utilities to improve tenants' access to energy-usage data	C C C C	○ ○ ○ + ∞		
Implement mandatory, phased energy efficiency upgrades for rental units (e.g., SmartRegs in Boulder)	C C C C	= ○ ❄ ○ ∞		
Support building automation to optimize efficiency and effectiveness	C C C C	○ $ ○ ○ ○		
Deploy a targeted outreach strategy to engage renters	C C C C	= ○ ○ + ∞		
Adopt building energy reporting and disclosure ordinances	C C C C	○ ○ ○ ○ ○		
Require energy performance disclosure at point of lease or sale	C C C C	= $ ❄ ○ ○		
Implement sub-metering for multifamily buildings for more granular building energy data	C C C C	= ○ ○ ○ ∞		
Promote energy efficiency opportunities through outreach, workshops, and neighborhood challenges	C C C C	= ○ ○ ○ ∞		
Pilot green leasing strategies to address the landlord and tenant split incentive	C C C C	= $ ❄ + ∞		

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GHG REDUCTION TOOLKIT: Residential Energy

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Anticipate and mitigate likely expansion of air conditioning use	C C C C	Primary Co-Benefits: ∞		
ACTIONS				
Avoid or delay the need for air conditioning through building design and management	C C C C	$ ∞		
Require high efficiency air conditioning systems as AC use becomes more prevalent	C C C C	$		
Coordinate with efforts to adopt high efficiency electric heating systems (e.g., dual ground/air-source heat pumps)	C C C C	+ ∞		

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GHG emissions in the **Commercial Energy** sector are associated with the use of electricity, natural gas and propane in owner-occupied and tenant-occupied businesses in single occupancy and mixed-use buildings. These properties vary widely in age, quality, size, occupancy and use. All are typically served by both electric and natural gas utilities. Opportunities to reduce GHG emissions are tied to decarbonizing the supply of energy flowing to commercial properties and consuming less energy in them. The co-benefits of successfully reducing Commercial Energy sector GHGs include direct financial savings for businesses and enhancing the health, safety and comfort of the built environment.

GHG REDUCTION TOOLKIT:

Commercial Energy

GHG REDUCTION TOOLKIT: Commercial Energy

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Promote building energy benchmarking and reporting	C C C C	Primary Co-Benefits: $ ❄ + ∞		
ACTIONS				
Create commercial energy benchmarking and disclosure ordinance	C C C C	$ ❄ +		
Leverage the business license renewal process as a way to increase benchmarking participation and performance	C C C C	= + ∞		
Facilitate submetering for more granular building energy data and improve building owners' access to utility data	C C C C	$ ∞		
Provide technical support to help building owners begin benchmarking	C C C C	=		
Increase the efficiency of natural gas heating systems and appliances	C C C C	Primary Co-Benefits: $ ❄ + ∞		
ACTIONS				
Expand participation in voluntary incentive programs for upgrading old or inefficient equipment	C C C C	$ ❄ + ∞		
Identify opportunities for and implement district heating projects	C C C C	$ ❄ + ∞		

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GHG REDUCTION TOOLKIT: Commercial Energy

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Replace NG heating and appliances with electric and/or renewable systems	C C C C	Primary Co-Benefits: ○ ○ ❄ ✚ ∞		
ACTIONS				
Eliminate natural gas connections for all new commercial developments	C C C C	○ ○ ○ ✚ ○		
Integrate geothermal heat or ground heat to offset natural gas use	C C C C	○ $ ❄ ✚ ∞		
Promote solar thermal for water heating	C C C C	○ $ ○ ✚ ∞		
Provide rebates and incentives to replace old or inefficient boilers with electric	C C C C	= ○ ○ ✚ ○		
Encourage integration with air conditioning systems if future AC need is anticipated (e.g., dual ground/air-source heat pumps)	C C C C	○ ○ ○ ✚ ∞		
Enhance energy and resource efficiency in new commercial developments	C C C C	Primary Co-Benefits: = $ ❄ ✚ ∞		
ACTIONS				
Strengthen building codes to promote energy and resource efficiency in new commercial developments	C C C C	○ ○ ❄ ✚ ∞		
Provide above-code incentives for new commercial developments	C C C C	○ ○ ❄ ✚ ○		

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GHG REDUCTION TOOLKIT: Commercial Energy

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Enhance energy and resource efficiency in new commercial developments				
ACTIONS				
Require new buildings achieve LEED standards, mandating that criteria focus on energy efficiency	C C C C	∞		
Require new buildings meet net zero energy building (NZEB) standards	C C C C	∞		
Use land use planning to encourage density in development	C C C C			
Allow an outcome-based compliance path (target) to promote build/design flexibility	C C C C	∞		
Coordinate regional alignment of building energy codes and beyond code preferences	C C C C	= $		
Bring all buildings up to current building codes or retrofit a majority of existing buildings	C C C C	**Primary Co-Benefits:** $ ∞		
ACTIONS				
Require or incentivize remodels to meet current energy code	C C C C	∞		
Require commercial lighting retrofits in existing buildings	C C C C	$ ∞		

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GHG REDUCTION TOOLKIT: Commercial Energy

