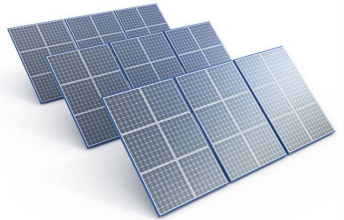
Enabling Community Energy Sustainability

Florida League of Cities 2021 Annual Conference
Renewable Energy and 21st Century Sustainability
World Center Marriott in Orlando
1:30PM Friday, August 13, 2021

James Fenton, Director

UCF | FSEC Energy Research Center
UNIVERSITY OF CENTRAL FLORIDA

FSEC Program Areas



Solar

Buildings

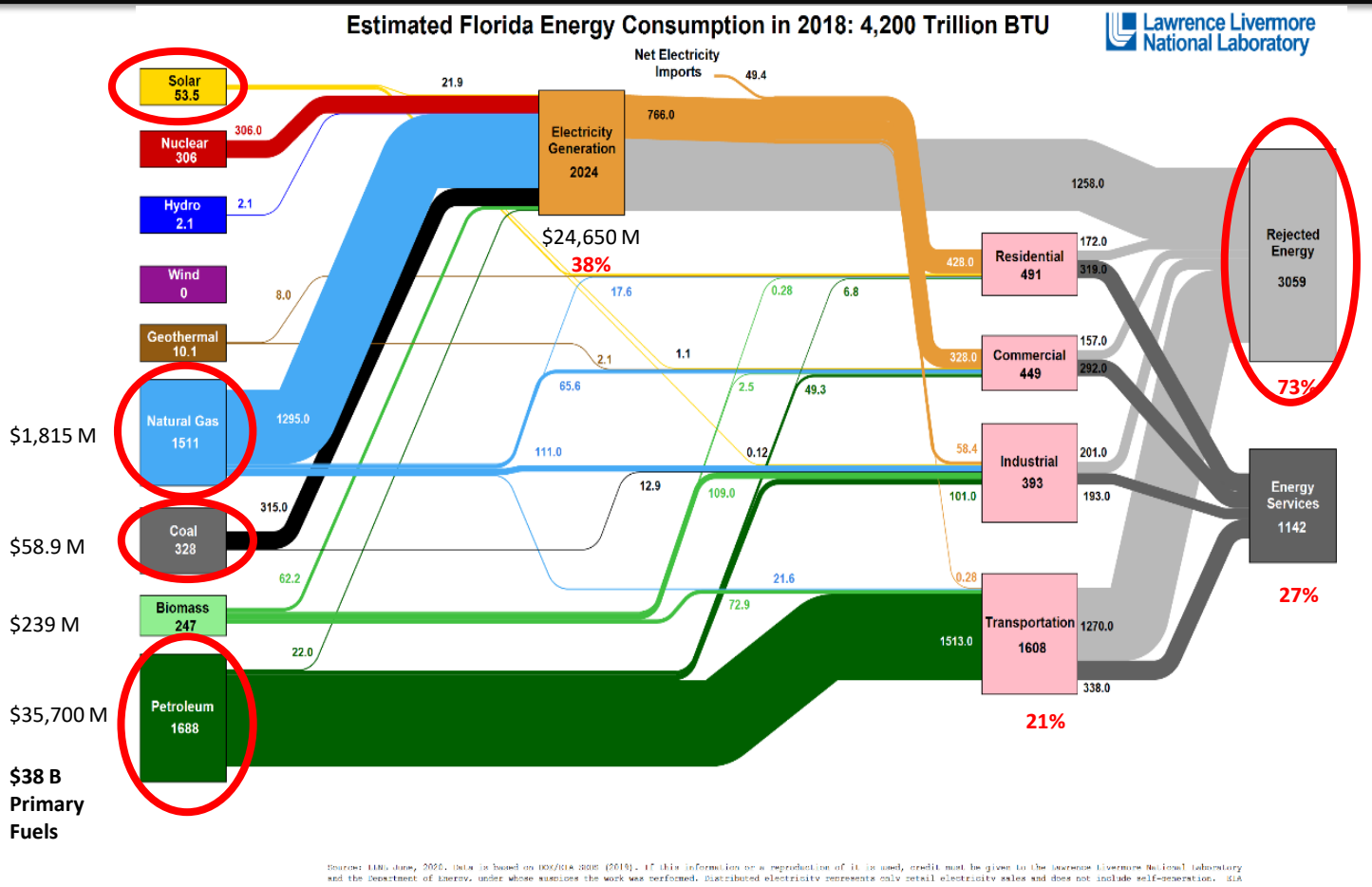
Transportation

Storage

Systems

Education

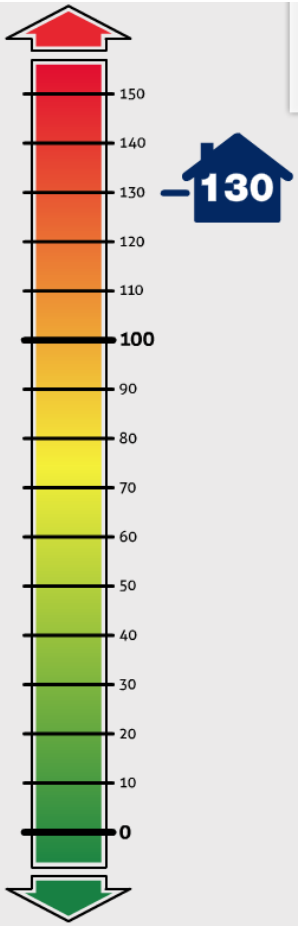
Policy



- **Florida spent $63 billion on energy, almost all from imported coal, oil, gas, and nuclear**
- **73% of primary energy is wasted**
- **Florida Electricity: 54% Residences, 39% Commercial establishments > 90% Buildings**

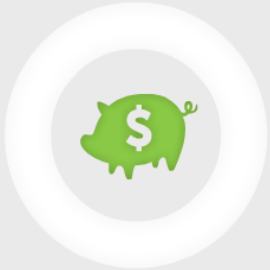
*2018 Latest Energy Flow Chart Available from LLNL https://flowcharts.llnl.gov/commodities/energy

Energy Efficient Homes



THE RESNET HERS INDEX

Find a RESNET Energy Smart Builder



ANNUAL SAVINGS

CARBON FOOTPRINT

COMFORT

130 Your house is not energy efficient and is generating additional costs rather than saving you money.

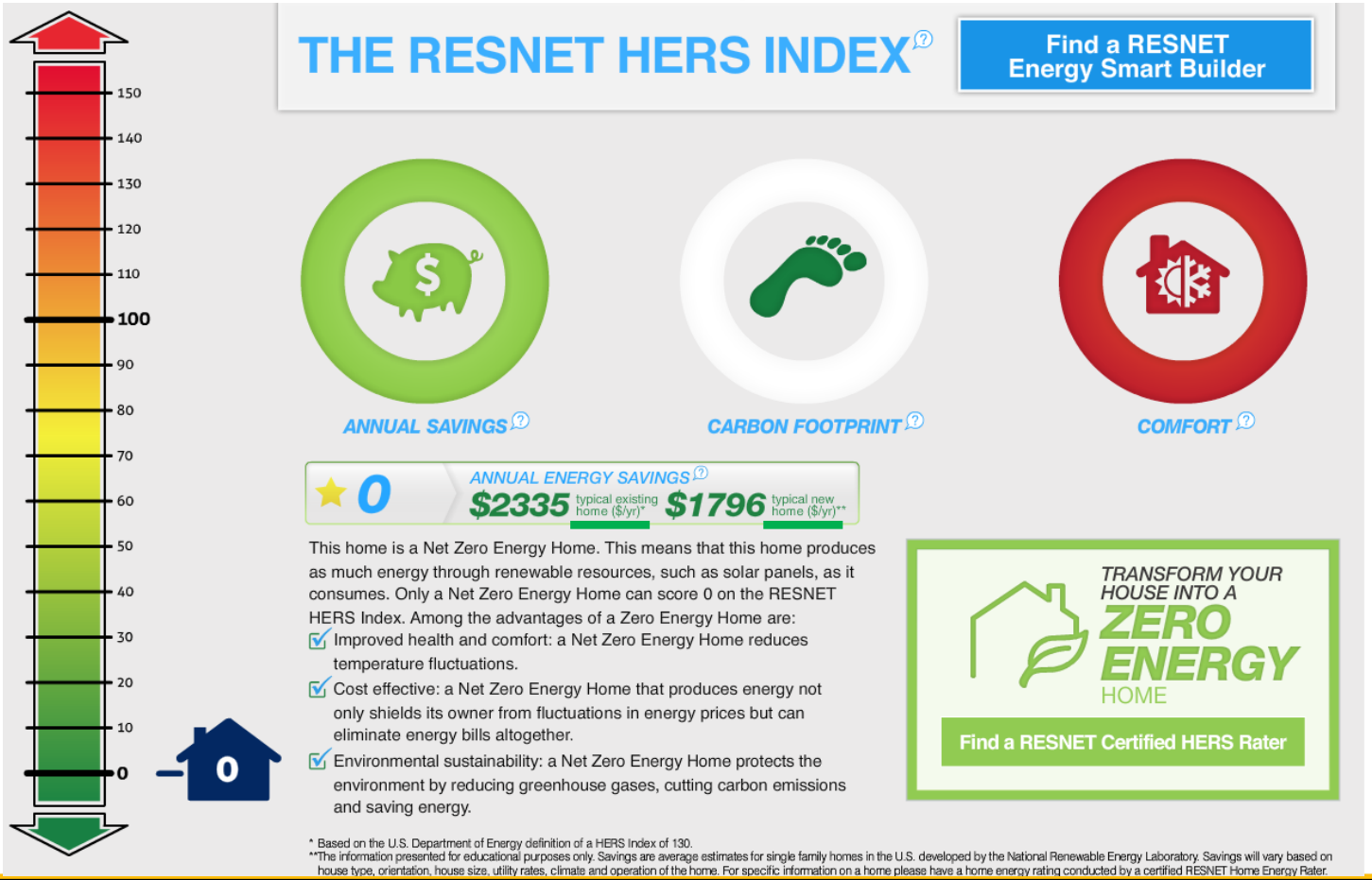
This is the typical resale home score. That means if you're in the market for a home, this house will be at least 30% less energy efficient than it should be. Therefore, the smart way to buy a home is to determine its HERS Index score before you decide to buy. If you decide to purchase such a house, you should definitely consider taking advantage of an Energy Improvement Mortgage.

LOOK FOR THE **HERS INDEX SCORE** BEFORE BUYING

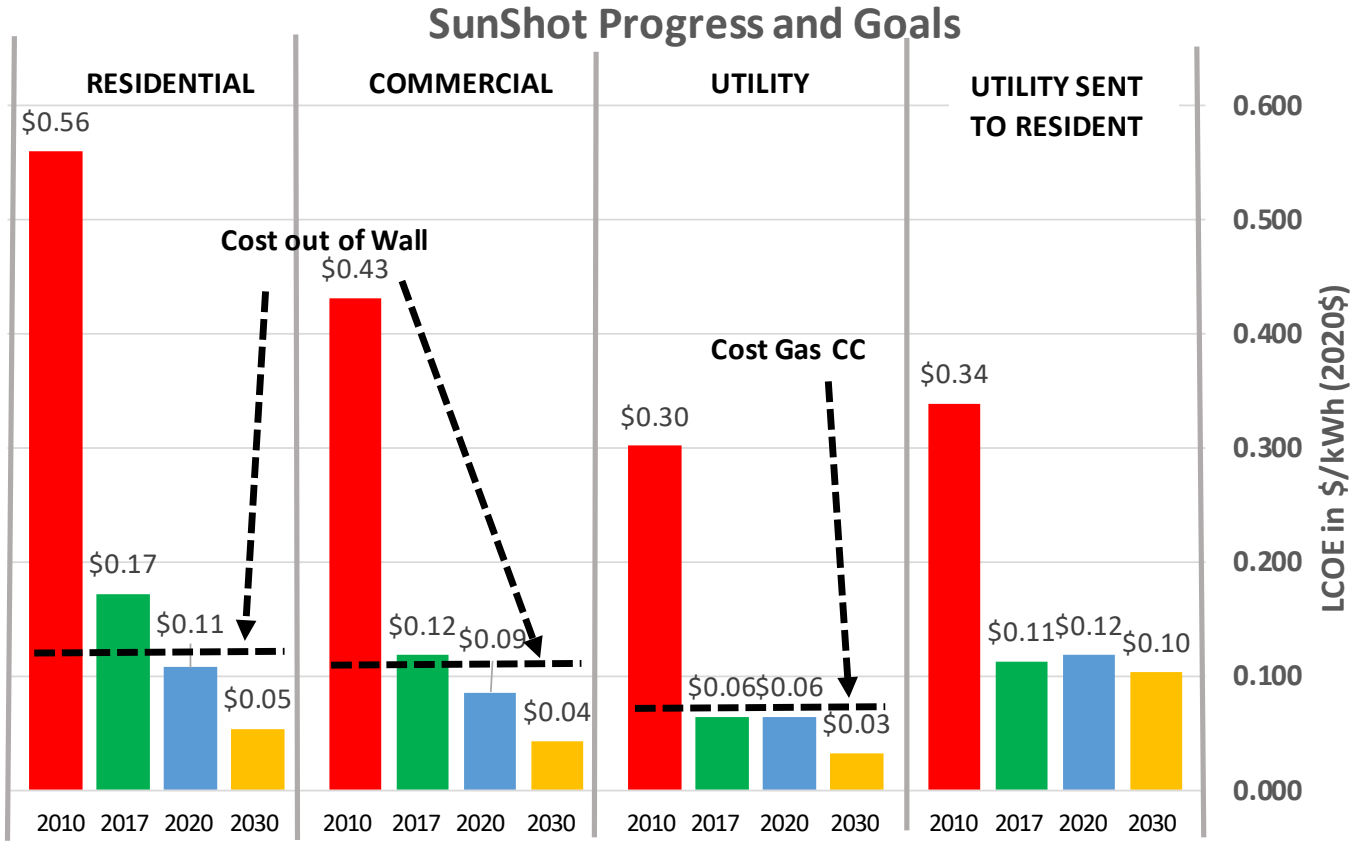
Find a RESNET Certified Professional

* Based on the U.S. Department of Energy definition of a HERS Index of 130.
**The information presented for educational purposes only. Savings are average estimates for single family homes in the U.S. developed by the National Renewable Energy Laboratory. Savings will vary based on house type, orientation, house size, utility rates, climate and operation of the home. For specific information on a home please have a home energy rating conducted by a certified RESNET Home Energy Rater.

