A Sustainable Vision for Deerfield Beach

Siemens City Performance Tool Analysis for 2030

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About the Report

Infrastructure is the backbone of a city's economy and urban development projects help to create a livable and sustainable smart city. Smart Infrastructure intelligently connects energy systems, buildings and industries to adapt and evolve the way we live and work. We work together with customers and partners to create an ecosystem that intuitively responds to the needs of people and helps customers to better use resources. It helps our customers to thrive, communities to progress and supports sustainable development. We do this from the macro to the micro level, from physical products, components and systems to connected, cloud-based digital offerings and services. From intelligent grid control and electrification to smart storage solutions, from building automation and control systems to switches, valves and sensors.

Siemens contributors to this report include:
Dr. Noorie Rajvanshi, Denise Quarles, Bryan Readon

For more information about Siemens work in the major metropolitan areas of Florida and about this report, please contact:
Denise Quarles
Head of External Affairs, SE Region
denise.quarles@siemens.com

Siemens would like to thank the city of Deerfield Beach for their support during the development of this report and analysis, especially Hillary Silverstone, Sustainability Coordinator, and Chad Grecsek, Director of Sustainable Management.

We have used colors and visual cues in powerful ways to enhance the meaning and clarity of data visualization throughout this report. Please refer to the following as you are browsing:

CO_2eq **Transport** **Buildings** **Energy**

Contents

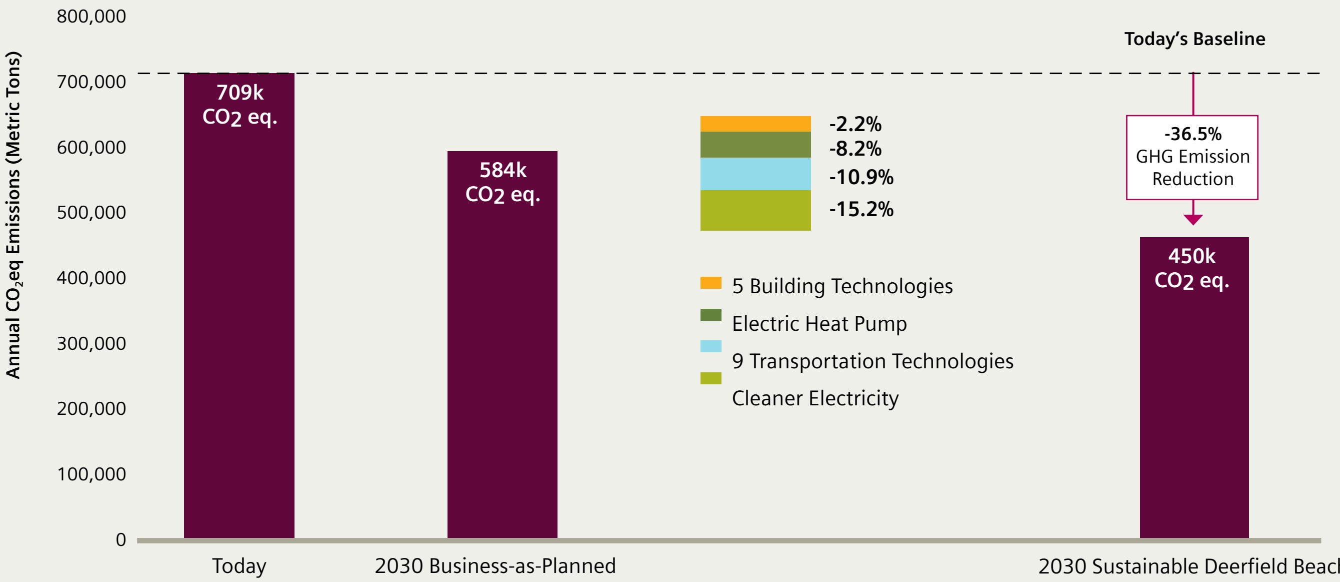
Summary

Cities around the world are making a commitment to sustainability to fight climate change. For many cities in Florida, impacts of climate change and sea level rise are even more immediate. Siemens has been working with the city of Deerfield Beach (DFB) to evaluate how technology can aid the city in planning for a more sustainable future. Using the Siemens' City Performance Tool (CyPT) we are working closely with the city to evaluate not only how the city can achieve deep carbon reductions but also economic co-benefits of climate action planning including job creation. Siemens' CyPT was developed with cities in mind, to help cities make informed infrastructure investment decisions, identifying which technologies from the transport, building, and energy sectors might be utilized to accomplish goals such as mitigating that city's greenhouse gas emissions, improving air quality and adding new jobs to the local economy. Using a three-step process, Siemens works with cities to first build a GHG emissions baseline for its transport, buildings, and energy sectors, then chooses technologies to simulate on that baseline, and finally estimates economic and environmental impacts of investing in those technologies.

Our analysis shows that it is possible for the city of Deerfield Beach to reduce their Green-House Gas (GHG) emissions by 36.5% by 2030 as compared to today. This would require adoption of 7.5% renewable electricity, 15.6% active and public transit, thermal electrification in buildings, adoption of rooftop PV panels, 5 building automation and efficiency technologies as well as 9 transportation technologies. These deep carbon reductions are accompanied by economic benefits, including roughly 5,400 direct/indirect local jobs that would be created to install, operate and maintain these technologies about 45 percent of which would require special skills and training over the next 10 years.

Deep Carbon Reduction and Economic Co-Benefits

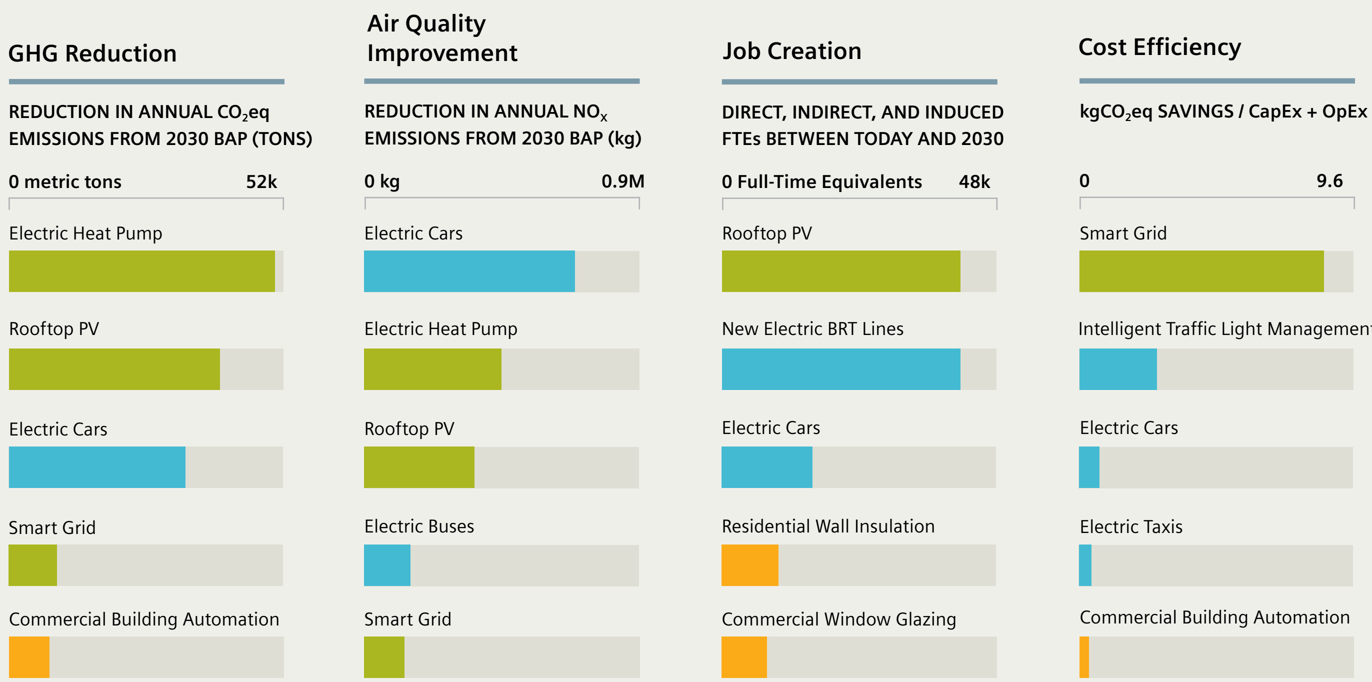
A deep carbon reduction scenario for Deerfield Beach shows that it is possible for the city to achieve 36.5% reduction in GHG emissions from energy use in buildings and transportation by 2030 as compared with today. Carbon reductions come with a price tag of implementing these technologies over the next 10 years but will also create local jobs.