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Bring all buildings up to current building codes or retrofit a majority of existing buildings				
ACTIONS				
Require or incentivize refrigeration upgrades	C C C C	$ ❄ ∞		
Ban or disincentivize open doors while heating or cooling is happening	C C C C	❄ ✚		
Conduct energy assessments	C C C C	= $ ✚ ∞		
Provide energy efficiency and renewable energy incentives for large consumers	C C C C	$ ❄ ✚ ∞		
Develop programs targeting specific commercial users (e.g., small lodges, restaurants, etc.)	C C C C	$ ❄		
Require deep energy retrofits at designated points, such as time of sale or major renovation	C C C C	= $ ❄ ✚ ∞		
Establish incremental timeline to require that all commercial buildings meet current building energy codes	C C C C	❄ ✚ ∞		
Develop and implement program for energy efficiency and renewable energy in historical buildings	C C C C	$ ❄ ✚ ∞		

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GHG REDUCTION TOOLKIT: Commercial Energy

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Model best practices through energy retrofitting of government buildings and properties	C C C C	Primary Co-Benefits: $ ❄ + ∞		
ACTIONS				
Implement energy efficiency measures on government buildings, offices and facilities	C C C C	$ ❄ + ∞		
Improve energy efficiency in affordable housing units and complexes	C C C C	= $ ❄ + ∞		
Require green capital needs assessment for renovation projects financed by local government	C C C C	$ ❄ + ∞		
Train building operators and facility managers in energy efficiency best practices	C C C C	$ +		
Ensure new government buildings achieve high performance green building standards (e.g., NEZB, LEED, etc.)	C C C C	$ ❄ + ∞		
Identify opportunities for and implement district heating in new construction, remodels and campuses	C C C C	$ ❄ + ∞		
Improve education and infrastructure; optimize utility rates	C C C C	Primary Co-Benefits: = $ ∞		
ACTIONS				
Integrate carbon sequestration practices and infrastructure into built environment	C C C C	❄ + ∞		

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GHG REDUCTION TOOLKIT: Commercial Energy

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Improve education and infrastructure; optimize utility rates				
ACTIONS				
Provide contractor education programs on green building and energy efficiency upgrades	C C C C	$ + ∞		
Require certification of building operators	C C C C	$ ❄ + ∞		
Redesign utility rates to incentivize and balance current and future priorities (e.g., electric vehicles, fuel switching, time of use, peak shaving, energy efficiency, demand side management)	C C C C	= $ ❄ + ∞		
Establish a green business certification program to recognize buildings that achieve energy efficiency and sustainability thresholds	C C C C	$ ❄		
Create green business corridors	C C C C	$ ❄		
Require higher energy efficiency standards for major appliances	C C C C	❄ + ∞		
Optimize water distribution system to make it as efficient as possible	C C C C	$ + ∞		
Increase public works oversight in construction to prevent continual reconstruction due to poor initial construction quality	C C C C	= $ ∞		

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GHG REDUCTION TOOLKIT: Commercial Energy

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Improve education and infrastructure; optimize utility rates				
ACTIONS				
Promote optimal thermostat settings to couple comfort with efficiency	C C C C	=		
Expand messaging and communication on energy programs	C C C C	= $		
Anticipate and mitigate likely expansion of air conditioning use in buildings	C C C C	**Primary Co-Benefits:** $ + ∞		
ACTIONS				
Avoid or delay the need for air conditioning through building design and management	C C C C	$ ∞		
Require high efficiency air conditioning systems as AC use becomes more prevalent	C C C C	$		
Coordinate with efforts to adopt high efficiency electric heating systems (e.g., dual ground/air-source heat pumps)	C C C C	+ ∞		

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GHG REDUCTION TOOLKIT: Commercial Energy

Notes:

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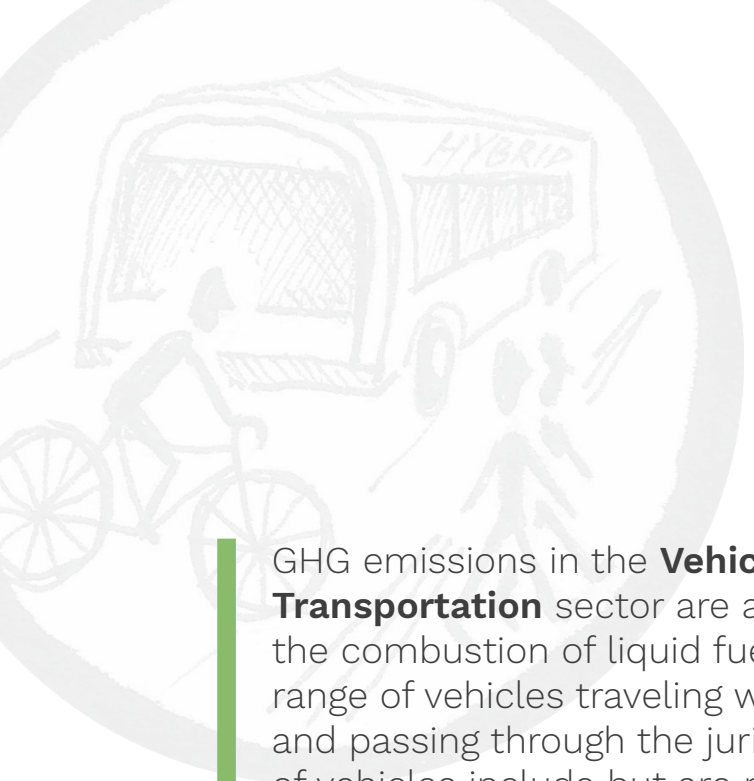

GHG emissions in the **Vehicles and Transportation** sector are associated with the combustion of liquid fuels in the wide range of vehicles traveling within, to, from, and passing through the jurisdiction. Types of vehicles include but are not limited to personal vehicles, light trucks, transit buses, commercial transport vehicles, heavy duty vehicles, and motorcycles. Opportunities to reduce emissions in this sector are diverse, and include shifting transportation modes away from single occupancy vehicle use and transitioning personal and commercial vehicle fleets to low or zero-emission options like electric vehicles. The co-benefits of successfully reducing Transportation sector GHGs include reduced congestion and improved air quality.