Efficiency First



Rooftop Solar Has Lowest Cost

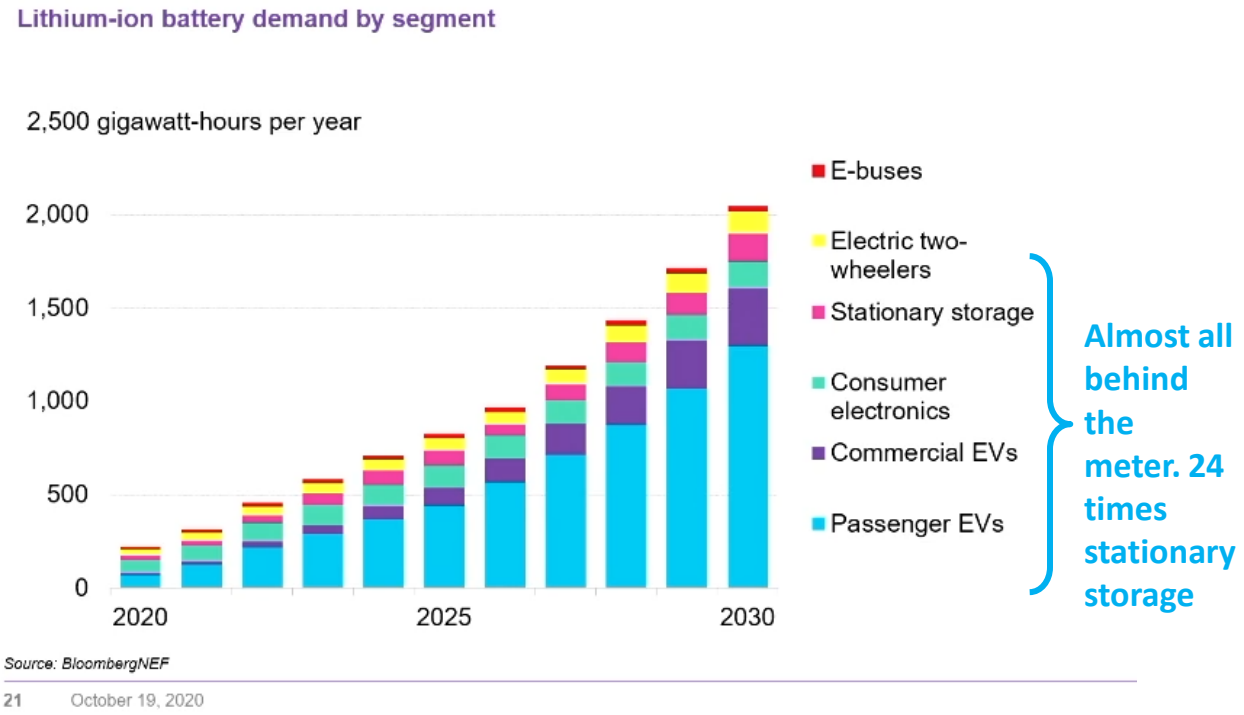


- When utilities add power plants the customers pay more (shareholders win)
- When customers add solar on their roof customers pay less (residents win)

- 2020 Rooftop solar is less expensive than electricity out of the wall and less expensive than utility solar transmitted and distributed to the customer through the wall. In 2030 rooftop solar is half the cost of utility solar distributed to the customer!

V2G – Where the Batteries Are

Lithium-ion battery demand will increase ten-fold in a decade



Driving Sustainable Energy Investment in Florida Communities

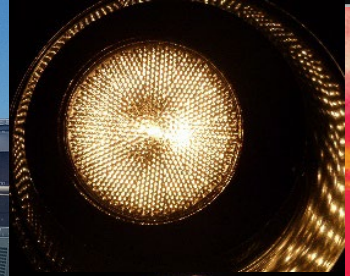
- What do we know about Florida Communities?
  - Recognizing climate change impact and making choices to respond
  - Adopting aggressive (but achievable) renewable energy targets
- Hypothesis:
  - Many Florida Communities need assistance in identifying and prioritizing cost-effective and timely options to meet targets
  - FSEC can play critical role—identify research-informed options and monitor/validate deployments—to help communities reach clean energy/sustainability goals
- Potential Solution:
  - Florida Energy Investment Collaborative

Florida Energy Investment Collaborative

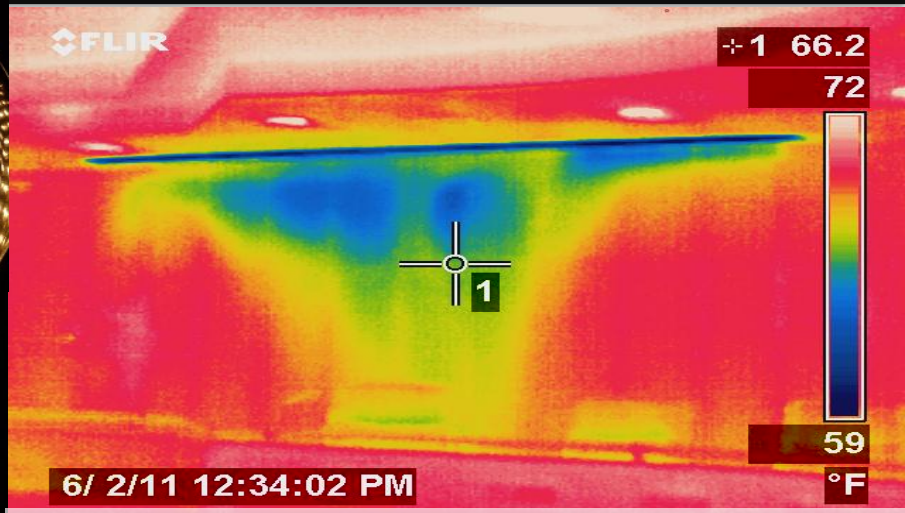
- How might communities benefit?
  - Potential for communities to pool funds for collaboration
  - Transparent, merit-based process identifies highest impact projects
  - Streamlined project execution with FSEC as one-stop-shop for management, support, and verification
- Currently at concept stage
  - Key outcome would be selection, funding, completion of high impact renewable/clean energy projects at community level
  - Thinking through possible partners (communities, utilities, others?), proposal process, funding mechanisms, etc.
  - FSEC could provide program management, technical assistance, field verification

MUNICIPAL BUILDING ENERGY ASSESSMENTS

HVAC Upgrades Improve Efficiency

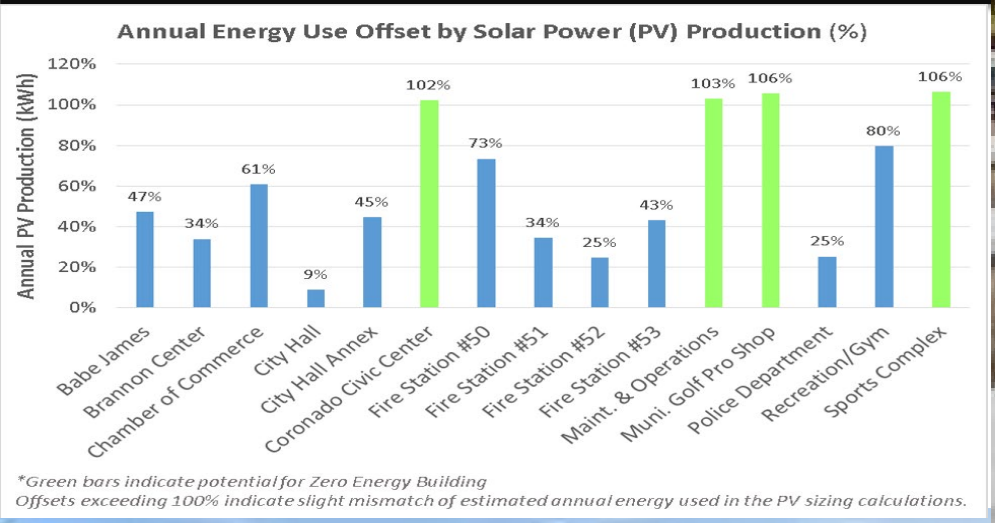


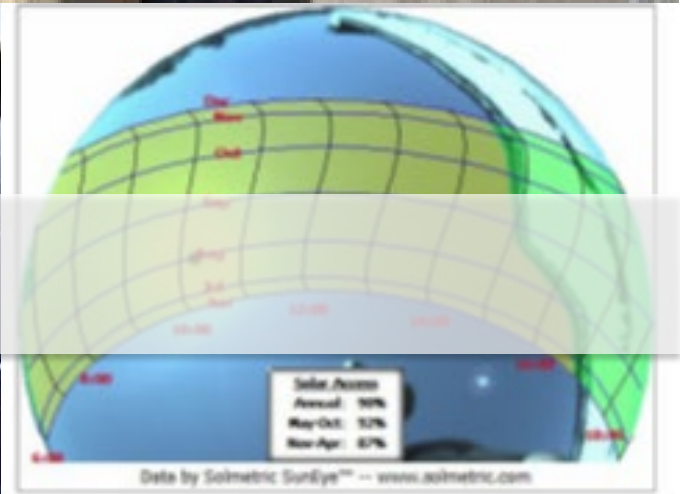
Incandescent and CFL Lamps



Overcooling of Unoccupied Assembly Space

Missing R19 Insulation





SOLAR FEASIBILITY STUDIES

Is Your Building Right for Solar?

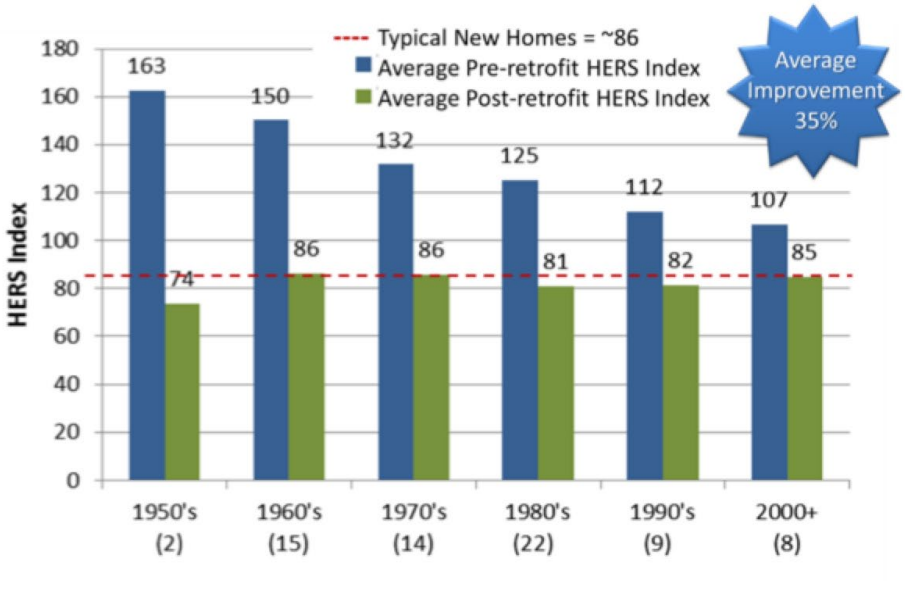
- Energy Use
- Available Space
- Age of Roof
- Orientation
- Interconnection

ENERGY-EFFICIENT AFFORDABLE HOUSING

Habitat for Humanity®

A home is not **affordable** if it is not healthy, durable, and energy efficient.