Emission Reductions		Jobs Generated	Costs
260,000 Metric tons CO_2 eq. compared to today	**36.5%** Percentage CO_2 eq. reduction compared to today	**5,400** Full-time equivalents between today and 2030	**$0.8 Billion** Capital and operating expenditures between today and 2030

High-Performing Technologies

The technologies that produce highest GHG reduction are air-sourced electric heat pumps, rooftop PV, electric cars, commercial building automation and modern grid. Converting 75% of cities' homes and offices to use electric heat pumps for water and space heating would produce highest GHG savings but adding more solar (10% from rooftop panels) has benefits beyond GHG reduction. Rooftop PV would also improve air quality by reducing NOx emissions and create over 1,600 local jobs.



Background

Deerfield Beach's year-round focus on sustainability has resulted in a long list of accomplishments. Small adjustments, minor improvements and more capital-intensive projects have been executed. There have been efforts by municipal government and local stakeholders alike, all acting for change. While they are proud of what they have been able to accomplish so far with policy and voluntary actions, they recognize there is still much work to be done to develop a citywide plan.

Recognizing the importance of city government leading by example, in 2016 the city began tracking and monitoring electricity usage in its municipal buildings to develop a baseline for energy use, cost and environmental impact. Through a competitive procurement process, the cty selected Siemens as their partner to identify energy efficient capital improvement opportunities to be implemented through a performance contract for municipal buildings and related infrastructure. This project was placed under contract in September 2019 and will continue for the next few years as equipment is replaced or installed followed by performance monitoring.

While upgrading municipal assets is actively underway and shows great leadership in energy efficiency, the city government cannot do it alone. Citywide, all stakeholders will need to continue, or join in on the journey to a more sustainable Deerfield Beach.

The questions with sustainability and resiliency are often: Where do we go from here? Who are the right stakeholders? What will be the impact? And how can technology be leveraged to get there? Siemens is assisting the city by identifying technology pathways to becoming smarter and more sustainable.

Deerfield Beach is planning for its sustainable future by leveraging smart tools and technologies. An ongoing partnership between the city and Siemens is showing how this vision could become a reality. Using a proprietary City Performance Tool (CyPT), Siemens is working closely with the city to create a city-wide sustainability plan.

City Performance Tool

In order to help cities make more informed infrastructure investment decisions, Siemens has developed the City Performance Tool (CyPT) which identifies the best technologies in the energy, buildings and transportation sectors for reducing greenhouse gas (GHG) emissions, improving air quality and creating new jobs in the local economy. The tool compares the performance of over 70 technologies and generates a shortlist of the most effective solutions to help cities meet their environmental targets.

Based on over 350 inputs from the energy building and transportation sectors, as well as population growth projections, the model measures the city's baseline CO_2 eq., PM10 and NOx emissions. CO_2 eq. accounting is performed at scopes 1, 2, and 3 levels in accordance with globally-recognized standards for GHG accounting for cities.[i] Scope 1 emissions are defined as those emanating from sources located within the city boundary, while scope 2 emissions occur as a consequence of the use of electricity from the grid, as well as heat, steam and / or cooling within the city boundary. Scope 3 emissions are those that occur outside the city boundary as a result of activities taking place within the city.

The model also tests the performance of each technology on a number of socio-economic indicators such as capital and operating expenses and the number of jobs in terms of gross full-time equivalents (FTE) [1]

Starting with the city's population, energy performance and environmental baseline, the model estimates the future impacts of technologies along the following three drivers:

1. **Cleaner underlying energy mix:**
   Shifting the energy generation mix from non-renewable to renewable energies (e.g., photovoltaics) and/o improving the efficiency of the current fossil fuel sources (e.g., Combined Cycle Gas Turbines).

2. **Improved energy efficiency in buildings and transport:**
   Replacing existing technologies with more energy efficient technologies. For example, replacing traditional street lighting with LEDs and / or demand-oriented street lighting.

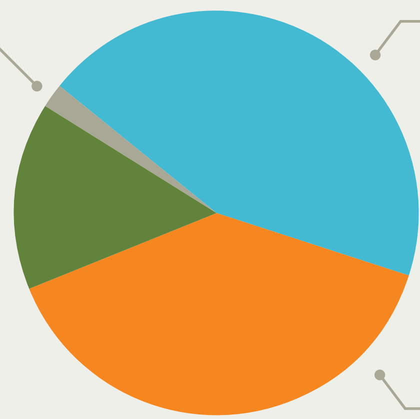
3. **Modal shift in transportation:**
   Modeling changes in the modal split of the city. For example, by creating new Bus Rapid Transit (BRT) lines, a city potentially moves passengers away from single occupancy cars and into the BRT.

The CyPT model has been used to assess infrastructure development opportunities available to cities across the world, including Adelaide, Charlotte, Los Angeles, Orlando, Pittsburgh, San Francisco, Seoul, Washington DC and Wuhan, among many others. A key example of how Siemens is partnering with cities to drive the sustainable development agenda is the case of Charlotte, where a recent CyPT study between Siemens and the city's sustainability office analyzed the potential impacts of investing in technologies that could contribute to a smart, sustainable future. The study estimated that by implementing 16 smart building and transportation technologies, Charlotte could reduce GHG emissions by 5% and improve air quality by 8%, while creating more than 8,000 jobs by 2025, from 2016 levels. Furthermore, the study showed that by 2050, these benefits could increase to 20% reduction in GHG emissions, 21% improvement in air quality, and close to 100,000 new jobs.

1 An FTE is a person-year of work, calculated as 2,080 hours of work in the U.S.

CyPT Inputs

The CyPT can be customized through more than 350 city-specific data inputs, which when combined, project how a city is expected to grow and change as its population and infrastructure expand. More than half of the inputs that go into the CyPT look at how people move around the city, live, and work.



2% General
- Population
- Geographic Size
- Emissions Target

15% Energy
- Electricity Mix
- Heating Mix
- Emissions Factors for Fuels

39% Transport
- Annual Passenger Miles
- Freight Ton Miles
- Length of Road Network
- Length of Highway Network
- Bus, BRT, Streetcard, Lightrail,
- Commuter / Regional Rail, Taxis, Bicycles, Cars, etc.