GHG REDUCTION TOOLKIT:

Vehicles & Transportation

GHG REDUCTION TOOLKIT: Vehicles & Transportation

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Reduce VMT by promoting alternatives to single-occupancy vehicles	C C C C	Primary Co-Benefits: = $ ❄ + ∞		
ACTIONS				
Encourage employers to subsidize bus passes for employees	C C C C	= ❄ +		
Create funding mechanism for free regional bus ridership	C C C C	= $ ❄ +		
Promote and incentivize carpooling	C C C C	= $ ❄ + ∞		
Strengthen enforcement of high occupancy vehicle (HOV) and transit lanes	C C C C	❄ +		
Boost public transit reliability	C C C C	=		
Promote teleworking as an alternative to commuting	C C C C	$ ❄		
Make transit more convenient, affordable and fun than driving (e.g., optimized schedules, dedicated bus lanes, comfortable seats, free wi-fi, etc.)	C C C C	= $ ❄ + ∞		
Increase the number and quality of safe routes and transit options to schools	C C C C	= ❄ + ∞		

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GHG REDUCTION TOOLKIT: Vehicles & Transportation

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Reduce VMT by promoting alternatives to single-occupancy vehicles				
ACTIONS				
Evaluate high-speed rail to optimize transit coverage and efficiency	C C C C	= $ ❄ + ∞		
Enable growth of on-demand mobility services (i.e., ride-sharing, e-hailing, bike-sharing, car-sharing etc.)	C C C C	○ $ ❄ + ○		
Place 'air pollution disclosure' labels on gas pumps (similar to Surgeon General's warning on cigarettes)	C C C C	○ ○ ○ ○ ○		
Enhance first and last mile connectivity to transit	C C C C	**Primary Co-Benefits:** = $ ❄ + ∞		
ACTIONS				
Expand feeder transit network to primary bus stops (e.g., circulators, 'mobility as a service')	C C C C	= $ ❄ + ∞		
Expand bike share network to better connect neighborhoods and work centers to public transit	C C C C	= $ ❄ + ∞		
Expand rideshare network to better connect people traveling to similar destinations	C C C C	= $ ❄ + ∞		

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GHG REDUCTION TOOLKIT: Vehicles & Transportation

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Enhance first and last mile connectivity to transit				
ACTIONS				
Promote zero-emission and driverless technologies for expanded mobility services	C C C C	$ +		
Expand bicycle network to better connect neighborhoods and work centers to public transit	C C C C	= $ ❄ + ∞		
Expand pedestrian infrastructure to better connect neighborhoods and work centers to public transit	C C C C	= $ ❄ + ∞		
Promote adoption of alternate fuel vehicles for individuals and fleets	C C C C	**Primary Co-Benefits:** $ ❄ + ∞		
ACTIONS				
Provide free parking for zero-emissions vehicles in areas that typically charge parking fees	C C C C	❄ +		
Increase the proportion of EVs in fleets (e.g., car share, municipal, rental cars, hotel shuttles, etc.)	C C C C	= ❄ +		
Create EV charging hubs for taxis or other fleets	C C C C	❄ + ∞		
Increase EV charging stations in visible, accessible locations	C C C C	= $ ❄ + ∞		

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GHG REDUCTION TOOLKIT: Vehicles & Transportation

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Promote adoption of alternate fuel vehicles for individuals and fleets				
ACTIONS				
Encourage off-peak EV charging through electricity rate structure	C C C C	$ ❄ + ∞		
Require EV charging stations (or EV readiness) in all new commercial developments	C C C C	$ ❄ + ∞		
Require EV charging stations (or EV readiness) in all new multifamily developments	C C C C	= $ ❄ + ∞		
Require all new single-family construction to be EV ready	C C C C	$ ❄ + ∞		
Provide incentives to tie PV (and storage battery) installation to EV purchases	C C C C	$ ❄ + ∞		
Provide free public EV charging stations	C C C C	= $ ❄ + ∞		
Support the full spectrum of low emission vehicle technologies, in addition to EVs	C C C C	= $ ❄ +		
Convert transit and government fleets to low-carbon fuel vehicles (e.g., electric buses)	C C C C	❄ + ∞		
Provide financial incentives to convert fleets to low-carbon fuel vehicles	C C C C	= $ ❄ +		
Make transportation fuels at landfill using methane capture	C C C C	$ ❄ ∞		

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GHG REDUCTION TOOLKIT: Vehicles & Transportation