Cost-Effective Retrofits of Existing FL Homes



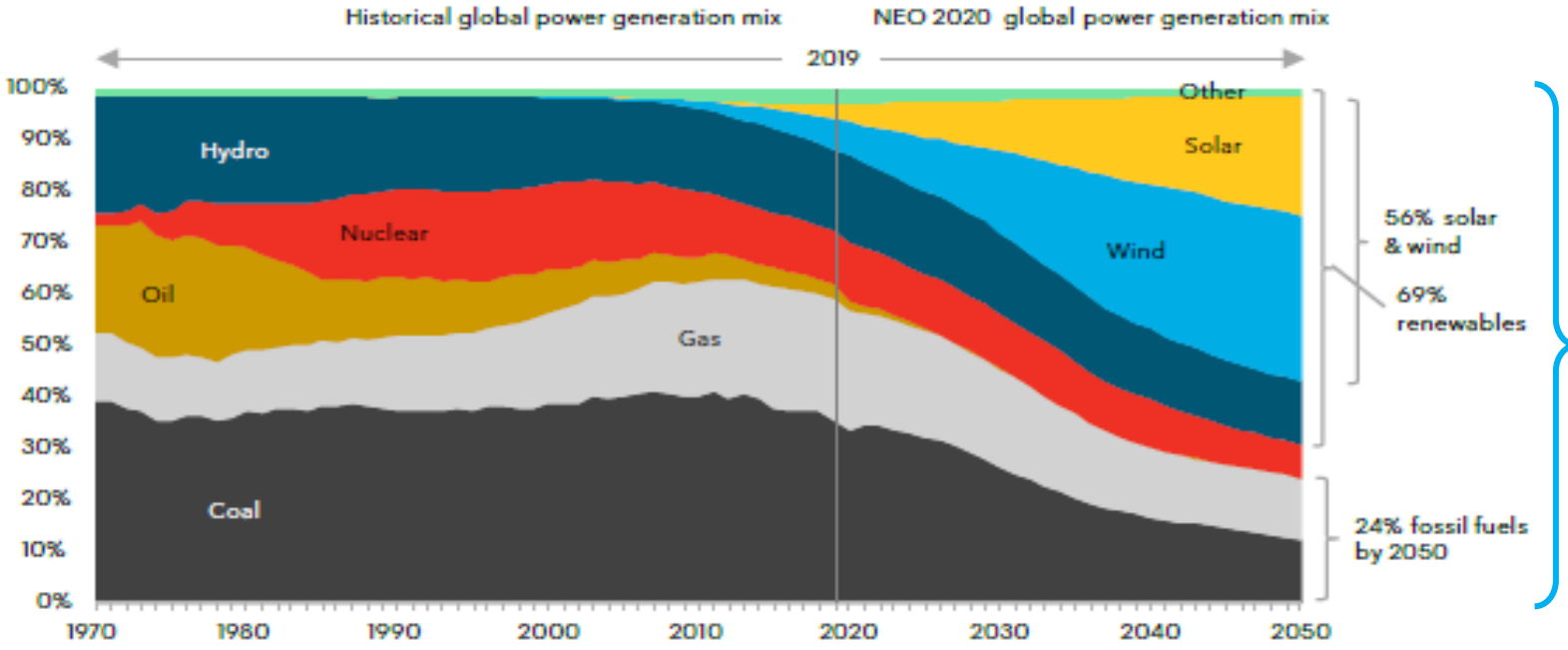
Average HERS Index Pre- and Post-Retrofit

Average Improvement of 35%

Building America Partnership for Improved Residential Construction

BloombergNEF New Energy Outlook 2020 Economic Transition Scenario

Figure 2: Global electricity generation mix

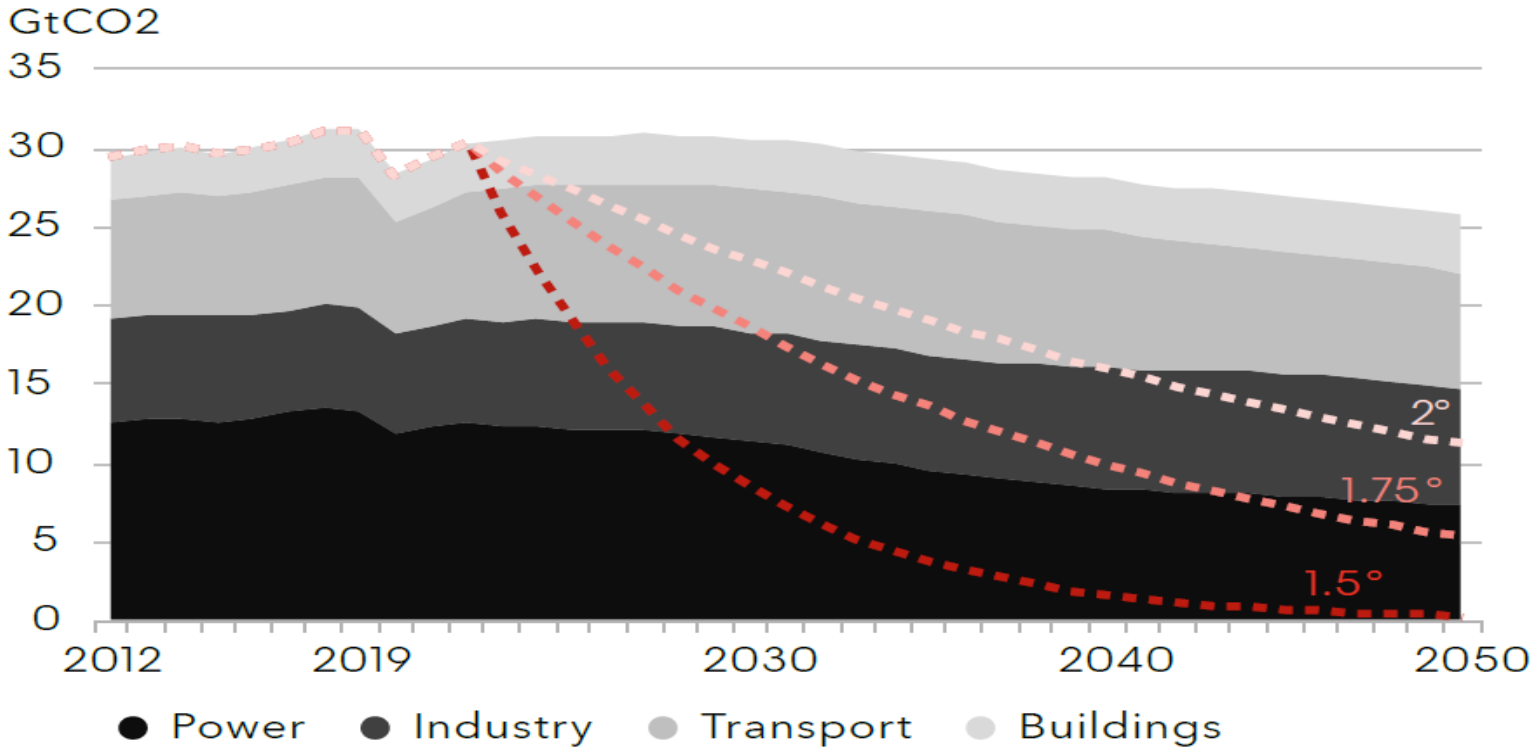


40,451 TWh in 2050

24,000 TWh in 2020

Source: BloombergNEF, IEA

Emissions in the Economic Transition Scenario, by sector, and a range of carbon budgets



Source: BloombergNEF

Solar, Efficiency, Energy Storage & EV Job Growth is Just Starting

TOP 10 STATES FOR CLEAN ENERGY JOBS

RANK	STATE	TOTAL*	SOLAR	WIND	ENERGY EFFICIENCY	CLEAN VEHICLES
1	California	512,934	126,507	5,785	318,542	22,389
2	Texas	233,447	11,433	25,386	162,816	17,800
3	Florida	158,652	10,528	4,461	118,412	9,360
4	New York	156,059	11,603	3,491	123,292	8,624
5	Michigan	126,081	5,419	4,783	85,061	25,304
6	Illinois	123,247	5,341	8,706	89,469	10,417
7	Massachusetts	116,491	16,527	1,983	86,473	3,184
8	Ohio	112,486	8,108	1,080	81,676	16,646
9	North Carolina	110,913	8,912	908	86,559	7,280
10	Virginia	95,158	4,241	1,628	78,670	5,436

https://www.e2.org/reports/clean-jobs-america-2019/

* Total includes renewable energy, energy efficiency, clean vehicles, battery storage, advanced biofuels, low-impact hydro and other sectors.

CLEAN ENERGY GROWTH IN PERSPECTIVE

110,000

Clean energy jobs grew 3.6 percent in 2018, adding jobs in nearly every state and combining to add over 110,000 net new clean energy jobs nationally.

12

Number of states that have or are considering policies that get 100 percent of their electricity from clean energy sources.

3X

Clean energy jobs outnumbered fossil fuel jobs nearly 3 to 1 in 2018.

10

The number of states that generate more than 20 percent of their electricity from wind and solar—Kansas, Iowa, Oklahoma, North Dakota, South Dakota, Vermont, California, Maine, Colorado, and Minnesota.[3]

156 GW

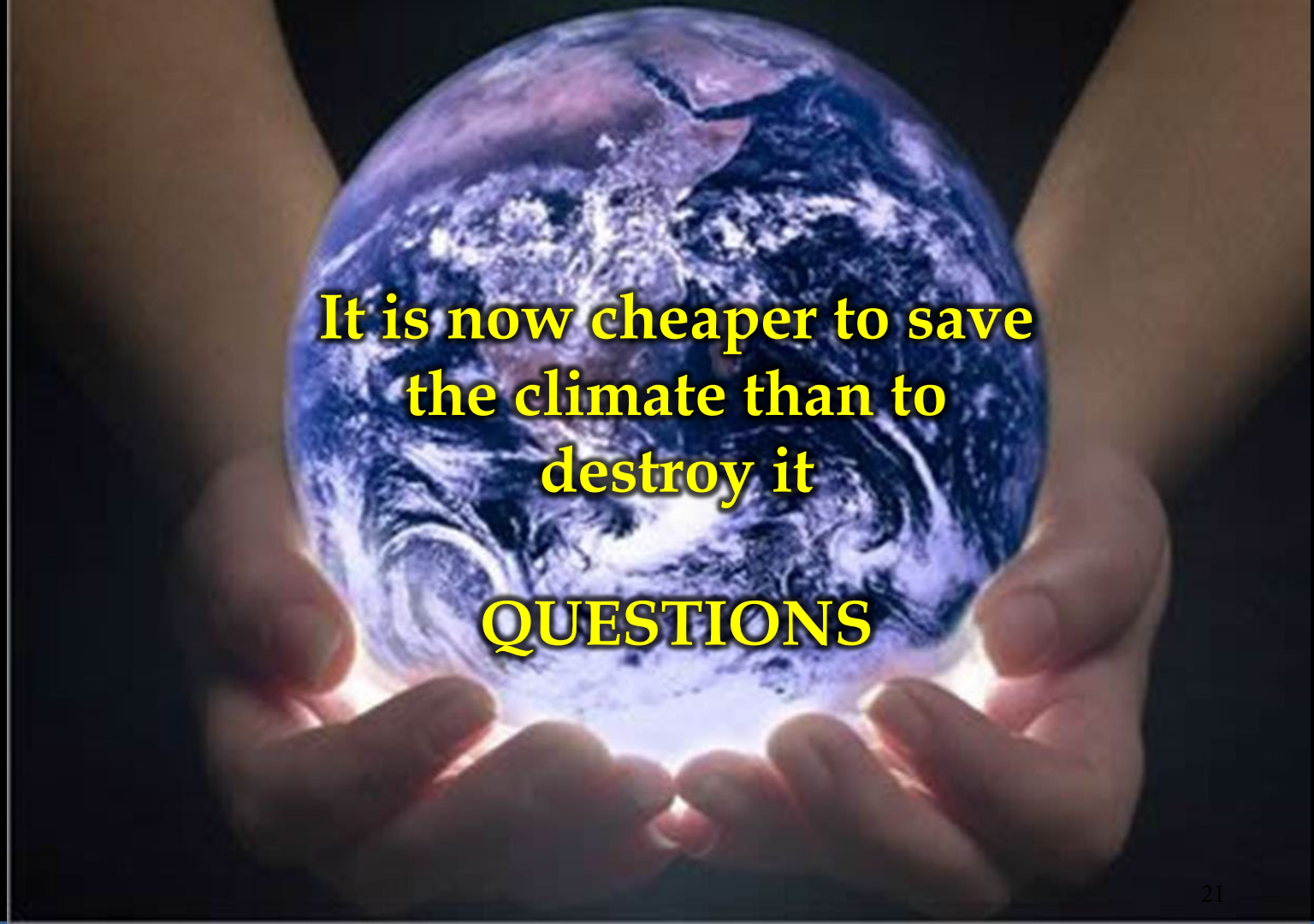
Combined capacity of installed solar and wind surpassed 150GW in 2018. Wind energy is the largest source of renewable generating capacity. A new solar project is installed in America every two minutes.[4,5]

Vision For Florida

Spend Little to No funds on Imported Primary Fuels

- Building energy efficiency improvements, utility and rooftop solar, energy storage, smart-charging electric vehicles (V2G), and demand response all needed to achieve 100% renewables.
- Both utilities and customers (those on each side of the electric meter) must be empowered to achieve 100% renewables. Resiliency will then be achieved.

(Planes start to switch from fossil fuels to renewable hydrogen in 2045. Electric high speed trains could displace much of the fossil fuel planes and get you there quicker and cheaper!)