44% Buildings
- Square Footage by Building Type
- Electricity Demand
- Heating Demand
- Cooling Demand
- End Use for Electricity, Heating, and Cooling
- Building Envelope

Scope of Emissions in the CyPT Model

CyPT Inputs

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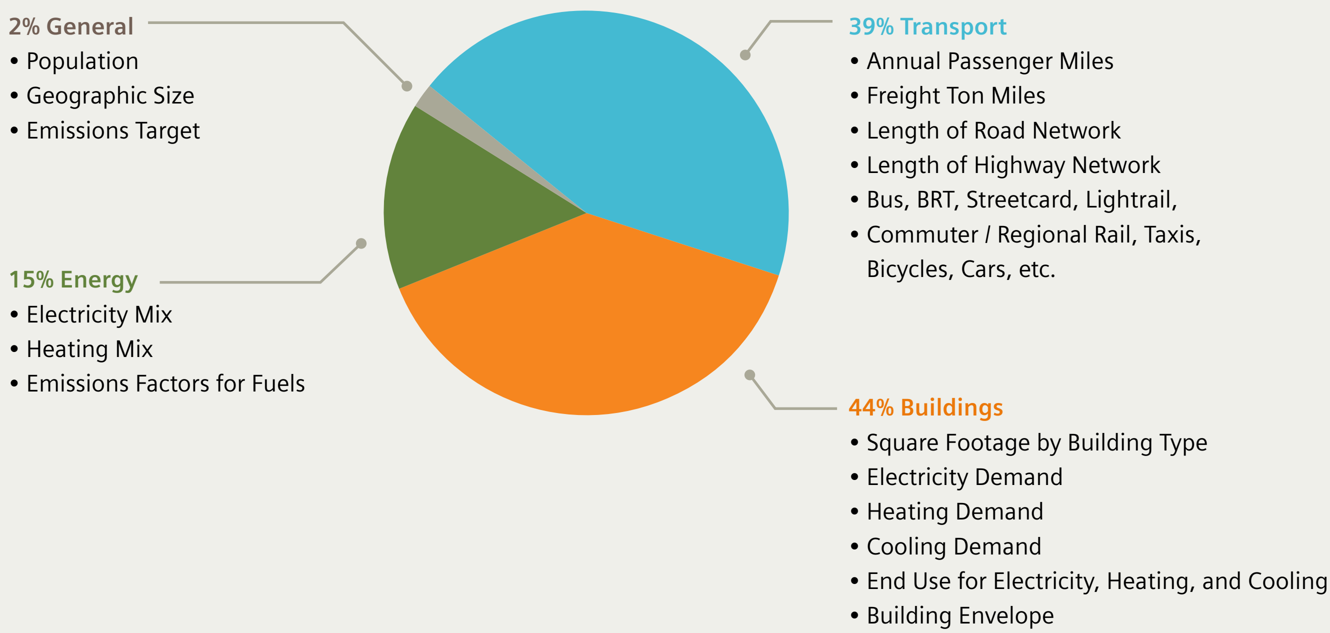
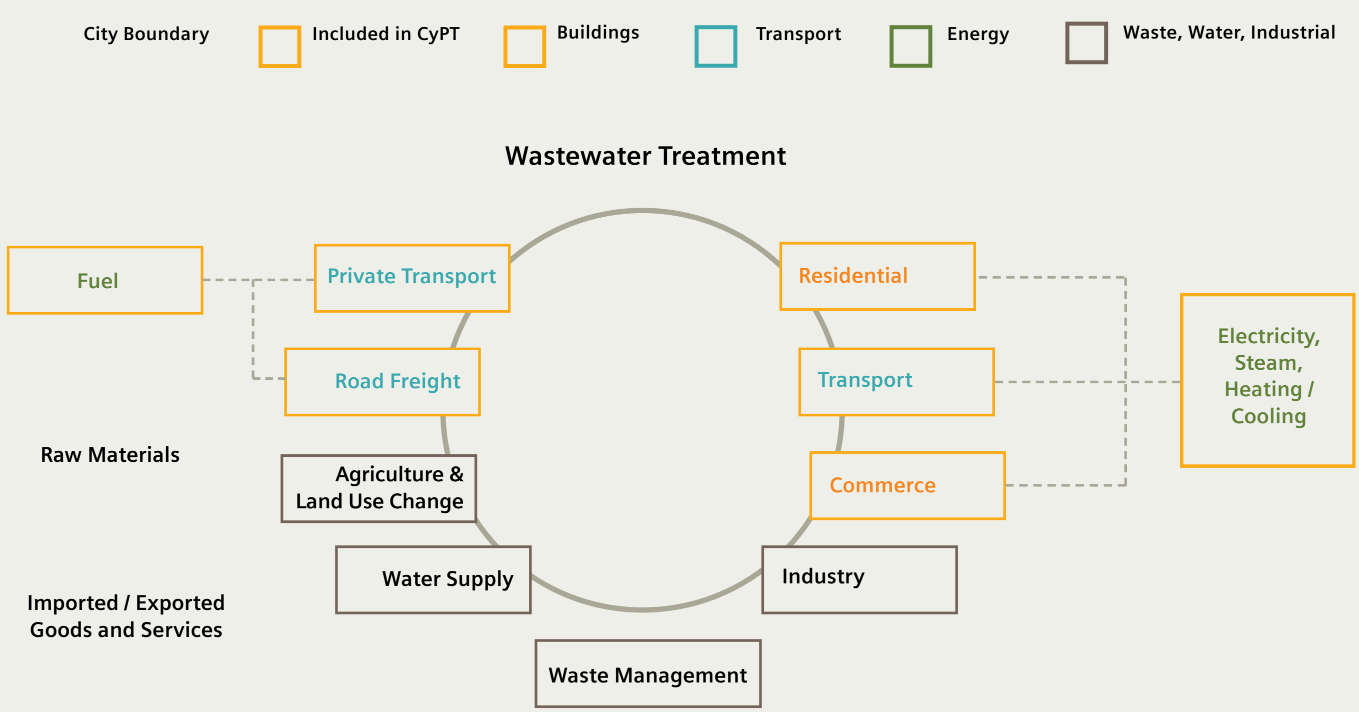


Scope of Emissions in the CyPT Model



Deerfield Beach Results

Baseline Data and Emissions

The CyPT model runs on over 350 data points collected from the city. This data represents how energy is generated and used in the city, how people move around today as well as how their behaviors and usage patterns will be different in the future. In order to forecast 10 years into the future we consulted existing plans and policies from city, county and state departments. Two documents that were particularly useful were: 1) Ten-year site plan from Florida Power and Light[ii] that outlines the strategy for addressing growing electricity demand for the region as well as how renewables will be incorporated into the generation mix; 2) Broward County Transit Development Plan[iii] which serves as the strategic guide for public transportation in Broward County over the next 10 years and the details in this plan were useful for calculating the passenger mode share in the city of Deerfield Beach in 2030.

We also reviewed The Southeast Florida Regional Climate Change Compact [iv] website and used the information as guidance for implementation rates of technologies.

We also accessed the Department of Energy, state and local energy data for Deerfield Beach.[v] This database served to fill in any gaps not covered by the data supplied by the city. Using this information, we built the baseline emissions model for the City for two timelines: today and 2030. Instead of the most commonly used business-as-usual scenario which assumes a status quo in terms of behaviors and usage pattern, we have adopted a "business-as-planned" (BAP) scenario.