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Promote the adoption of alternate fuel vehicles for individuals and fleets				
ACTIONS				
Deploy public outreach campaign and give the public opportunities to drive an EV	C C C C	=		
Facilitate EV bulk purchase program	C C C C	$ ❄ + ∞		
Redesign urban form and population density to reduce vehicle use	C C C C	Primary Co-Benefits: ❄ + ∞		
ACTIONS				
Use zoning and transit-oriented development to site new development near jobs and transit	C C C C	= $ ❄ + ∞		
Enable a greater percentage of the workforce to live near work and transit	C C C C	= $ ❄ + ∞		
Improve winter bike and pedestrian options	C C C C	= $ ❄ + ∞		
Improve and expand pedestrian infrastructure (e.g., pedestrian malls, fast walk signals, sidewalks)	C C C C	= $ ❄ + ∞		
Create or expand no car zones	C C C C	$ ❄ + ∞		

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GHG REDUCTION TOOLKIT: Vehicles & Transportation

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Redesign urban form and population density to reduce vehicle use				
ACTIONS				
Improve and expand bicycle infrastructure (e.g., well-placed bike lanes, find solutions for conflict/hazard areas, etc.)	C C C C	= $ ❄ + ∞		
Build bike racks in strategic locations; consider covered or winter bike racks	C C C C	= $ ❄ + ∞		
Support local food production and sale at scale	C C C C	$ ❄ + ∞		
Change codes to include EV service equipment installations as acceptable transportation demand management (TDM) option	C C C C	❄ ∞		
Limit parking and drop-off permits at schools	C C C C	❄ +		
Eliminate minimum parking requirements for development; instead, require transit and mobility services	C C C C	= + ∞		
Support relevant federal, state and local policy through active legislative and regulatory engagement	C C C C	**Primary Co-Benefits:** = $ ❄ + ∞		
ACTIONS				
Support local, state and federal incentives, policies and programs to grow EV adoption and infrastructure	C C C C	= ❄ +		

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GHG REDUCTION TOOLKIT: Vehicles & Transportation

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Support relevant federal, state and local policy through active legislative and regulatory engagement				
ACTIONS				
Actively support Colorado transit grants	C C C C	= $ ❄ + ∞		
Support EPA greenhouse gas emissions standards and fuel efficiency standards for medium- and heavy-duty engines and vehicles	C C C C	❄ +		
Promote state fuel economy standards, such as California's standards	C C C C	❄ +		
Advocate for a strengthening of the CAFE standards (the national fuel economy targets)	C C C C	= ❄ +		
Promote new mobility technologies and business models	C C C C	Primary Co-Benefits: $		
ACTIONS				
Integrate a multi-modal mobility system at the regional or state scale	C C C C	= $ ❄ + ∞		
Pilot on-demand bus and/or van share	C C C C	= $ ❄ +		
Implement peak demand service for strategic transit routes	C C C C	= $ ❄ + ∞		

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GHG REDUCTION TOOLKIT: Vehicles & Transportation

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Promote new mobility technologies and business models				
ACTIONS				
Address regulatory barriers to shared-use mobility and driverless vehicles	C C C C	= $ ❄ + ∞		
Support on-demand parking apps to reduce vehicle circulation and congestion	C C C C	$ ❄		
Deploy real-time public transit data to provide up-to-the-minute information (e.g., bus arrival information, parking availability, etc.)	C C C C	❄ +		
Increase the cost of using fossil-fuel vehicles	C C C C	**Primary Co-Benefits:** ❄ +		
ACTIONS				
Establish CO_2 fees on fossil-fuel vehicles at purchase or registration	C C C C	❄ +		
Establish congestion fees on fossil-fuel vehicles in designated areas or for driving during high-use times	C C C C	❄ +		
Tax gasoline sales locally or regionally	C C C C	$ ❄ +		

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GHG REDUCTION TOOLKIT: Vehicles & Transportation

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Increase the cost of driving in certain places	C C C C	Primary Co-Benefits: ○ ○ ❄ ✚ ○		
ACTIONS				
Institute new parking pricing models (e.g., performance-based parking, off-street parking tax, dynamic pricing, etc.)	C C C C	○ ○ ❄ ○ ○		
Establish regional road pricing (e.g., toll roads, dynamic pricing)	C C C C	○ ○ ❄ ○ ○		

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GHG emissions in the **Waste and Landfill** sector come from waste generated within the jurisdiction, then transported to, and processed at the landfill. Organic components within the waste stream generate methane as they decompose. Organic components vary but predominantly include food waste and construction and demolition (C&D) waste. Heavy duty vehicles hauling waste to the landfill and processing it on site consume liquid fuels. Opportunities to reduce emissions in this sector include diverting or salvaging organic components of the waste stream and increasing the efficiency of hauling and processing. The co-benefits of successfully reducing Landfill sector GHGs include extending the life of local landfills and improving local environmental quality.

GHG REDUCTION TOOLKIT:

Waste & Landfill

GHG REDUCTION TOOLKIT: Waste & Landfill

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Increase rates of and participation in composting and recycling	C C C C	Primary Co-Benefits: $ ❄ ∞		
ACTIONS				
Require composting through codes or regulations	C C C C	= $ ❄ + ∞		
Create convenient, accessible neighborhood compost drop-off locations	C C C C	= ❄ ∞		
Equip an entity like the landfill with resources to turn organic waste into a safe and usable compost product	C C C C	$ ❄ + ∞		
Make finished compost product accessible to gardeners and landscapers	C C C C	$ ❄ ∞		
Require waste haulers to offer compost pickup	C C C C	$ ❄ + ∞		
Require waste haulers to offer recycling pickup	C C C C	= ❄		
Run ongoing public education campaigns to promote composting	C C C C	=		
Ensure buildings have adequate space for composting and recycling collection and storage (e.g., equal space ordinance)	C C C C	❄ +		
Create (or strengthen, if existing) yard waste composting ordinances	C C C C	❄ +		