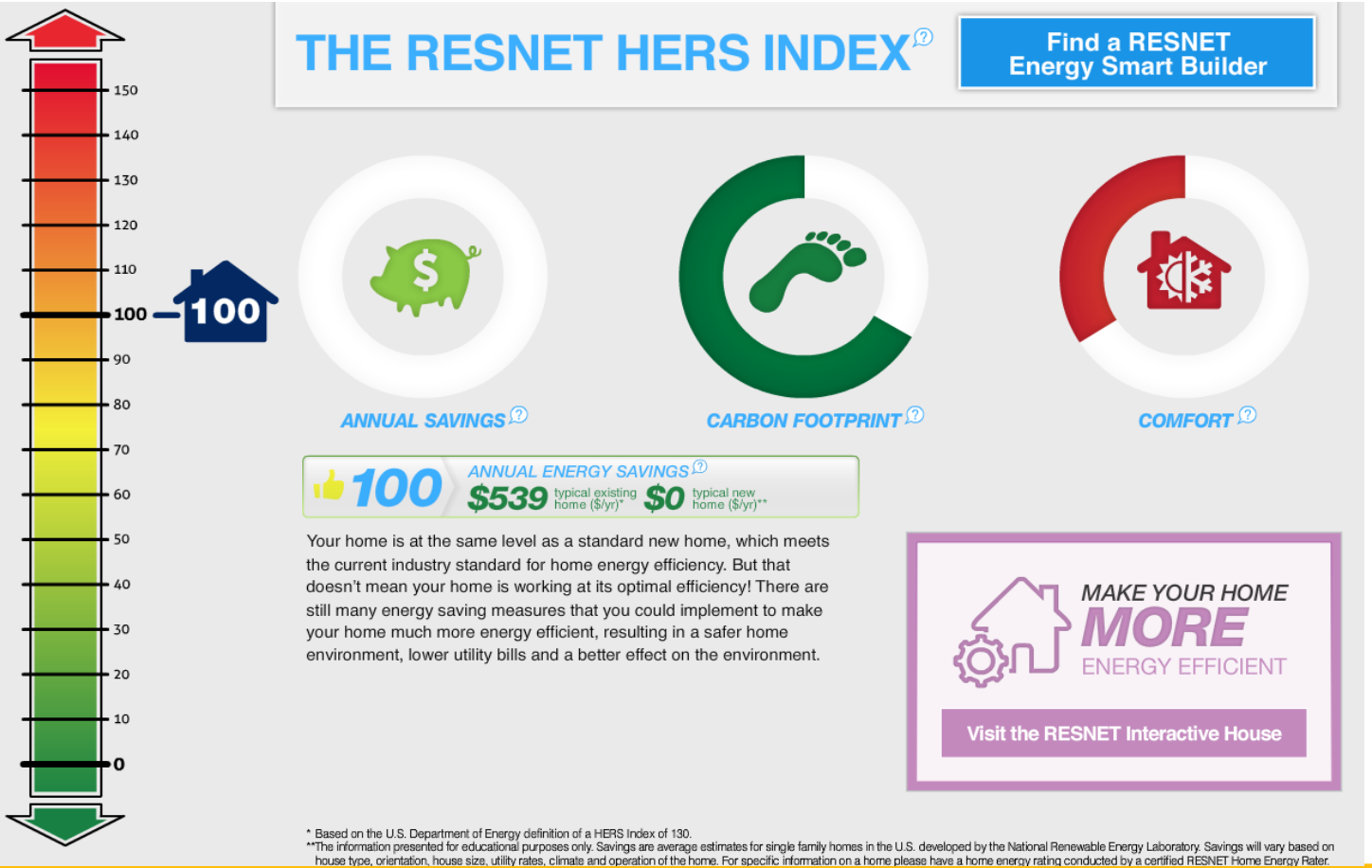

It is now cheaper to save
the climate than to
destroy it
QUESTIONS

Easter Parades in New York City

Year 1900: One Motor Vehicle

Year 1913: One Horse & Carriage

Efficiency First

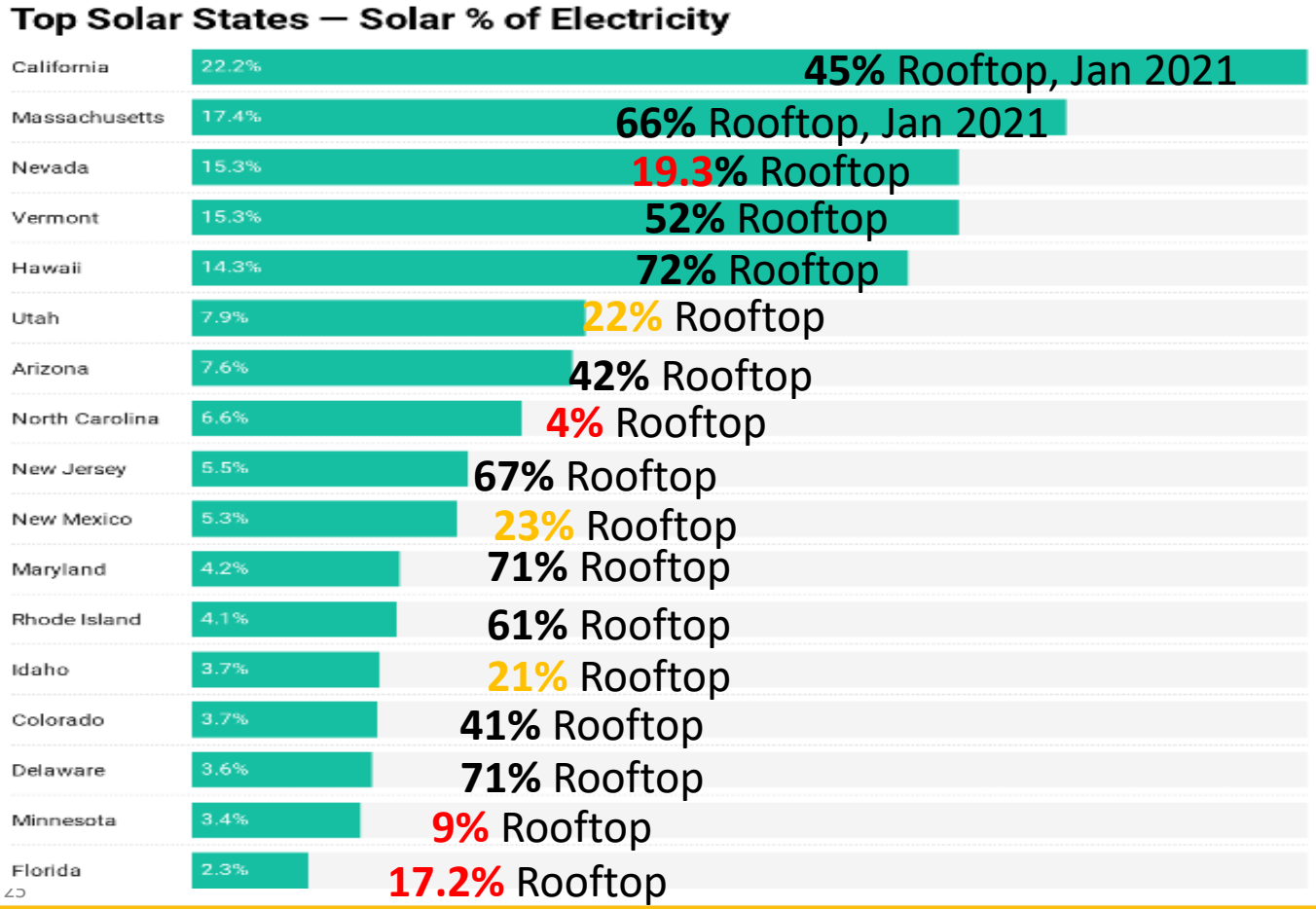


1967 slab-on-grade, 1190 ft², 2/2 home

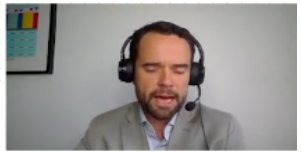
	HERS Index
Pre-retrofit	165
Minimum AC Replacement	144
Post-retrofit	74
% Improvement over Minimum	**49%**

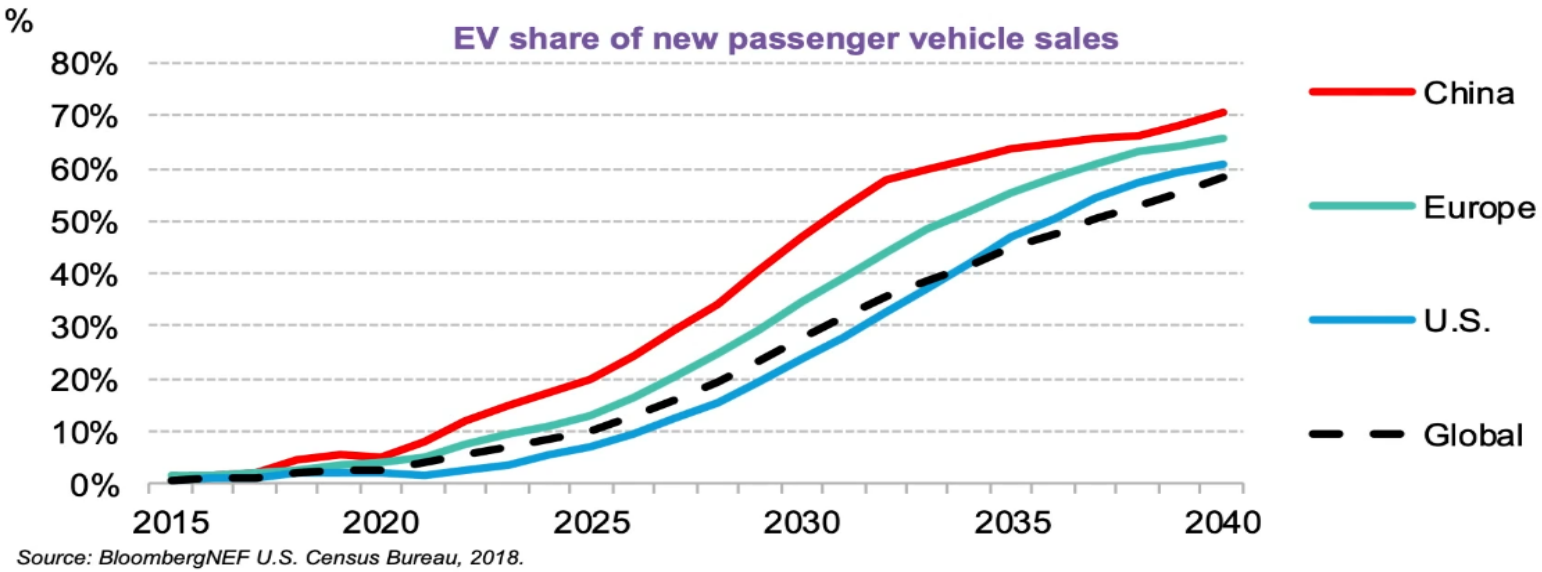
	Projected Annual Energy Cost
Pre-retrofit	$1,983
Minimum AC Replacement	$1,839
Post-retrofit	$1,120
Annual Saving over Minimum	**$719**
Incremental Cost	$5,181
Annual Finance Increase	**$337**
First Year Cash Flow	**+$382**
(Fixed 5%, 30 year)	

2.3% of Florida's Electricity is Solar



……But the U.S. catches up in the 2030s





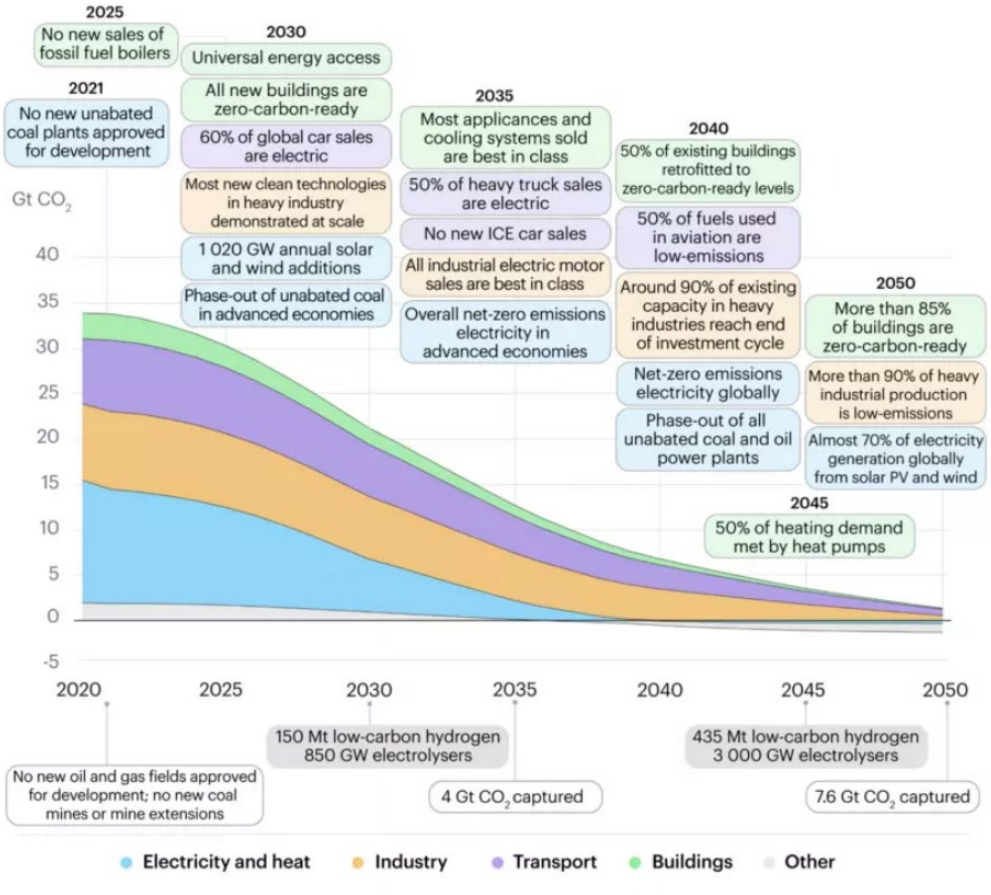
Source: BloombergNEF U.S. Census Bureau, 2018.