The BAP scenario makes some assumptions about renewable energy integration (up by 7% in 2030) and usage of active and public transit (up by 8.7% in 2030). As a result of these assumptions, the baseline GHG emissions for 2030 show a 17.6% reduction as compared to today even without implementation of any technologies.

Deerfield Beach, Today and 2030

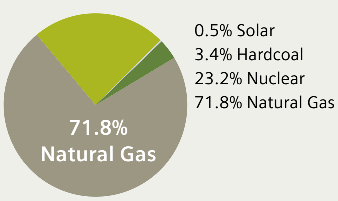
Based on data collected from regional and local agencies as well as city departments, our analysis shows a 2030 business as planned scenario for Deerfield Beach. This scenario, based on assumptions of greener electricity as well as increased use of public and active transit, shows a 17.6% reduction in GHG emissions for 2030 in spite of a 13% increase in population.

Population Today: 78,753

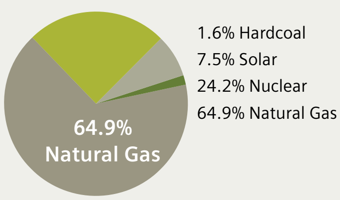
Population 2030:* 89,381 (Business-as-planned)*

Electricity Mix

Today
0.5% Renewable

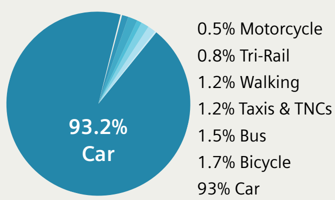


2030 (Business-as-planned)
7.5% Renewable

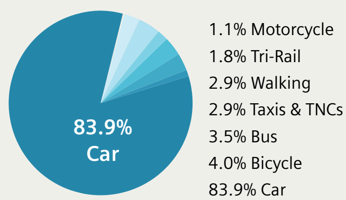


Passenger Mode Share

Today
6.4% Transit and Active Transport

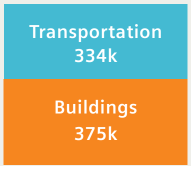


2030 (Business-as-planned)
15.1% Transit and Active Transport*

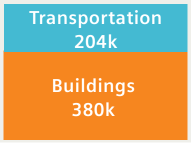


CyPT-Estimated Annual GHG Emissions**

Today
709 Thousand Metric Tons



2030 (Business-as-planned)
584 Thousand Metric Tons



*Based on a scenario to reduce travel by single occupancy passenger cars by 10%
**2017 Estimates for Buildings and Transportation sector are calculated from CyPT analysis by collecting over 350 data points from the city.

Building & Energy Technology Impacts

Out of 31 available building and energy technologies available in the CyPT model, we chose eight levers that are most relevant for the city. This section discusses how these technologies will reduce the energy usage in the buildings and consequently bring the GHG emissions even further down as compared to the BAP scenario in 2030.

Today, homes and apartments in the city cover 75% of the built space and use approximately half of the total electricity consumed by buildings.

Due to the warm and humid climate of south Florida, residents avoid large heating bills and enjoy lower than average Energy Use Intensities (EUI) for homes in Deerfield Beach. The average EUI for southern region as per U.S. Energy Information Administration (EIA), 2015 Residential Energy Consumption Survey[vi] is 35.6 kBTU/sq. ft., 25% higher than the city's average. However, the efficiency of energy use in residential building cannot be extended to non-residential buildings stock in the city. On average, the non-residential buildings in Deerfield Beach use almost twice as much energy as the regional average for the South Atlantic according to the Commercial Buildings Energy Consumption Survey.[vii]

Building Data in Deerfield Beach Today

Homes and apartments cover 75% of the city's built space with home sizes about 700 sq. ft. larger than the national average in metropolitan areas. Offices and warehouses account for about 60% of the city's non-residential space.

Residential Buildings Today

Share of Building Stock by Sq Footage

75%

Average Residential Unit Size

2,733 ft^2

Total Electricity Consumption

382 GWh

Average Energy Use Intensity

26.8 $kBTU/ft^2$

Non-Residential Buildings Today

Share of Building Stock by Sq Footage

25%

Total Non-Residential Building Footprint

16M ft^2

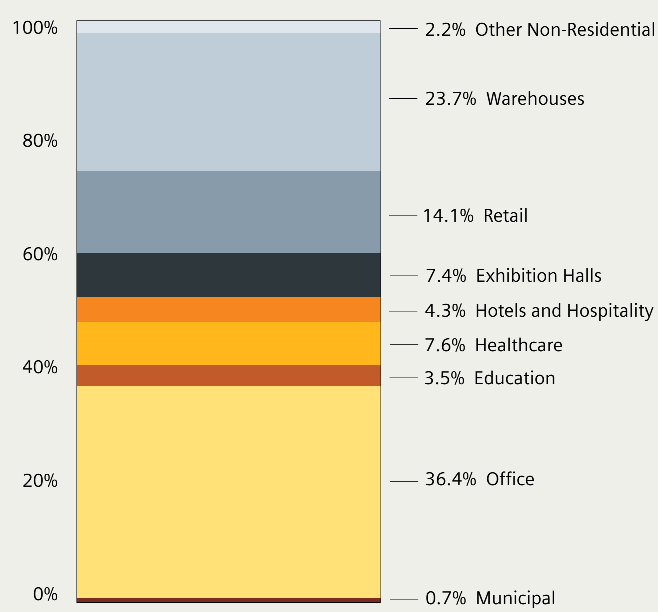
Total Electricity Consumption

421 GWh

Average Energy Use Intensity

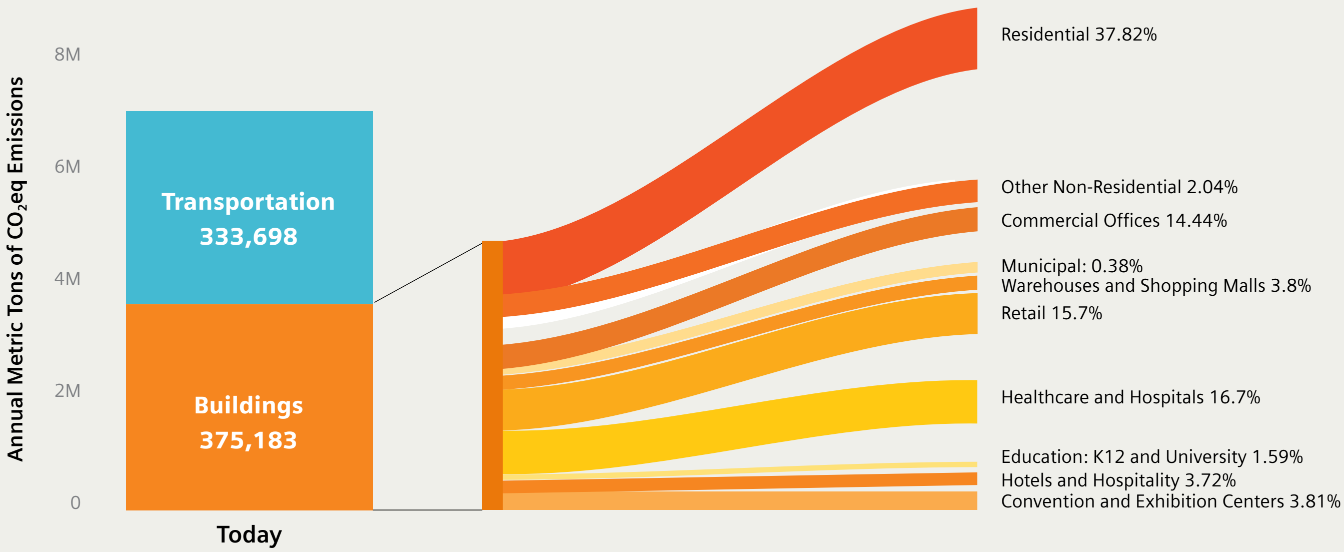
134 $kBTU/ft^2$

Breakdown of Square Footage of Non-Residential Buildings



Breakdown of GHG Emissions by Building Type, Today

Even with a larger built footprint, homes in Deerfield Beach are efficient and account for only 38% of the emission footprint from buildings.