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GHG REDUCTION TOOLKIT: Waste & Landfill

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Increase rates of and participation in composting and recycling				
ACTIONS				
Create (or enforce, if existing) ban on burying yard waste in landfill				
Create composting program and infrastructure for multifamily complexes				
Supply local food waste to agricultural operations (e.g., animal feed)				
Provide resources and support for property managers to increase recycling and composting				
Charge more for trash service and reduce trash pickup days				
Implement a single-stream recycling policy				
Expand public recycling and composting infrastructure				
Expand businesses' participation in compost collection services				

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GHG REDUCTION TOOLKIT: Waste & Landfill

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Maximize diversion of construction and demolition (C&D) waste	C C C C	Primary Co-Benefits: $ ❄ ∞		
ACTIONS				
Create a system for moving C&D waste to markets	C C C C	$ ∞		
Make demolition more expensive than deconstruction	C C C C	$ ❄ ✚ ∞		
Mandate deconstruction	C C C C	$ ❄ ✚ ∞		
Update building codes to ensure deconstruction of buildings is prioritized over demolition	C C C C	$ ❄ ✚ ∞		
Charge a lot more for C&D loads	C C C C	$ ❄ ✚ ∞		
Adopt and enforce C&D waste ordinance	C C C C	$ ❄ ✚ ∞		
Create a salvage yard for deconstructed building materials	C C C C	= $ ❄ ✚ ∞		
Establish reuse center for building materials	C C C C	= $ ❄ ✚ ∞		
Facilitate markets for resale businesses to pre-resell materials	C C C C	$ ❄ ∞		

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∞ Builds Resilience

GHG REDUCTION TOOLKIT: Waste & Landfill

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Maximize diversion of construction and demolition (C&D) waste				
ACTIONS				
Offer incentives to encourage reuse of existing structures	C C C C	○ ○ ❄ ✚ ○		
Introduce onboard technology to sort C&D waste at landfill	C C C C	= $ ❄ ✚ ∞		
Provide technical support to contractors to reduce C&D waste	C C C C	= ○ ○ ✚ ○		
Increase community compliance with waste diversion ordinances	C C C C	**Primary Co-Benefits:** = ○ ❄ ✚ ○		
ACTIONS				
Impose tickets and fines for not recycling or for contaminating recycling loads	C C C C	○ ○ ○ ○ ○		
Provide consistent education across relevant target audiences	C C C C	= ○ ○ ○ ○		
Create and enforce zero-waste event requirements	C C C C	= ○ ❄ ○ ∞		
Require recycling and compost bins at public events	C C C C	= ○ ❄ ✚ ∞		
Align city, county and regional waste policies and codes	C C C C	= ○ ○ ○ ○		

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GHG REDUCTION TOOLKIT: Waste & Landfill

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Increase community compliance with waste diversion ordinances				
ACTIONS				
Perform compliance spot-checks (similar to health code inspections at restaurants)	C C C C	=		
Host community-wide waste collection events to support proper disposal of hard-to-recycle items (e.g., electronics, tires, batteries, etc.)	C C C C	= $ ❄ + ∞		
Consume fewer products and resources	C C C C	Primary Co-Benefits: ❄ ∞		
ACTIONS				
Conduct “buy local” and “consume local” campaigns	C C C C	$ ∞		
Promote reusable mugs and water bottles	C C C C	$ ❄		
Develop and adopt local Styrofoam ban	C C C C	❄ +		
Tax or ban plastic water bottles	C C C C	❄ +		
Develop programs to reduce use of plastic foodservice packaging	C C C C	❄ +		
Incentivize the use of reusable containers over disposable	C C C C	❄ +		

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GHG REDUCTION TOOLKIT: Waste & Landfill

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Consume fewer products and resources				
ACTIONS				
Promote government and corporate purchasing policies favoring low waste	C C C C	$ ❄ ∞		
Redesign organizational purchasing rules to favor sustainable consumption	C C C C	$ ❄ ∞		
Require improved materials management by businesses and government	C C C C	$ ❄ + ∞		
Increase oversight by public works departments to reduce the need to reconstruct poorly built projects	C C C C	❄ + ∞		
Support food waste reduction programs	C C C C	= $ ❄ + ∞		
Change state regulations to allow food rescue (e.g., food pantry)	C C C C	= $ ❄ + ∞		
Facilitate donation of excess or unused food (e.g., Uber-style app to connect restaurants and private chefs to organizations that feed the hungry)	C C C C	= $ ❄ + ∞		
Require use of recycled asphalt in streets	C C C C	❄ + ∞		
Ban plastic bags	C C C C	❄ +		

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GHG REDUCTION TOOLKIT: Waste & Landfill

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Consume fewer products and resources				
ACTIONS				
Impose fees on paper bags	C C C C	= ❄		
Promote thrift stores, reuse programs, fix-it clinics and community share programs	C C C C	= $ ❄ ∞		
Increase the cost of waste disposal for MSW and C&D	C C C C	Primary Co-Benefits: ❄ ∞		
ACTIONS				
Implement tiered 'Pay As You Throw' rates to all jurisdictions served by a particular landfill	C C C C	= ❄ ✚		
Expand and improve existing waste hauling practices	C C C C	Primary Co-Benefits: $ ❄ ✚		
ACTIONS				
Combine yard waste and food waste for pickup service	C C C C	$ ❄ ✚		
Re-route haulers to increase operating efficiency	C C C C	$ ❄ ✚		
Require haulers use cleaner vehicles	C C C C	❄ ✚		