BloombergNEF

BNEF Talk: 2020 Long Term Electric Vehicle Outlook https://about.bnef.com/summit/munich/videos/?vid=420741305

https://www.iea.org/reports/net-zero-by-2050

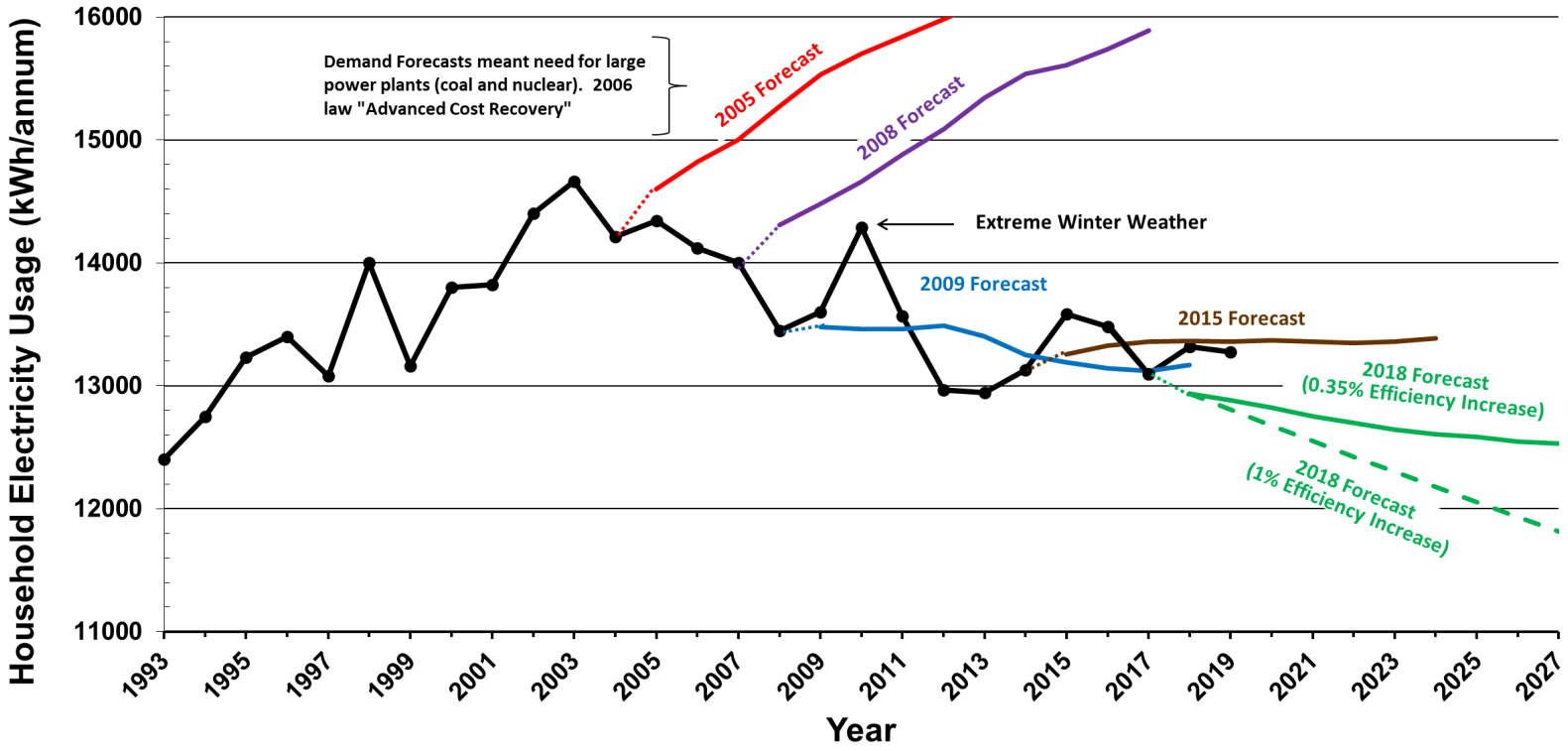
https://www.weforum.org/agenda/2021/06/net-zero-emissions-2050-milestones



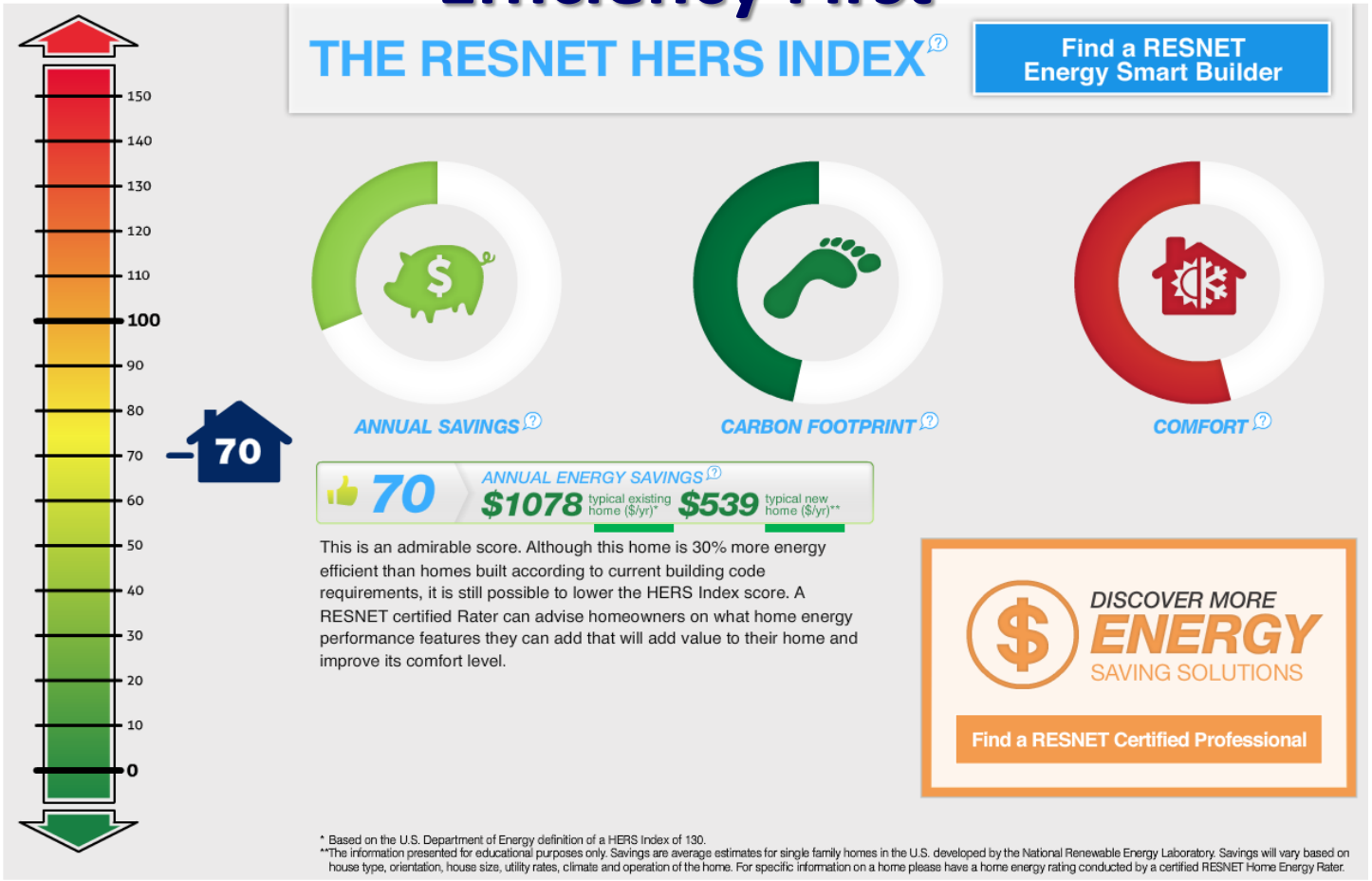
Florida Utility Forecasts Show Lots of Utility Solar
Residential Energy Efficiency Improvements and Customer Owned Solar Forecasts Are Missing

State of Florida: Energy Consumption per Household

(In 2019 9,178,136 Residential Customers used 53.9% of the electricity = 121,825 GWh)



Efficiency First



ENERGY RESILIENCY

Green Works Orlando: 21st Century Sustainability from the Most Visited City in America!

Chris Castro, LEED GA, CPB
Director, Office of Sustainability & Resilience
Future-Ready co-chair
City of Orlando

Green Works Orlando
Office of Sustainability & Resilience

- Award-winning sustainability program called "**Green Works Orlando**" launched by Mayor Buddy Dyer in 2007

- Develops internal and citywide policies + programs to:
  - Protect natural resources and the environment (air, water, land)
  - Improve public health and social equity
  - Create green economic dev. and green jobs opportunities
  - Decrease air pollution and carbon emissions
  - Enhance city resilience and adapt to climate change impacts
  - Reduce operational expenses and enhance efficiency
  - Educate the residents and businesses on sustainable practices

- Focuses on 7 key areas:
  - Clean Energy
  - Green Buildings
  - Local Food Systems
  - Zero Waste
  - Livability
  - Clean Water
  - Electric & Alternative Transportation

GREEN WORKS ORLANDO
cityoforlando.net/greenworks

CITIES RACE TO ZERO

WHY

CITIES NEED TO ACT

Home to **55%** of the global population

Generate **80%** of GPD

80% of cities do not meet air quality standards

Responsible for **75%** of global energy use and emissions

By 2050, 5 billion people living in cities will be exposed to **food insecurity, extreme heat, and/or sea-level rise.**

And now ... IPCC Report has underscored that we are in a CODE RED situation and demand urgent action from our elected leaders.