CyPT Levers: Building and Energy

Residential Buildings

Non-Residential Buildings

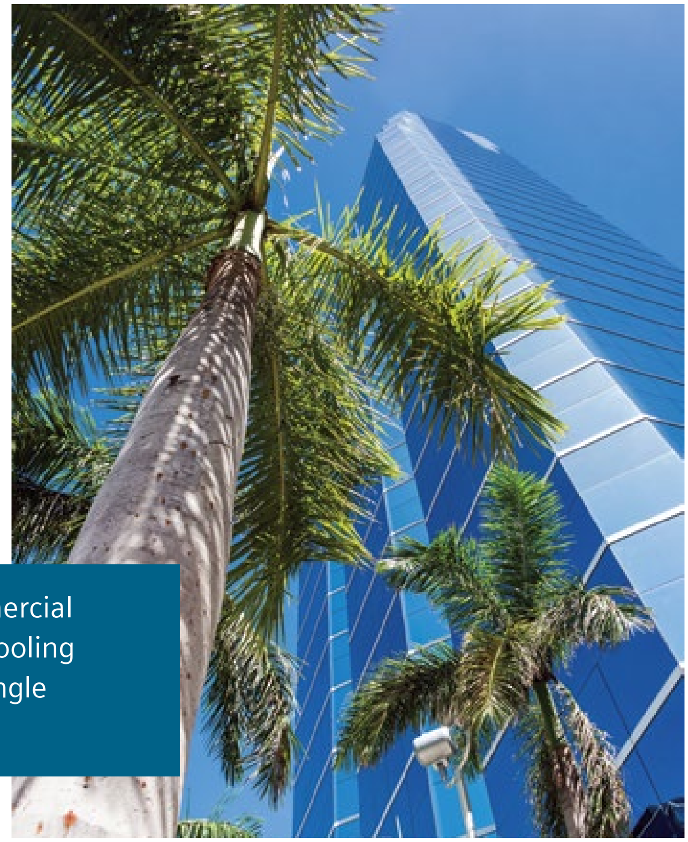
Lever	Unit	Adoption, Today	Adoption, Today
Wall Insulation (Residential)	% of Building Stock With Lever	30%	50%
Home Automation (Residential)	% of Building Stock With Lever	2%	15%
Window Glazing (NR)	% of Building Stock With Lever	15%	45%
Building Automation (NR)	% of Building Stock With Lever	2%	20%
Room Automation - Lighting + HVAC (NR)	% of Building Stock With Lever	3%	10%

Energy

Lever	Unit	Adoption, Today	Adoption, Today
Rooftop PV	% of Total Electricity Generation	0%	10%
Electric Heat Pumps	% of Total Heating Demand	58%	75%
Smart Grid for Monitoring & Control	% of Electric Grid Replaced with Smart Grid	0%	50%

Photo courtesy of Deerfield Beach, Florida: Old Schoolhouse 1920.

Energy use in buildings is responsible for approximately half of the city's GHG emissions. This impact covers both scope 1 (direct combustion of natural gas or biomass within buildings) and scope 2 and 3 (indirect impacts from production, transmission and distribution of electricity). Five building technologies modeled work to reduce this impact by improving the energy efficiency in the buildings. For example, application of double or triple glazing on commercial building windows prevents loss of heating and cooling energy by up to 72% as compared to unglazed single pane windows. Similarly, automating building operations such as installing occupancy sensors to control lighting and HVAC systems in buildings also reduces energy usage in buildings. Combined, these five building automation technologies with three energy and heating generation technologies can reduce GHG emissions by 15% as compared to 2030 BAP scenario.



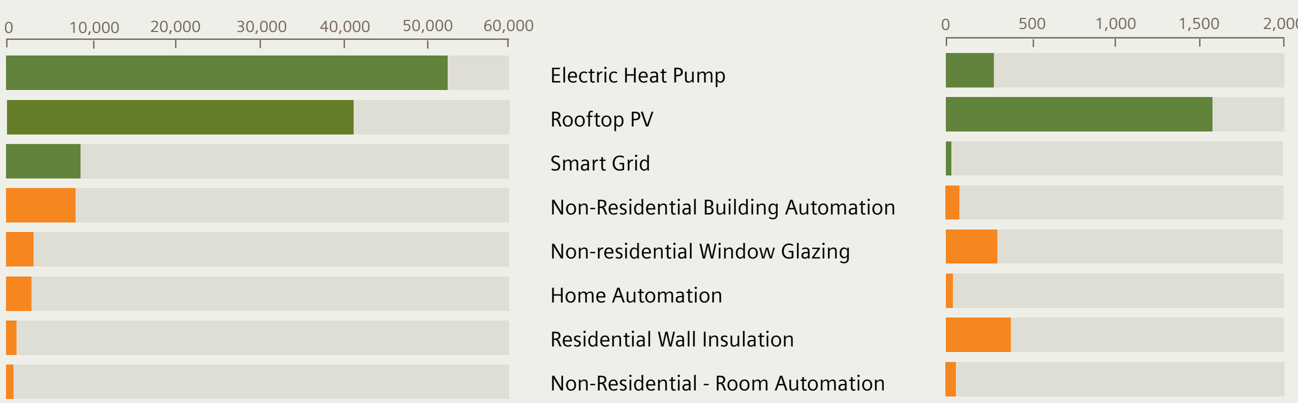
Application of double or triple glazing on commercial building windows prevents loss of heating and cooling energy by up to 72% as compared to unglazed single pane windows.

CyPT Levers DFB: Building and Energy

Even with the warm climate of south Florida, converting existing natural-gas-based furnaces used for air and water heating with electric heat pumps would provide the highest emission savings followed closely by installing rooftop solar panels. Installing and maintaining rooftop solar panels would also create over 1,500 local jobs.

GHG Emissions
Reduction in Annual Emissions from 2030 Business-as-Planned Metric tons of CO_2eq

Jobs Created
Direct, Indirect and Induced FTEs Created between Today and 2030



Transportation Technology Impacts

Similar to most cities in Florida, residents and visitors to Deerfield Beach rely heavily on cars as their primary mode of transportation. With only one commuter Tri-Rail line passing through the city every hour and eight bus lines, the low mode share of public transit is not that surprising. But the planned addition of two new electric Bus Rapid Transit (BRT) lines and investment in dedicated bike lanes and electric car sharing service by 2030 would be the right step towards shifting passenger miles away from single occupancy vehicles.

In the short term, the electrification of private fleets would be the most impactful strategy for GHG emission reduction for Deerfield Beach.

Transportation Data in Deerfield Beach Today

Residents and visitors to Deerfield Beach rely heavily on cars as their primary mode of transportation traveling, about 30 miles in a day. With very few public transit options, the vehicle ownership in the city is higher than the national average.