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GHG REDUCTION TOOLKIT: Waste & Landfill

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Pilot new technologies	C C C C	Primary Co-Benefits: ∞		
ACTIONS				
Develop waste-to-energy technologies at regional landfills	C C C C	= $ ❄ + ∞		
Pilot small-scale anaerobic digestion facilities for organic waste	C C C C	$ ❄ + ∞		
Assess feasibility of FastOx Gasification (waste becomes energy via hydrogen, syngas)	C C C C	$ ❄ ∞		
Combine small-scale plasma gasification with district heating	C C C C	$ ❄ ∞		

Notes:

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GHG emissions in the **Aviation and Airport** sector are associated with aircraft operations, airport ground support equipment, on road vehicle use and energy consumed in airport buildings. Aircraft operations include landings and takeoffs. Opportunities to reduce emissions in this sector include increasing the operating efficiency of aircraft, electrifying ground support equipment and ground access vehicles and maximizing the energy efficiency and production of airport buildings. The co-benefits of successfully reducing Airport sector GHGs include improvements to both public health and environmental quality.

GHG REDUCTION TOOLKIT:

Aviation & Airport

GHG REDUCTION TOOLKIT: Aviation & Airport

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Reduce airport-controlled GHGs	C C C C	Primary Co-Benefits: ❄ ✚		
ACTIONS				
Require EVs and/or cleaner fuels for ground support vehicles and ground support equipment (GSE)	C C C C	❄		
Build onsite PV or PV canopies to power EV service vehicles and EV GSE	C C C C	$ ❄ ∞		
Install alternative fueling sources (would need to be regionally based) at airports to enable airlines to convert ground support equipment to cleaner, lower emission vehicles	C C C C	❄ ✚ ∞		
Maximize the energy efficiency and energy performance of airport buildings	C C C C	$ ❄ ✚ ∞		
Integrate ground heat or geothermal heating into existing buildings and facilities	C C C C	$ ❄ ∞		
Replace airfield lighting with LED lighting	C C C C	$ ❄ ∞		
Increase the efficiency of the airport curbside to reduce vehicle trip lengths and idling	C C C C	❄ ✚		
Prohibit vehicle idling in pickup/drop-off and waiting zones	C C C C	❄ ✚		
Install ground power and preconditioned air systems at gates to reduce the use of the auxiliary power units on aircraft	C C C C	❄		

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GHG REDUCTION TOOLKIT: Aviation & Airport

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Reduce airport-controlled GHGs				
ACTIONS				
Optimize waste diversion practices and rates at airport facilities and terminal	C C C C	○ ○ ❄ ✚ ∞		
Require taxi and airport shuttles to meet a clean-fuels or MPGe standard for onsite agreements	C C C C	○ ○ ❄ ○ ○		
Reduce aircraft- and aviation-related GHGs	C C C C	Primary Co-Benefits: ○ ○ ❄ ✚ ○		
ACTIONS				
Modernize Air Traffic Control System (NextGen – FAA controlled)	C C C C	○ $ ❄ ✚ ∞		
Encourage continuous descent approaches (CDAs) if possible	C C C C	○ ○ ❄ ○ ○		
Financially incentivize the use of more efficient aircraft serving airport (e.g., through takeoff/ landing fees)	C C C C	○ ○ ❄ ✚ ○		
Incentivize the use of aviation biofuels in aircraft servicing local airport (would require local supply, regional approach or partnership with DIA)	C C C C	○ $ ❄ ✚ ∞		

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GHG REDUCTION TOOLKIT: Aviation & Airport

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Reduce aircraft- and aviation-related GHGs				
ACTIONS				
Offer targeted offsets through partnerships with industry leaders and airlines serving local airport	C C C C			
Encourage and support Bustang to DIA	C C C C			
Reduce the need for air travel via state/regional high-speed rail	C C C C			
Pressure local airlines to implement their aspirational International GHG goals	C C C C	Primary Co-Benefits:		
ACTIONS				
Inform airlines of local GHG reduction targets, and provide operational incentives connected with facilitating attainment	C C C C			
Educate passengers about 'greener' flying and becoming consumer advocates via airline promotional material	C C C C			
Encourage airlines to continue developing improved Engine and Airframe Technology	C C C C			

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GHG REDUCTION TOOLKIT: Aviation & Airport

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
If a new terminal is developed, ensure that it represents the pinnacle of energy efficiency and sustainability	C C C C	Primary Co-Benefits: $ ❄ + ∞		
ACTIONS				
Require any new terminal or airport building to be net-zero	C C C C	$ ❄ + ∞		
Mandate 'zero construction waste' and 'sustainable construction' plans for any new terminal or airport facilities	C C C C	❄ +		
Integrate ground heat or geothermal heating into new buildings and facilities	C C C C	$ ❄ ∞		
Plan for and install PV at airport and adjacent areas (e.g., PV parking canopies)	C C C C	$ ❄ ∞		
Ensure terminal encourages next-generation mobility by providing EV and 'mobility as a service' infrastructure	C C C C	= $ ❄		
Encourage passengers to use transit and mobility services to access airport	C C C C	Primary Co-Benefits: = $ ❄		
ACTIONS				
Deploy combined marketing outreach with chamber and lodges regarding transit and mobility options	C C C C			
Provide luggage delivery to hotels or residences so passengers can use the transit and mobility options of their choice	C C C C	= $ ❄		