CITIES

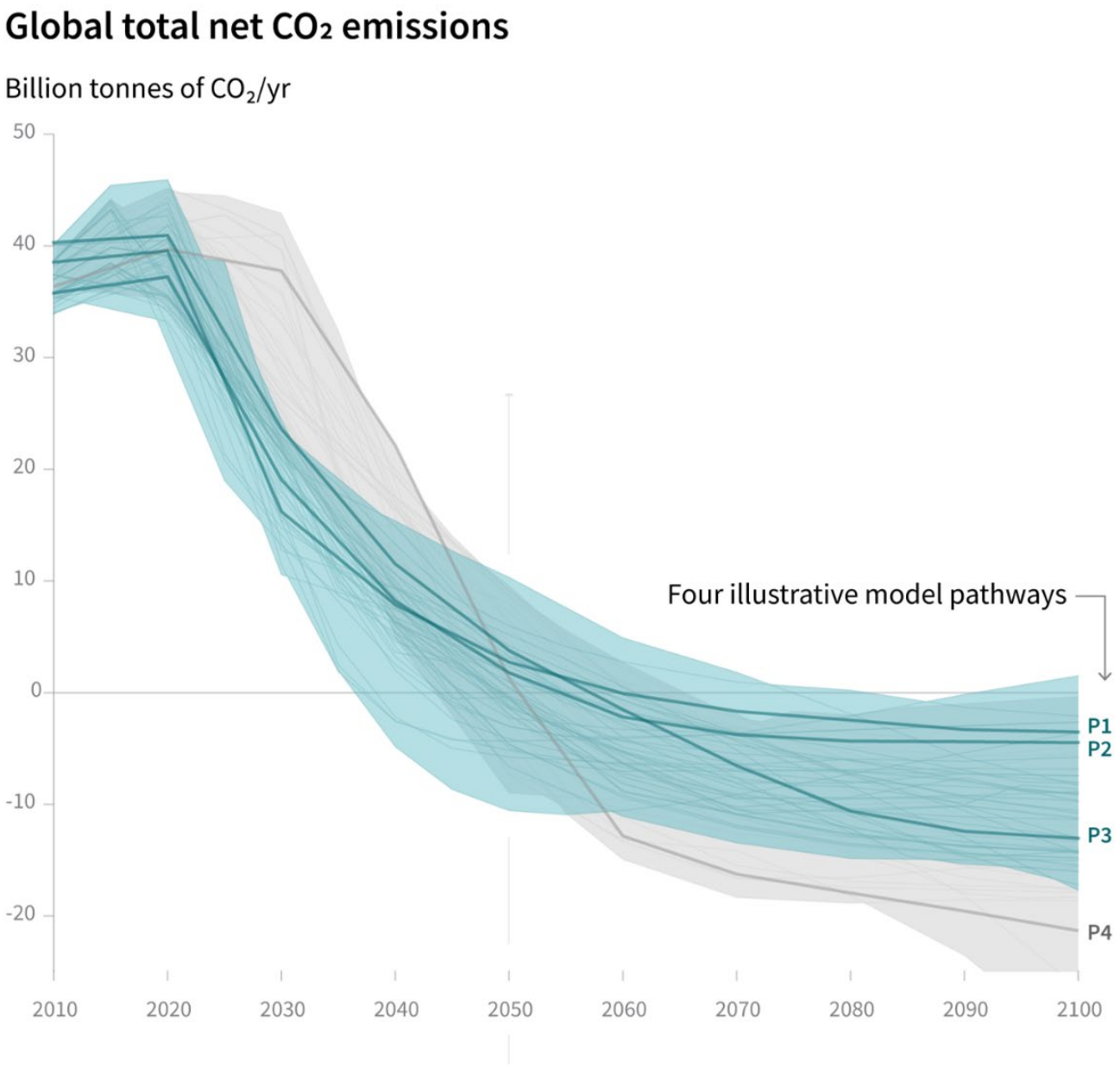
RACE TO ZERO

&

RACE TO ZERO

© Henning Witze

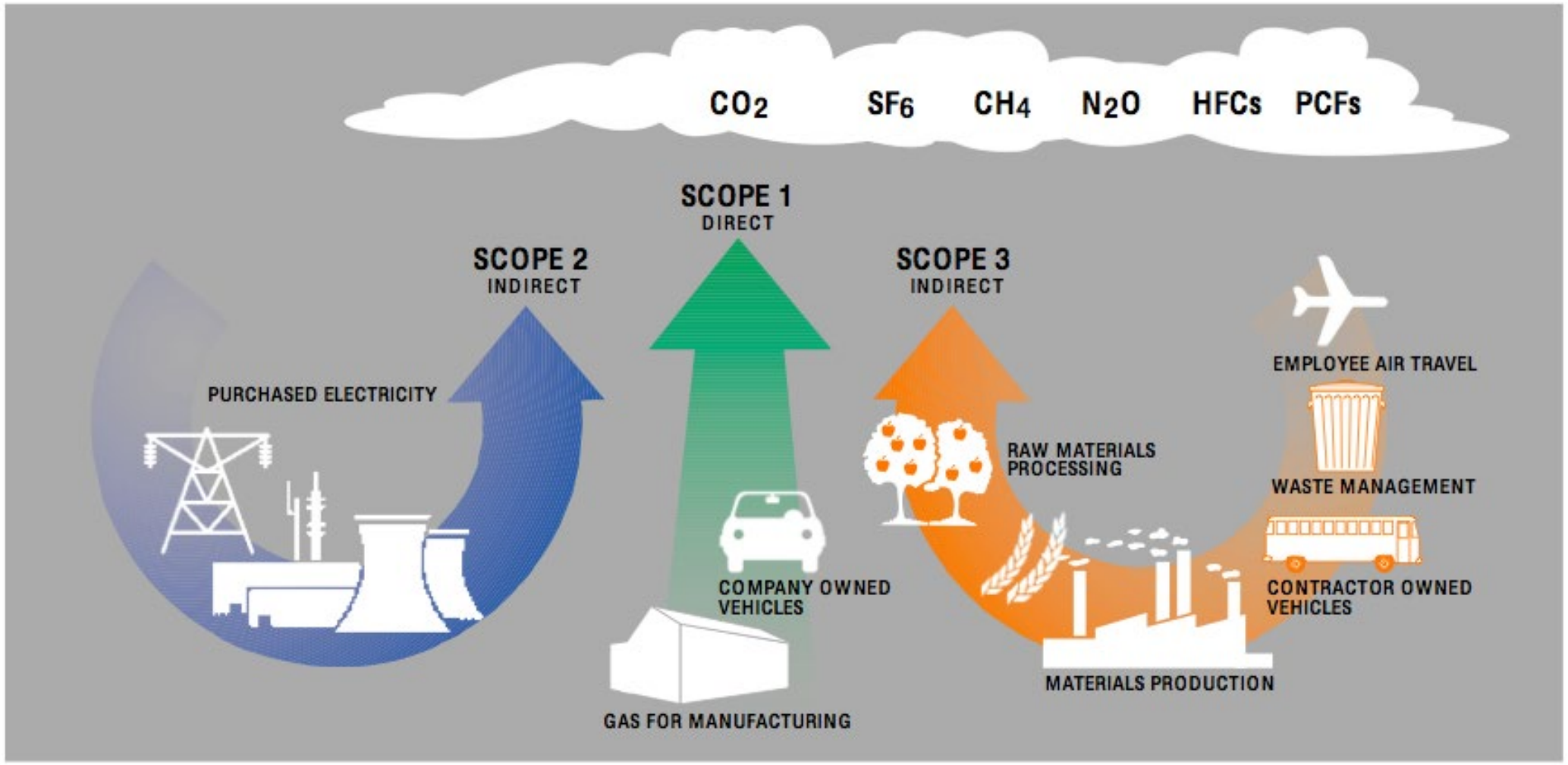
C40 CITIES · CDP DISCLOSURE INSIGHT ACTION · GLOBAL COVENANT of MAYORS for CLIMATE & ENERGY · ICLEI Local Governments for Sustainability · UCLG United Cities and Local Governments · WORLD RESOURCES INSTITUTE | ROSS CENTER · WWF



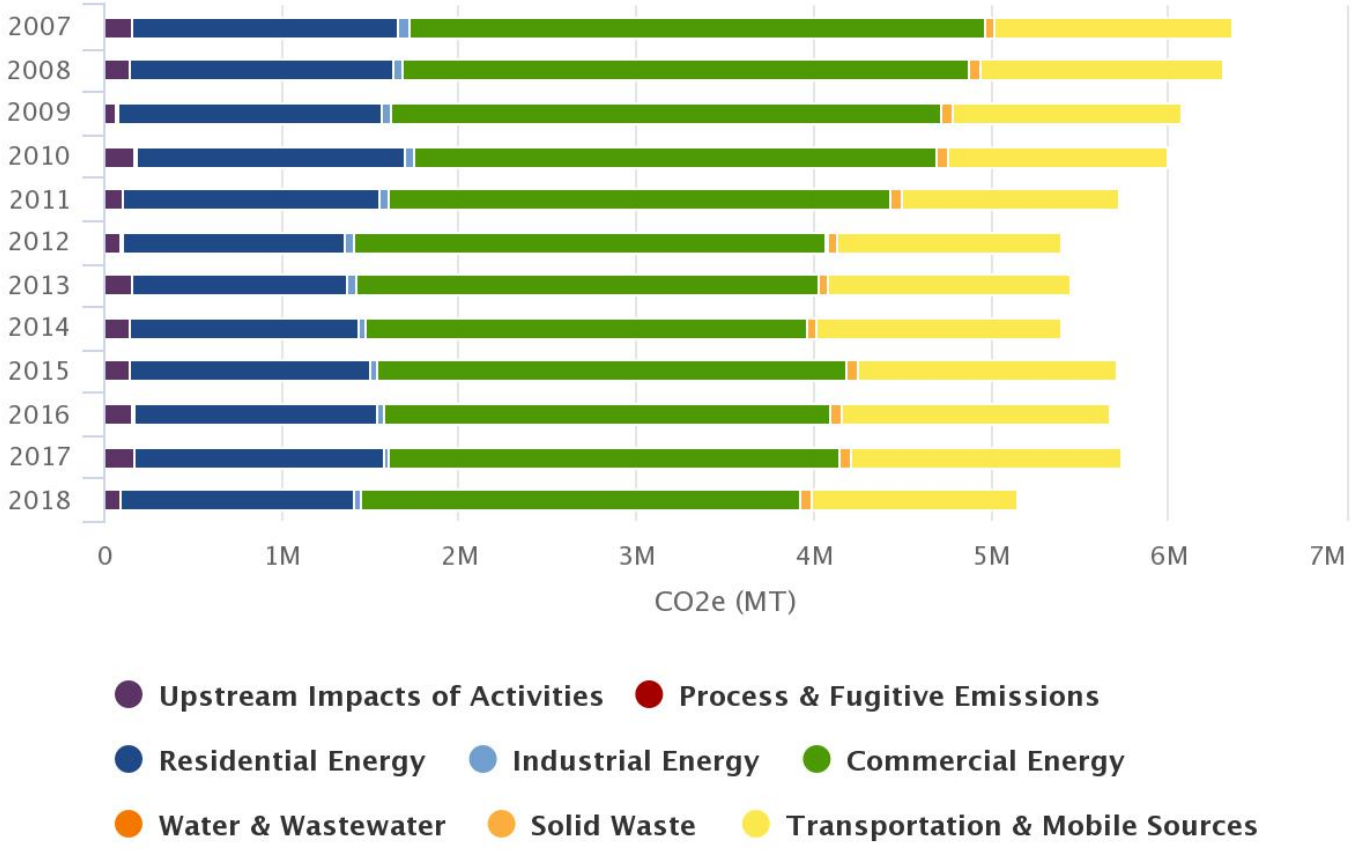
For the safety of people, planet, and economy we must reduce global emissions in half by 2030 and reach net zero emissions by 2050

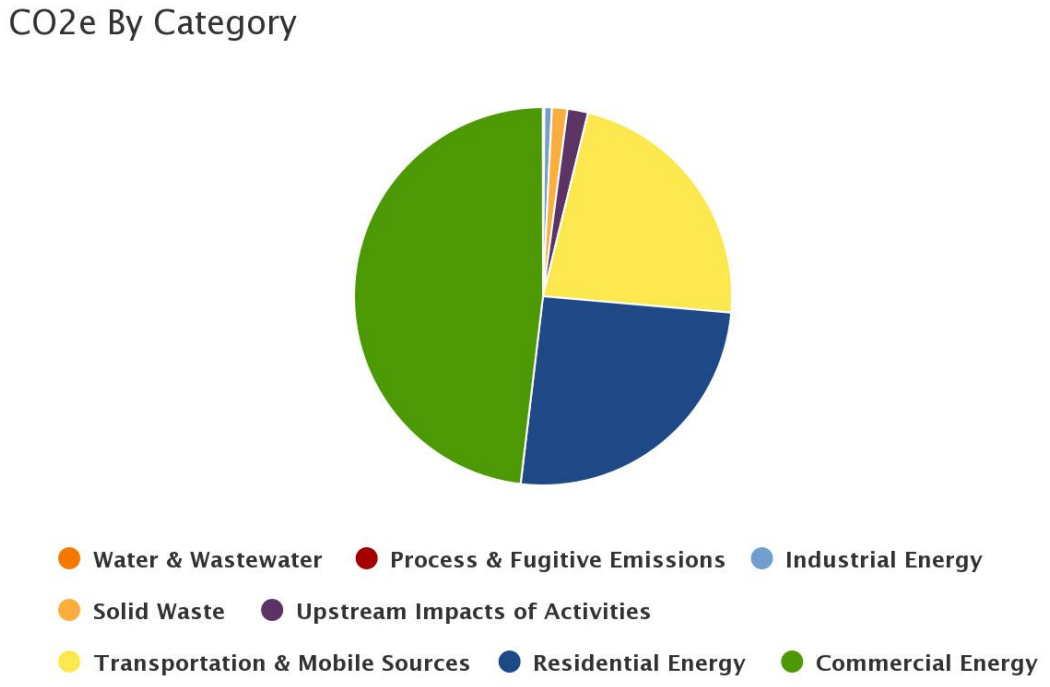
Source: IPCC Special Report on Global Warming of 1.5°C

Greenhouse Gas Emissions Inventory (GHGi)



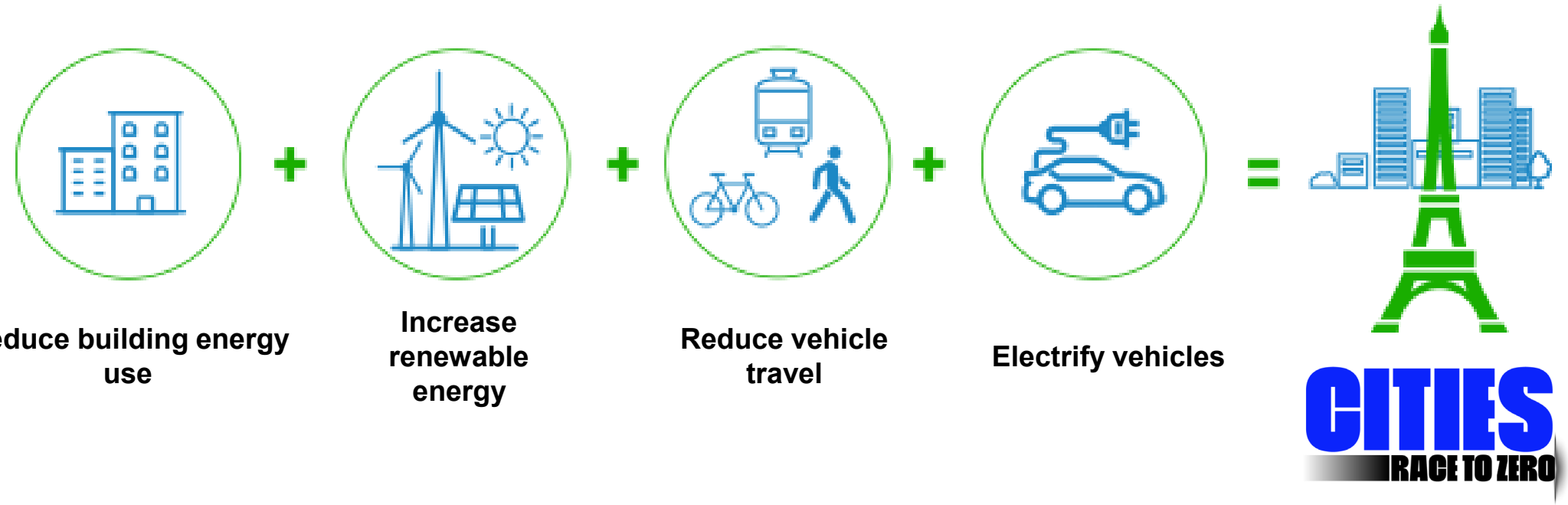
Orlando's Citywide yearly emissions by sector / source





Orlando's Climate Action Strategy

Through the **American Cities Climate Challenge,** the City of Orlando has launched an effort to accelerate and deepen our climate actions to create the greatest climate impact through 2030 and showcase the benefits – **good jobs, cleaner air, and cost savings** – that climate solutions brings.