Passenger Transportation

Average Miles Traveled, Per Person, Per Day

30 miles / person / day

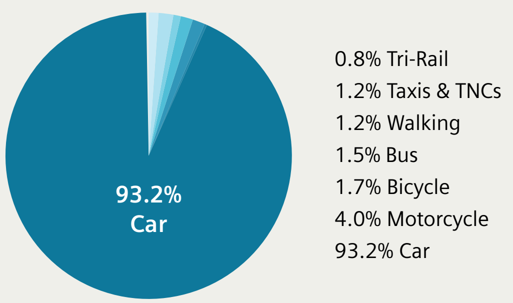
Number of Cars on the Road (Cars Per Household)

65,933 (3)

Average Fuel Economy

23.9 MPG

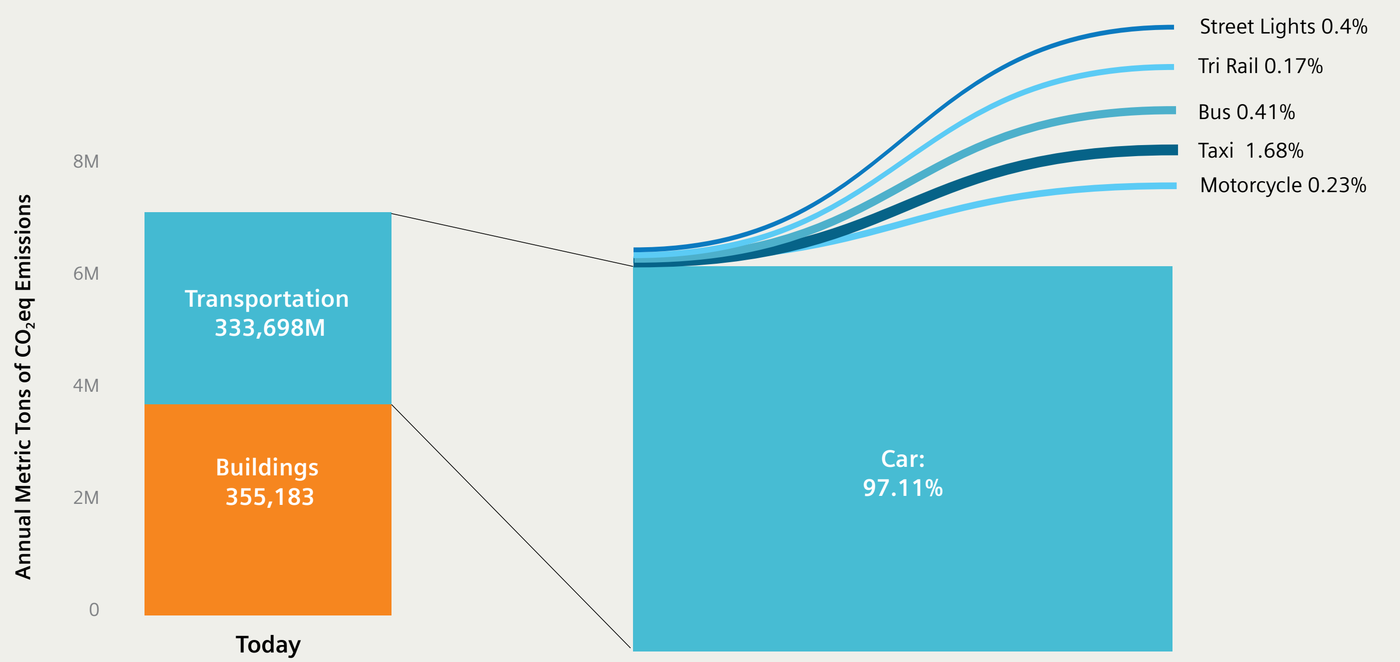
% of Total Annual Passenger Miles Traveled By Mode

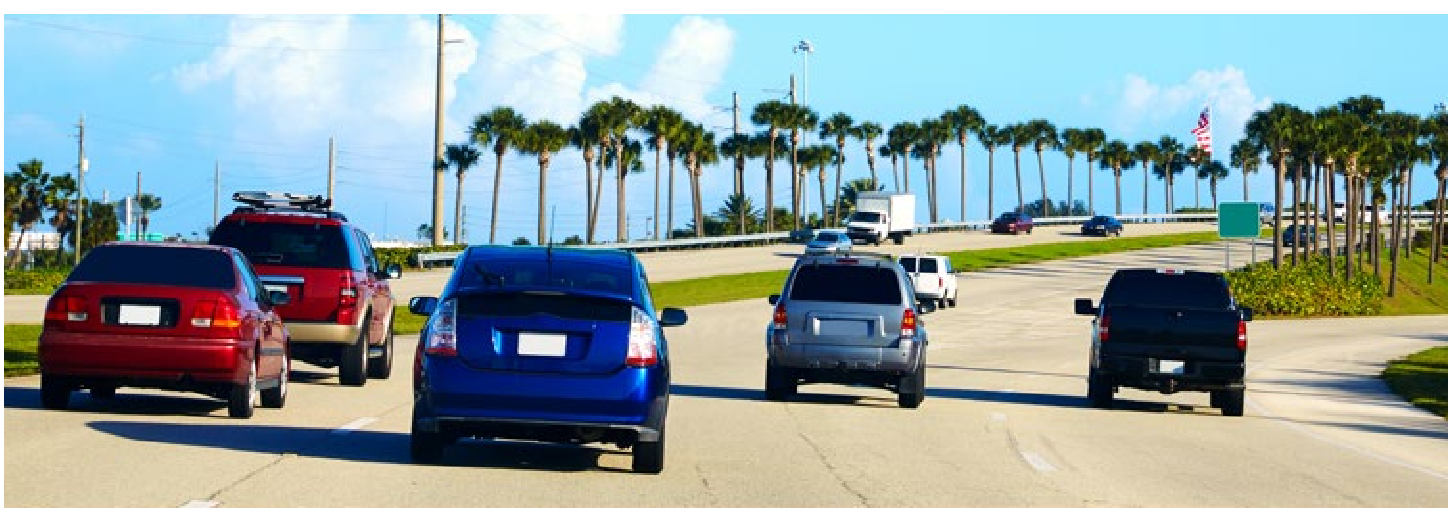


Even with this transition to larger public and active transit mode share, our analysis shows that cars would still dominate the mode share in Deerfield Beach in 2030 with over 83% of passenger miles travelled annually. In this scenario, the best transportation lever will be the electrification of private cars. Within the scope of CyPT, transportation accounts for nearly 50% of the city's GHG emissions. This is an unusual split since most cities we've worked with previously have a much higher percentage of GHG impacts coming from the building sector. However careful evaluation of the capita value for transportation emissions (approximately four metric tons per person) indicates that this value is comparable to most cities in North America, irrespective of their climate or geographical location. The unusual split in this case can be attributed to an energy efficient residential building stock as explained in the Building & Energy Technology Impacts section above.

Breakdown of GHG Emissions by Transportation Mode Today

Transportation accounts for nearly 50% of the City's GHG emissions. Over 97% of these come from single-passenger vehicles.