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GHG REDUCTION TOOLKIT: Aviation & Airport

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
(Cont.) Encourage passengers to use transit and mobility services to access airport				
ACTIONS				
Require rental car companies to have EV options (and require that EVs are a certain percentage of rental fleet); also require an MPGe standard for rental car fleet	C C C C	= $ ❄		
Partner with airport rental car companies to include info card about local mobility options (including option of zero-emissions rental cars)	C C C C			
Provide a dedicated ground transit route with local service into terminal drop-off	C C C C	= ❄ +		
Establish an easy-to-use link from terminal to transit	C C C C	= ❄ +		
Create a luxury bus system to carry people and luggage to and from airport to their accommodations	C C C C	❄		
Install signage and wayfinding from terminal to existing transit	C C C C	+		
Install light rail from airport to city	C C C C	$ ❄ +		
Provide appropriate amount of remote airport parking (including at Park and Rides)	C C C C	= ❄		

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GHG REDUCTION TOOLKIT: Aviation & Airport

OBJECTIVE	GHG REDUCTION POTENTIAL	CO-BENEFITS	TIMEFRAME	PARTNERS
Support relevant federal and state policies through active legislative and regulatory engagement	C C C C	Primary Co-Benefits: $ ❄		
ACTIONS				
Push for federal air quality standards to reduce GHGs associated with jet fuel	C C C C	❄		
Establish an active local government voice in federal aviation policy	C C C C	$ ❄		
Encourage or facilitate the adoption of 'sustainable aviation fuels,' such as biofuels	C C C C	$ ❄ + ∞		
Support federal carbon tax that includes aircraft operations	C C C C	= $ ❄ + ∞		

Notes:

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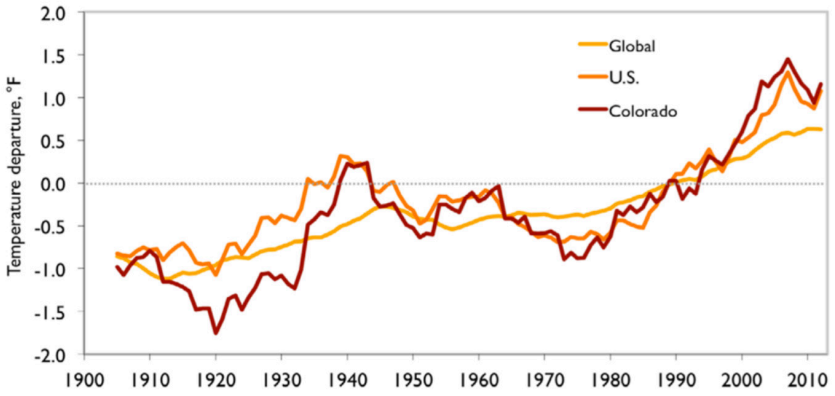
APPENDIX: Notable climate change info for your CAP

While questions remain about the exact specifics of future climate conditions, the basic facts of climate science and solutions are well understood, and more relevant and accessible to local communities than they ever have been. The following insights have been compiled to provide Toolkit users with accessible climate change information that can be drawn for use in their own climate action plans.

Our climate is changing, and more rapidly than at any point on record[i].

- "Every single year since 1977 has been warmer than the 20th century average, with 16 of the 17 warmest years on record occurring since 2001, and 2016 being the warmest year on recorded history."[ii]
- Global temperatures have risen by 1.5°F since 1880[iii] and national temperatures have increased 2°F since 1978[iv].
- In Colorado, average temperatures have risen by 2.5°F since the 1950s[v].
- In Western Colorado, there are 23 fewer frost free than there were before the 1980s and annual snowfall has declined by 10 inches[vi].

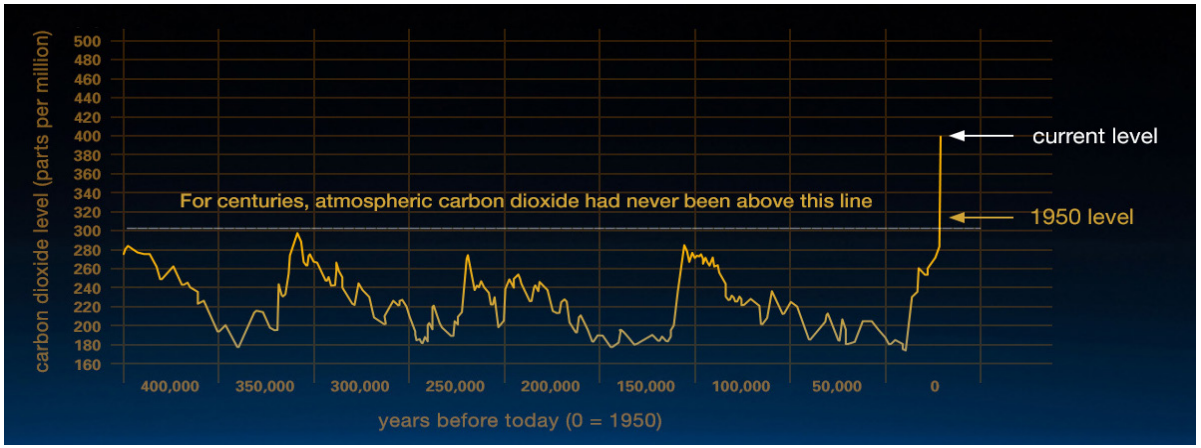
Figure 1. Observational record of annual mean temperature: Global, U.S. and Colorado (Aspen Global Change Institute[v])



Human activity is driving most of this change.