Green Buildings

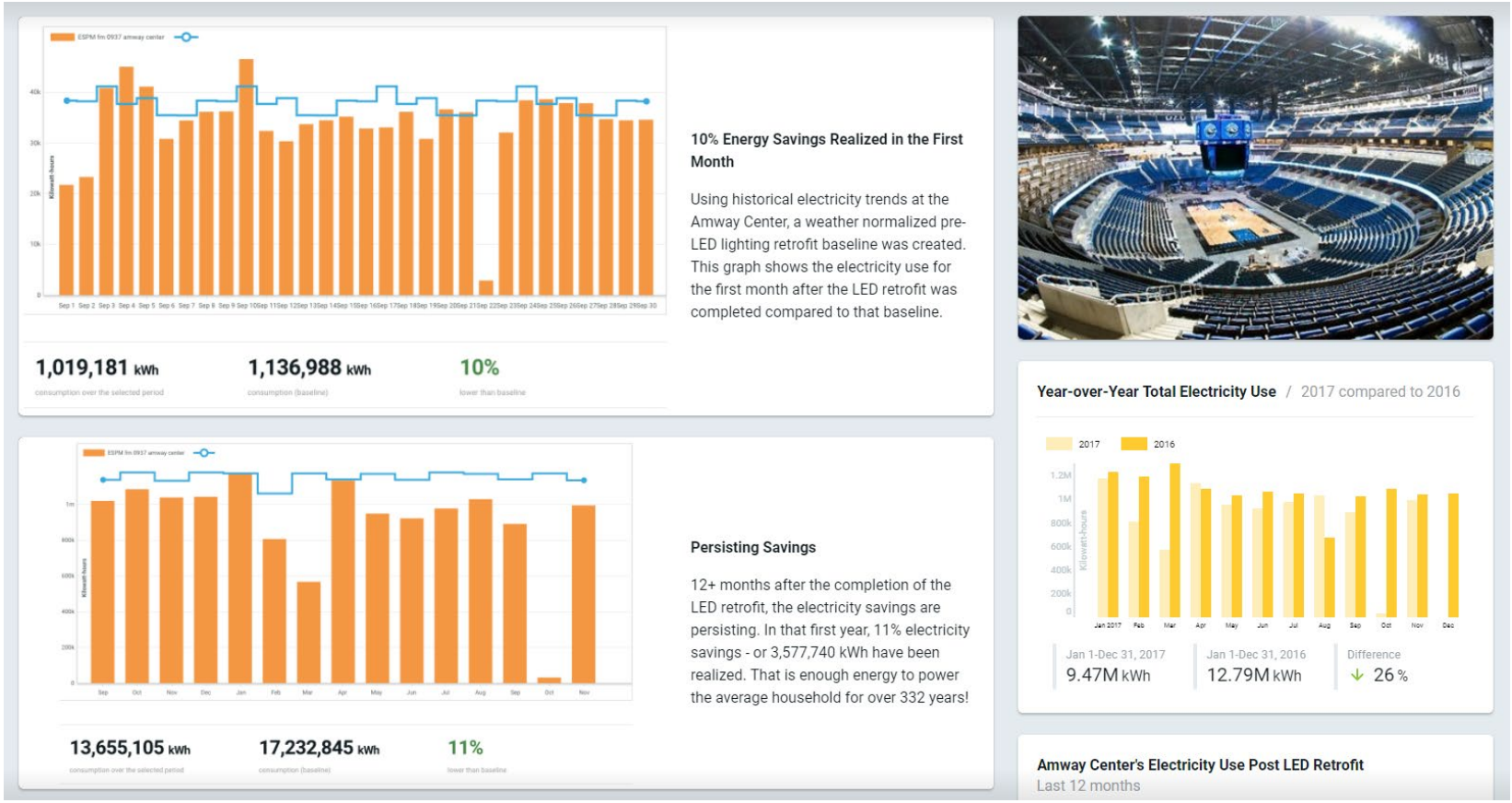
Mandatory LEED Silver certification for City buildings – Grid Interactive Efficient Buildings (GEBs)

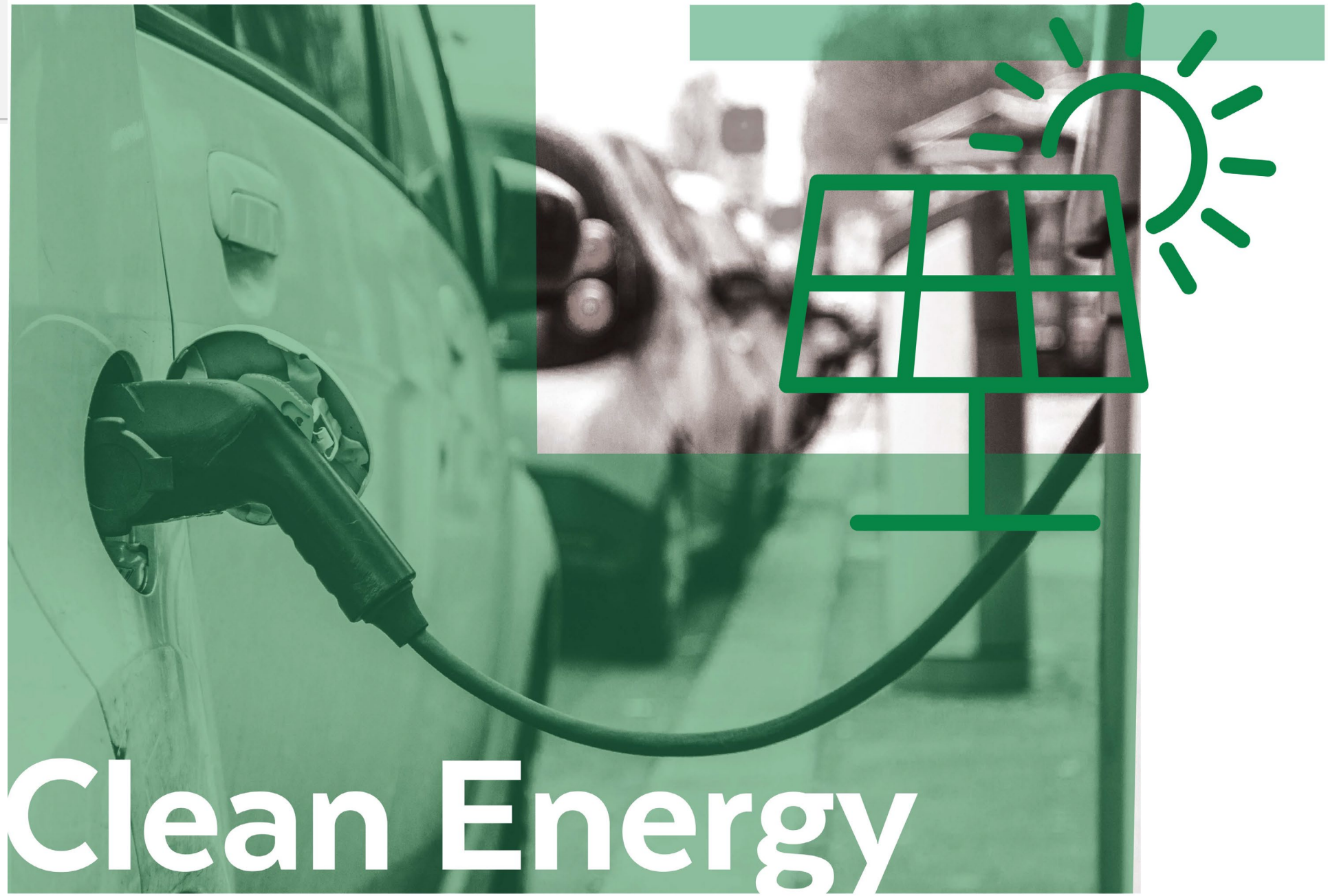
Municipal Green Bond for EE

- $17.5 M green bond for energy efficiency
- 56 municipal buildings across 5+ M sq ft.
- Self-performed vs. ESCO/ESPC model
- Lucid BuildingOS as EM&V tool

RESULTS:

- EUI savings: 23.4% portfolio-wide
- Annual savings: $2.4 M
- Revolving energy fund ~$250,000 per year




Clean Energy

On August 8th, 2017, the City of Orlando adopted **100% Renewable Electricity Policy**:

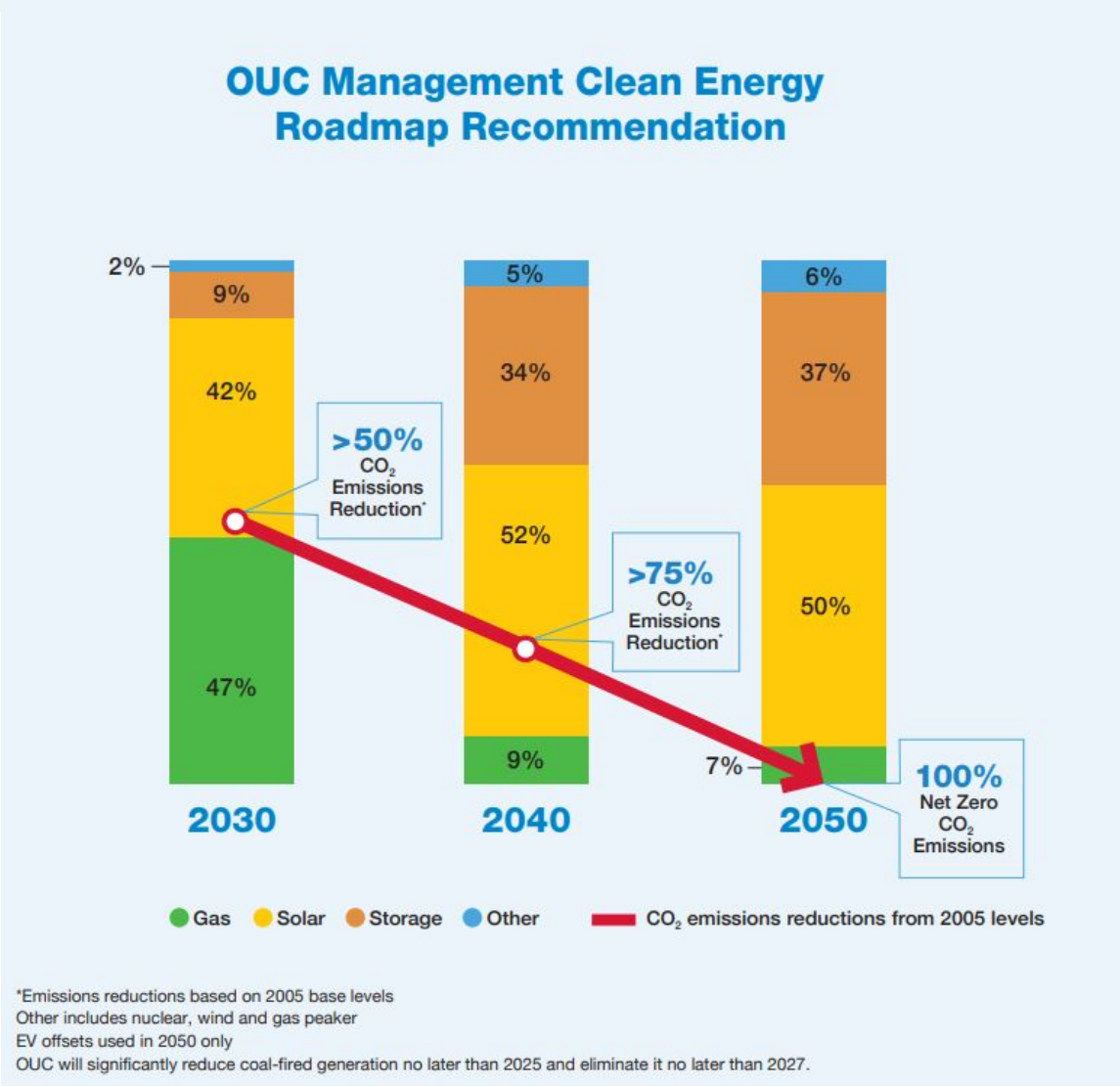
Municipal operations by 2030

Citywide by 2050*

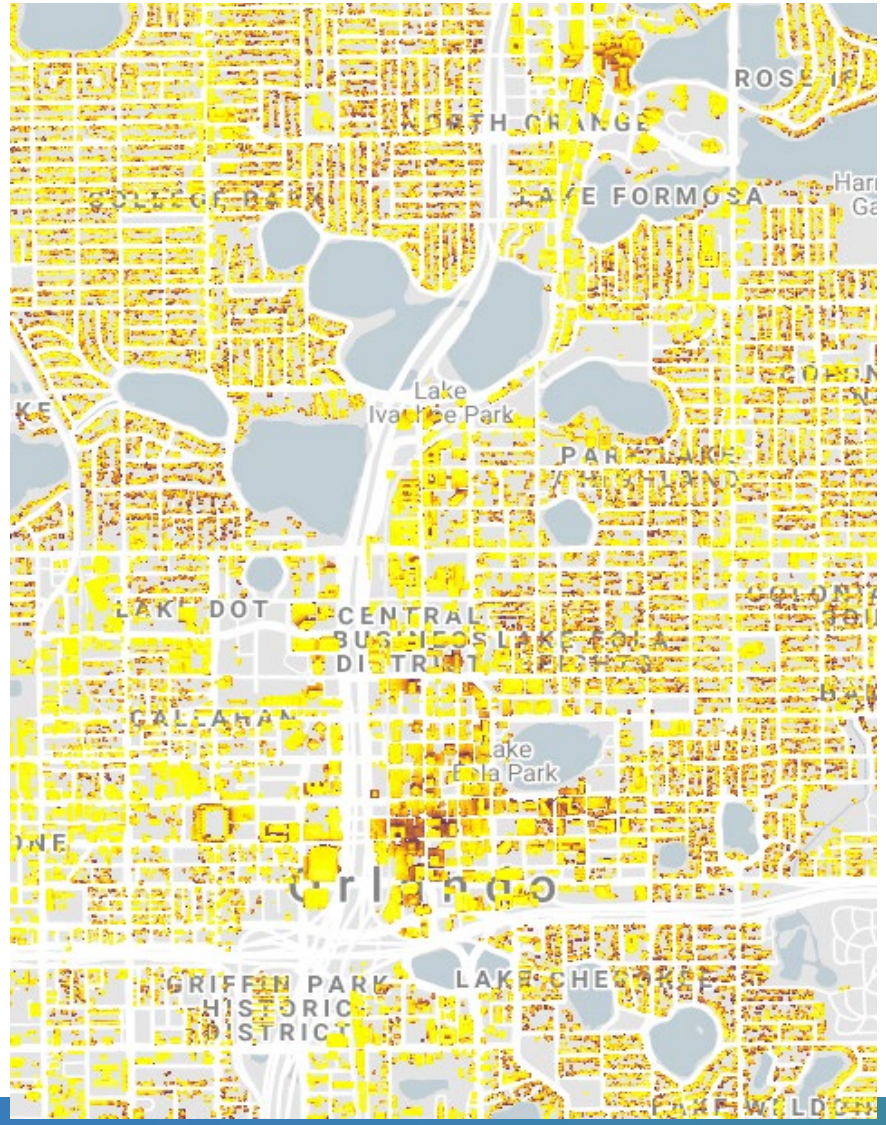
Orlando Utility Pulling Plug on Coal-Fired Generation