CyPT Levers Deerfield Beach: Transportation with Adoption Rates

Public Transit

Non-Residential Buildings

Lever	Unit	Adoption, Today	Adoption, 2030
eBuses	% of Public Bus Fleet	0 %	50%
eBRT - New Lines	Total Number of Lines	0	2

Private Transportation

Lever	Unit	Adoption, Today	Adoption, 2030
Electric Cars	% of Cars on the Road	0 %	30%
Electric Taxis	% of Taxis on the Road	0 %	50%
Electric Car Sharing	Number of Car Sharing Cars	0	150
Bikeshare	Total Number of Sharing Bikes	0	100

Infrastructure

Lever	Unit	Adoption, Today	Adoption, Today
Intelligent Traffic Light Management	% of Traffic Lights w/ Coordinated Fixed Time, Rule-based, or Adaptive Control	30 %	75%
LED Street Lighting	Total Number of Lines	0	75%

Our analysis shows in the short term, the electrification of private fleets would be the most impactful strategy for GHG emission reduction for Deerfield Beach. Investments in public transit expansion, as outlined in the Broward County Transit Development Plan[iii], is the right step towards increasing public mode share but will not move the needle for GHG emission reduction with out a significant increase in ridership.

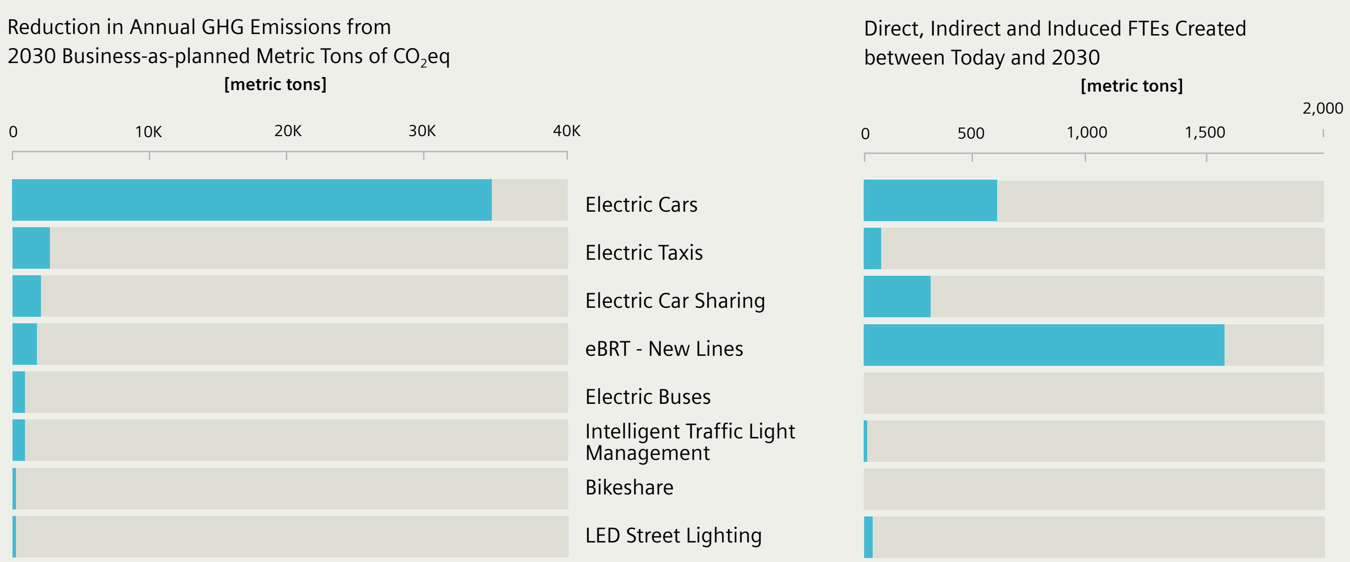
Transitioning to electric cars would also create more than 500 new jobs over the next 10 years specifically from the installation of charging infrastructure. However, the largest number of jobs would be created by the addition of two new electric Bus Rapid Transit lines. Our analysis assumes that these two BRT lines would also pull about 1% of passenger miles traveled away from single occupancy vehicles.

CyPT Lever Impacts, Transportation

Transportation accounts for nearly 50% of the city's GHG emissions. Over 97% of these come from single passenger vehicles.

GHC Emissions

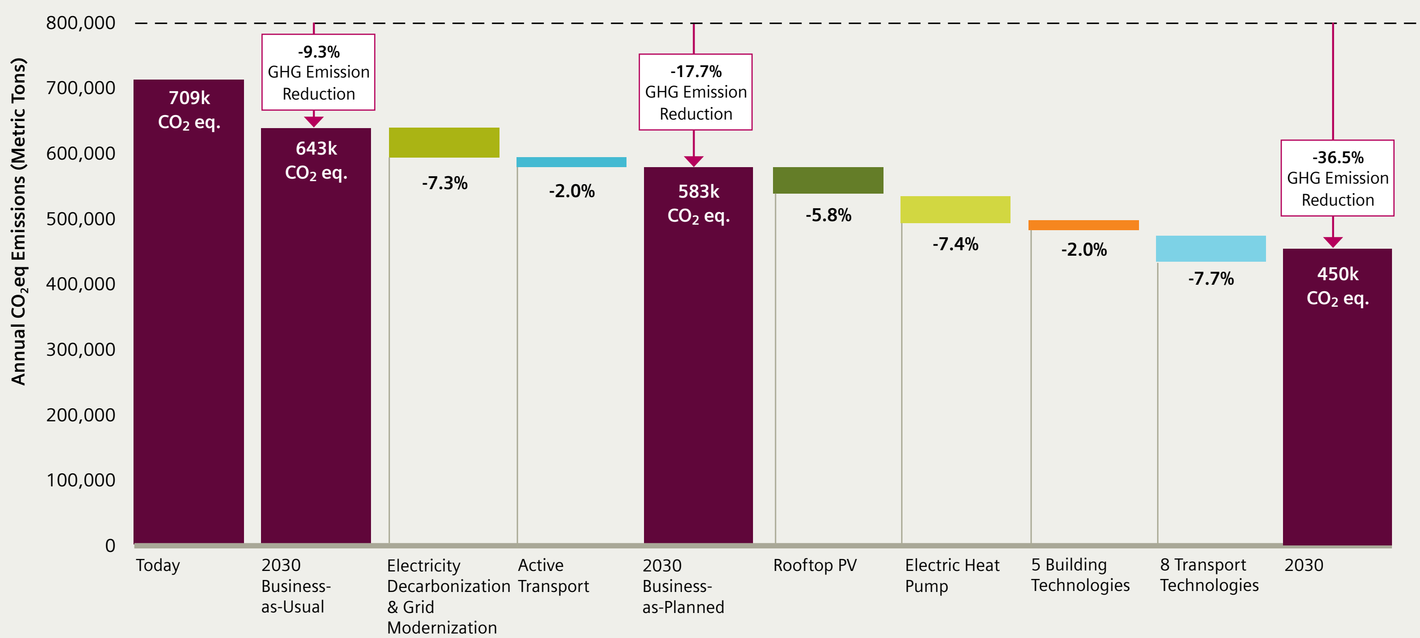
Job Creation



Putting it all Together

Our analysis shows an encouraging picture for the future of Deerfield Beach. By 2030 it is possible for the city of Deerfield Beach to reduce their Greenhouse Gas (GHG) emissions by 36.5% as compared to today. This would require the adoption of 7.5% renewable electricity, 15.6% active and public transit, thermal electrification in buildings, the adoption of rooftop PV panels, building automation and efficiency technologies as well as electrification of transportation and other technologies promoting active transit called out in the analysis. These deep carbon reductions are accompanied by economic benefits, including roughly 5,400 local jobs that would be created to install, operate and maintain these technologies. About 45% of these jobs would require special skills and training.