- 97% of climate scientists agree that the warming over the past century is due to human activity. Most leading scientific organizations worldwide have issued public statements affirming this[vii].
- Atmospheric concentrations of CO_2 have risen 40% since the industrial revolution[viii].

Figure 2. Evidence that atmospheric CO_2 has increased since the Industrial Revolution (NASA[vii])



APPENDIX: Notable climate change info for your CAP

The severity of future climate change is directly linked to GHG emissions.

- GHG emissions are the single most significant factor in determining the amount of future global temperature change[ix].
- Currently, the world is on a high emissions trajectory. Unless GHG emissions are mitigated, this could lead to a 9.7°F increase in Western Colorado by 2100[x].
- The best available science indicates that the world, Colorado and communities should reduce GHG emissions 45% below 2005 levels by 2030 and 90% below 2005 levels by 2050, to limit warming to 1.5 to 2°C above preindustrial levels[xi].

We know how to solve it.

- Robust and effective climate solutions are developed and ready for implementation at the international, national, state and local level[xii].

Acting now is less expensive than inaction and can create healthy, thriving communities.

- Dramatically reducing GHG emissions is much less expensive than the anticipated costs of dealing with the impacts of unchecked climate change[xiii] [xiv].
- Effectively addressing climate change at the scale necessary to solve the problem could be the largest wealth creation opportunity of our time[xv].
- In communities, climate action typically creates numerous co-benefits such as increased resilience and economic activity, healthier citizens and improved environmental quality. This Toolkit defines some of the co-benefits that are associated with various actions.
- Climate action is frequently complementary to existing priorities for communities and regions.

Local action matters.

- While future climate will be determined by global GHG emissions, the cumulative impact of local action is significant and meaningful.
- 78% of energy globally is consumed in cities[xvi]. Collectively, local action can significantly accelerate a transition away from fossil fuels.
- Local governments in the US currently have some of the most ambitious climate action commitments. More than 350 US mayors have signed a pledge to uphold the Paris Climate Agreement through local action and necessary policy at the state, federal and international levels[xvii].

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[i] American Meteorological Society, 2017. State of the Climate in 2016, https://www.ametsoc.org/ams/index.cfm/publications/bulletin-of-the-american-meteorological-society-bams/state-of-the-climate/.
[ii] NASA, 2017. Release 17-006. https://www.nasa.gov/press-release/nasa-noaa-data-show-2016-warmest-year-on-record-globally.
Quotation from Union of Concerned Scientists: http://www.ucsusa.org/global_warming/science_and_impacts/science/human-contribution-to-gw-faq.html#.WdvDKmhSzxU.
[iii] IPCC, 2013. Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution 12 of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
[iv] Aspen Global Change Institute, 2014. Climate Change and Aspen 2014, p. 28.
[v] Aspen Global Change Institute, 2014. Climate Change and Aspen 2014. p. 29.
[vi] Ibid p. 14.
[vii] NASA, 2017. Climate change: How do we know? https://climate.nasa.gov/evidence/.
[viii] NOAA, 2014. Global Warming FAQ. https://www.climate.gov/news-features/understanding-climate/global-warming-frequently-asked-questions#hide7.
[ix] Aspen Global Change Institute, 2014. Climate Change and Aspen 2014. p. 43.
[x] Ibid p. 44.
[xi] Western Resource Advocates, 2017. Colorado's Climate Blueprint. https://westernresourceadvocates.org/publications/colorados-climate-blueprint/.
[xii] Hawken, P., 2017. Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming. http://www.drawdown.org/.
[xiii] Universal Ecological Fund, 2017. The Economic Case for Climate Action in the US. https://feu-us.org/case-for-climate-action-us2/.
[xiv] American Security Project. http://www.americansecurityproject.org/resources/pnpl/Colorado%20FINAL.pdf.
[xv] Shah, J., 2013. Creating Climate Wealth: Unlocking the Impact Economy.
[xvi] CDP Cities, 2015. Report infographic.
[xvii] https://www.wearestillin.com/cities-counties/initiatives/.

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ASPEN SNOWMASS. ASPEN SKIING COMPANY
ASPEN ZERO IMPACT
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The City of Aspen strives to be an environmental leader and to promote environmental stewardship throughout the Roaring Fork Valley, across the state of Colorado, and around the globe. We recognize Aspen's dependence on climate and natural resources for a thriving economy, healthy ecosystems, and exceptional quality of life. In an effort to do our part to reduce the threat of climate change, Aspen's City Council adopted the Canary Action Plan in 2007, which commits to reducing community-wide emissions 30% by 2020 and 80% by 2050, below 2004 levels.

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The Community Office for Resource Efficiency (CORE) works cooperatively with businesses, individuals, utilities, and government entities to create measurable improvements in energy and water efficiency in order to benefit the environment and develop a more sustainable economy. The non-profit has been serving the Roaring Fork Valley since 1994.