Sustainable Deerfield Beach 2030



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Conclusion

Siemens City Performance Tool is helping cities become smarter and more sustainable. The analysis for the city of Deerfield Beach captures the top recommended technology levers for energy, buildings and transportation sectors for reducing GHG emissions, improving air quality and creating jobs in the local economy. This information is available for consideration by city leadership, partner organizations and local citizens. Deerfield Beach can leverage this analysis as they consider new policy, goal development, education and outreach and infrastructure investments.

Appendix

CyPT Technologies for Deerfield Beach

Building Levers		
Residential	Wall Insulation	Solid wall insulation e.g. made of expanded polystyrene (EPS) can be applied to already existing buildings. Applying the rigid foams to exterior side of walls raises thermal resistance. The insulation reduces the heat gain / loss through the walls and thus minimizes the heating/cooling energy needed. Reduction of CO_2e, PM10, and NOx related due to energy savings.
Residential	Home Automation	Home automation allows the automatic adjustment of heating, cooling, ventilation and lighting depending on the environmental conditions and the room occupancy by applying sensors and actuators as well as control units. This reduces the energy demand of heating, cooling, ventilation and lighting.
Non-Residential	Window Glazing	Applying double/triple glazed window made of two or three panes of glass and a space between them filled with air or insulating gases and reduces heat and noise transmission as well as solar gain from solar radiation through the window. Due to better window insulation, less heating and cooling energy is needed inside the building. Reduction of CO2e, PM10, and NOx related due to energy savings.
Non-Residential	Building Automation (BACS Class B)	Energy-efficient building automation and control functions save building operating costs. The thermal and electrical energy usage is kept to a minimum. It is possible to estimate the efficiency of a building based on the type of operation and the efficiency class of the building automation and control systems (BACS) installed. Energy Class B includes advanced building automation and controls strategies, such as demand-based operation of HVAC plant, optimized control of motors and dedicated energy management reporting. Reduction of CO_2e, PM10, NOx is related to thermal and electrical energy savings.
Non-Residential	Room Automation	Room Automation provides control and monitoring of heating, ventilation, and air conditioning within individual zones based upon demand, with options for automatic lighting. An in-built energy efficiency function identifies unnecessary energy usage at the room operating units, encouraging room users to become involved in energy saving, and different lighting scenarios can be programmed. Reduction of CO_2e, PM10, NOx is related to electrical power utilized in the heating, ventilation and air-conditioning and lighting of a building.
Transport Levers		
Public	Electric Buses	Share of the vehicle fleet operated by battery electric vehicles. Battery electric vehicles are "zero" exhaust gas emission vehicles. Significant reduction of local emissions PM10, NOx. A charging infrastructure is set up. The electricity used for charging is generated according to the general local electricity mix.
Public	e-Bus Rapid Transit New Line (eBRT)	Share of Passenger Transport at target year provided by e-Bus rapid transit: a high-performance public transport combining bus lanes with high-quality bus stations, and electrical vehicles. Faster, more efficient service than ordinary bus lines. Results in modal shift from private transport to public transport, shift from combustion engines and reduce energy demand per person km together with related emissions.
Private	Electric Cars	Share of conventional combustion vehicles replaced by battery electric vehicles. Battery electric cars are "zero" exhaust gas emission vehicles. Significant reduction of local emissions PM10, NOx. A charging infrastructure is set up. The electricity used for charging is generated according to the general local electricity mix.
Private	Electric Taxis	Share of conventional combustion vehicles replaced by battery electric vehicles. Battery electric cars are "zero" exhaust gas emission vehicles. Significant reduction of local emissions PM10, NOx. A charging infrastructure is set up. The electricity used for charging is generated according to the general local electricity mix.

Appendix

CyPT Technologies for Deerfield Beach – continued

Building Levers		
Private	Electric Taxis	Share of conventional combustion vehicles replaced by battery electric vehicles. Battery electric cars are "zero" exhaust gas emission vehicles. Significant reduction of local emissions. A fast charging infrastructure is set up and uses electricity generated using local fuel mix.
Private	Electric Car Sharing	Number of sharing cars / 1000 inhabitants at target year: model of car rental where people rent e-cars for short periods of time, on a self-service basis. It is a complement to existing public transport systems by providing the first or last leg of a journey. Resulting in fewer driving emissions due to eCar and shift to non-vehicle travel, such as walking, cycling and public transport.
Private	Bike Sharing	Number of sharing bikes/1000 inhabitants offered at target year resulting in a shift from all transport mode equally and lower energy demand per person kilometer together with related emissions.
Infrastructure	Intelligent Traffic Light Management	Smart traffic management systems utilize sensors to monitor traffic speed and density. These systems can optimize traffic signal timings, impose speed limits and open hard shoulders as required to maintain flow.
Infrastructure	LED Street Lighting	Share of low efficient streetlights replaced by more efficient light-emitting diodes (LEDs). Saving electricity together with related emissions. Additionally high reduction in maintenance due to longer lifetime (10 years versus 6-12 month) and possibility to dim the light depending on the environmental conditions.
Energy Levers		
Generation	Photovoltaic	Share of electricity provided by Photovoltaic at target year changing the energy mix and its related emissions provides cleaner electricity for buildings and electric powered transport modes.
Generation	Electric Air Sourced Heat Pumps	Share of heating supplied to the city buildings coming from air-sourced heat pumps that run on electricity.
Distribution	Smart Grid for Monitoring and Automation	Increased network performance with intelligent control-optimization of decentralized energy resources – economically and ecologically. Possibility for bidirectional energy flow, reduces technical and non-technical grid losses in distribution and corresponding reduced energy generation and related emissions.

Photo courtesy of Deerfield Beach, Florida

Endnotes

[i] The CyPT utilizes the 2012 GPC Protocol for Community-Wide Emissions as its methodology for estimating GHG emissions. It covers Scopes 1, 2, and 3 emissions for energy generation and energy use in buildings and transportation. Essentially, this means that the CyPT takes into consideration both direct emissions occurring within the city boundaries (such as from exhaust fumes) and indirect emissions from the conversion of chemical energy to power, heat or steam of purchased energy from out side the city. The included Scope 3 emissions refer to the emissions produced as a result of fuel production and extraction. This also includes the construction and production of renewable power plants.

[ii] Florida Power and Light, 2018, Ten Year Site Plan. Accessed, March 2019, https://www.fpl.com/company/pdf/10-year-site-plan.pdf

[iii] BCT Connected 2019-2028 Transit Development Plan, 2018. Accessed, March 2019. https://www.broward.org/BCT/Documents/BCT_2019-28-TDP.pdf

[iv] The Southeast Florida Regional Climate Change Compact. Accessed April 2019. https://southeastfloridaclimatecompact.org/

[v] Department of Energy, Energy Efficiency and Renewable Energy (EERE). State and Local Energy Data for City of Deerfield Beach. Accessed March 2019.
https://www.eere.energy.gov/sled/#/results/elecandgas?city=Deerfield%20Beach&abv=FL&section=electricity&currentState=Florida&lat=26.3184123&lng=-80.09976569999998

[vi] Energy Information Administration, EIA, 2015 Residential Energy Consumption Survey. 2018. Accessed December 2019. https://www.eia.gov/consumption/residential/data/2015/c&e/pdf/ce1.1.pdf

[vii] Energy Information Administration, EIA, 2012 Commercial Buildings Energy Consumption Survey (CBECS). 2012. Accessed December 2019. https://www.eia.gov/consumption/commercial/data/2012/c&e/cfm/e2.php