OUC The Reliable One

- **Net-zero carbon by 2050**
- **End coal-fired generation**, with a significant reduction no later than 2025, and eliminating it no later than 2027.
- **Accelerate solar and energy storage as primary strategies**. The utility also said it "will continue to monitor cost and performance developments for new and existing clean technologies, such as hydrogen and small modular reactors."
- **Leverage future clean technologies** to ensure diversity for reliability, in order to reduce dependency on solar and storage.
- **Strike to maintain competitive rates for customers while achieving strategic goals**. The utility acknowledged that, "Advancements of this magnitude require significant investments. However, the recommendation delivers the best value."



Citywide Rooftop Solar dGen Study



NREL Transforming ENERGY

Project Sunroof

greenlink

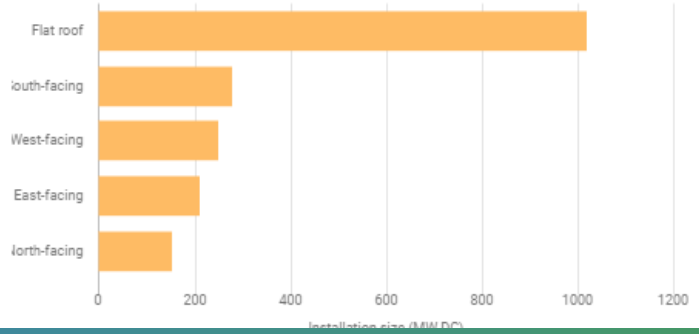
Overall

Total estimated size and solar electricity production of viable roofs for Orlando, FL

Roofs	Roofs
92%	54.5K

Roof space	Capacity	Electricity
135M sq ft	1.9K MW DC	2.6M MWh AC per yr

Total installation size (MW DC)

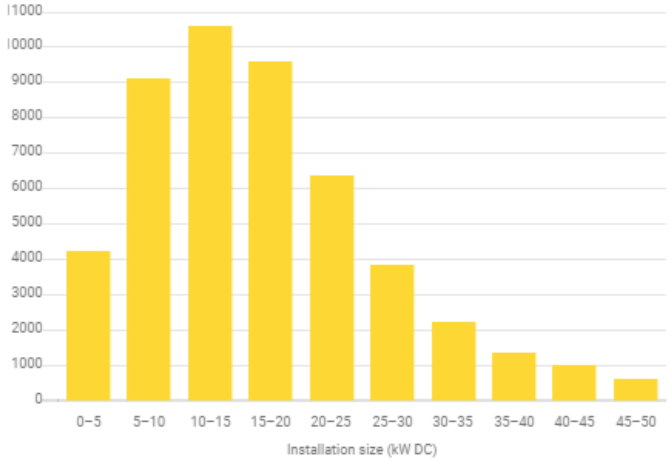


Per roof

Median estimated system size and solar electricity production per viable roof for Orlando, FL

Roof space	Capacity	Electricity
1.2K sq ft	16.3 kW DC	21.6K kWh AC per yr

Rooftop solar capacity distribution (number of roofs, < 50kW)



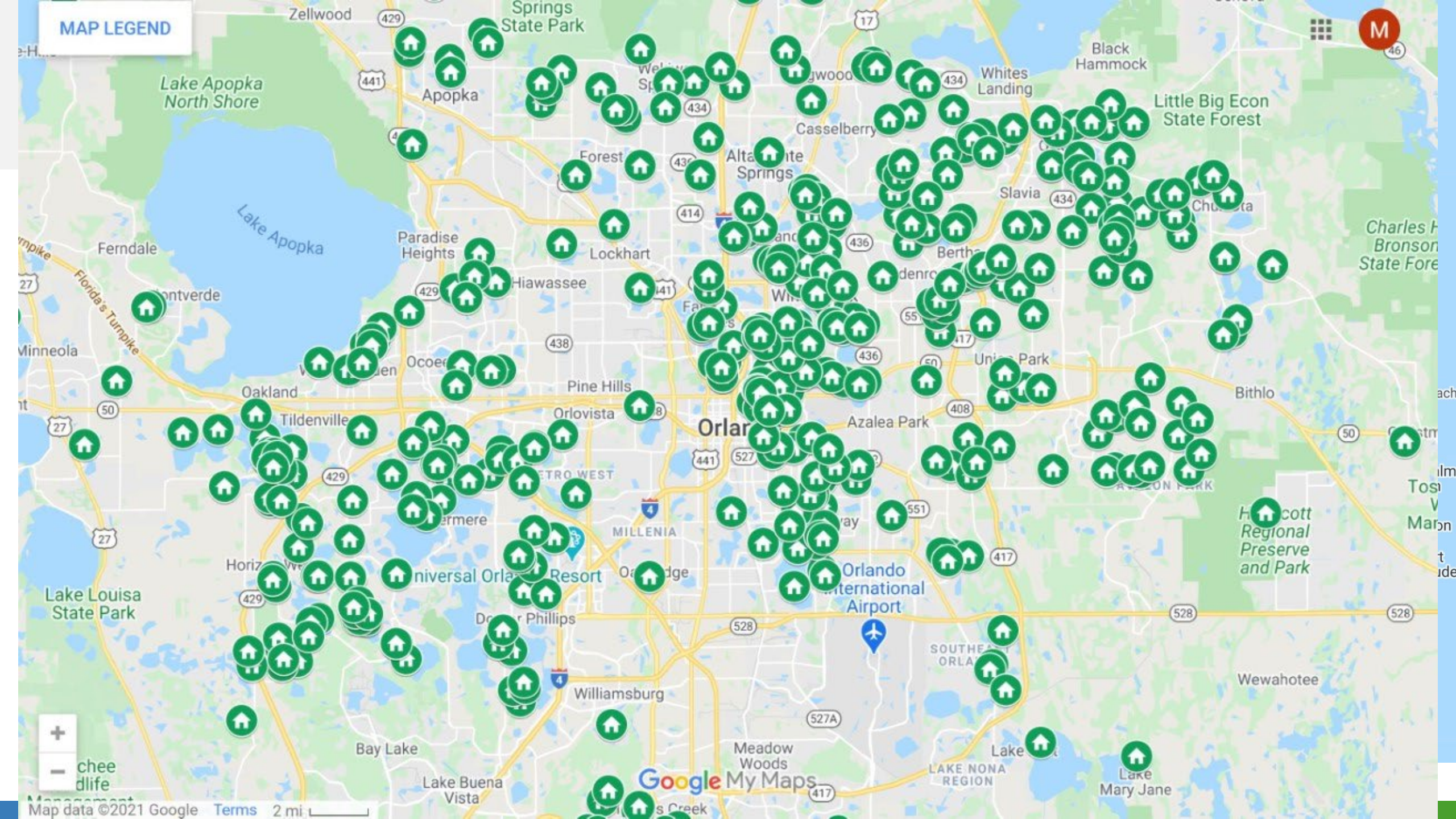
NREL Solar Energy Innovation Network (SEIN)

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

REopt

- Evaluated the techno-economic potential of PV and storage at critical City facilities
- Analyzed 15-min interval electric load data and complex utility rate structure of each site
- Provided technology sizing recommendations
- Compared direct purchase to third-party owned
- Analysis was used to prioritize CIP projects targeting rooftop solar and energy storage

FLEET & FACILITIES COMPLEX


MAP LEGEND
Springs State Park
Zellwood
Apopka
Lake Apopka North Shore
Lake Apopka
Ferndale
Florida's Turnpike
Paradise Heights
Lockhart
Hiawassee
Forest
Casselberry
Altamonte Springs
Black Hammock
Whites Landing
Little Big Econ State Forest
Slavia
Bertha
Charles H. Bronson State Fore
Minneola
Oakland
Tildenville
Ocoee
Pine Hills
Orlovista
Orlando
Azalea Park
Union Park
Bithlo
Lake Louisa State Park
Horizon West
MILLENIA
Universal Orlando Resort
Dr. Phillips
Orlando International Airport
Hal Scott Regional Preserve and Park
Williamsburg
Bay Lake
Meadow Woods
Lake Buena Vista
Lake Nona Region
Lake Mary Jane
Wewahotee
Google My Maps
Map data ©2021 Google
Terms
2 mi

130 MW+ Community Solar program — 150MW in pipeline

City Facilities on Community Solar

52 City facilities are subscribed:

- Orlando City Hall
- Orlando Police HQ
- 17 Fire Stations
- 12 Neighborhood and Senior Centers
- 21 Parks, including Lake Eola Park


Tue Nov 17 2020
50 ft
nearmap

Green Hydrogen Nanogrid Pilot @ OUC Gardenia facility

A floating solar array, which recently was expanded to 64 kilowatts of capacity from 31.

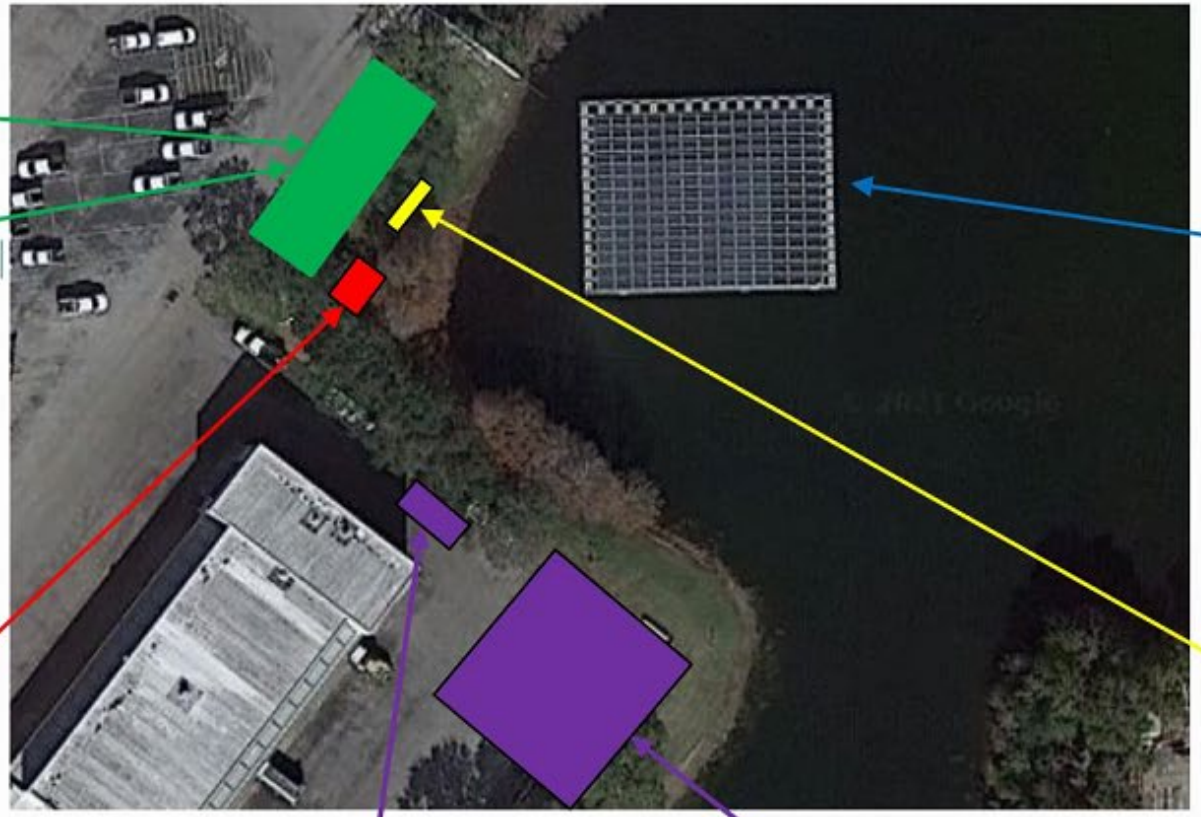
Three electric vehicle (EV) chargers, including one with vehicle-to-grid (V2G) capability.

Two Vanadium Redox Flow (VRF) batteries, which are used to store and dispatch energy.

H2 electrolyzer and two trailers with hydrogen storage tanks and H2 fuel cell

Vehicle-to-grid EV Charging Station

DC Fast Charger



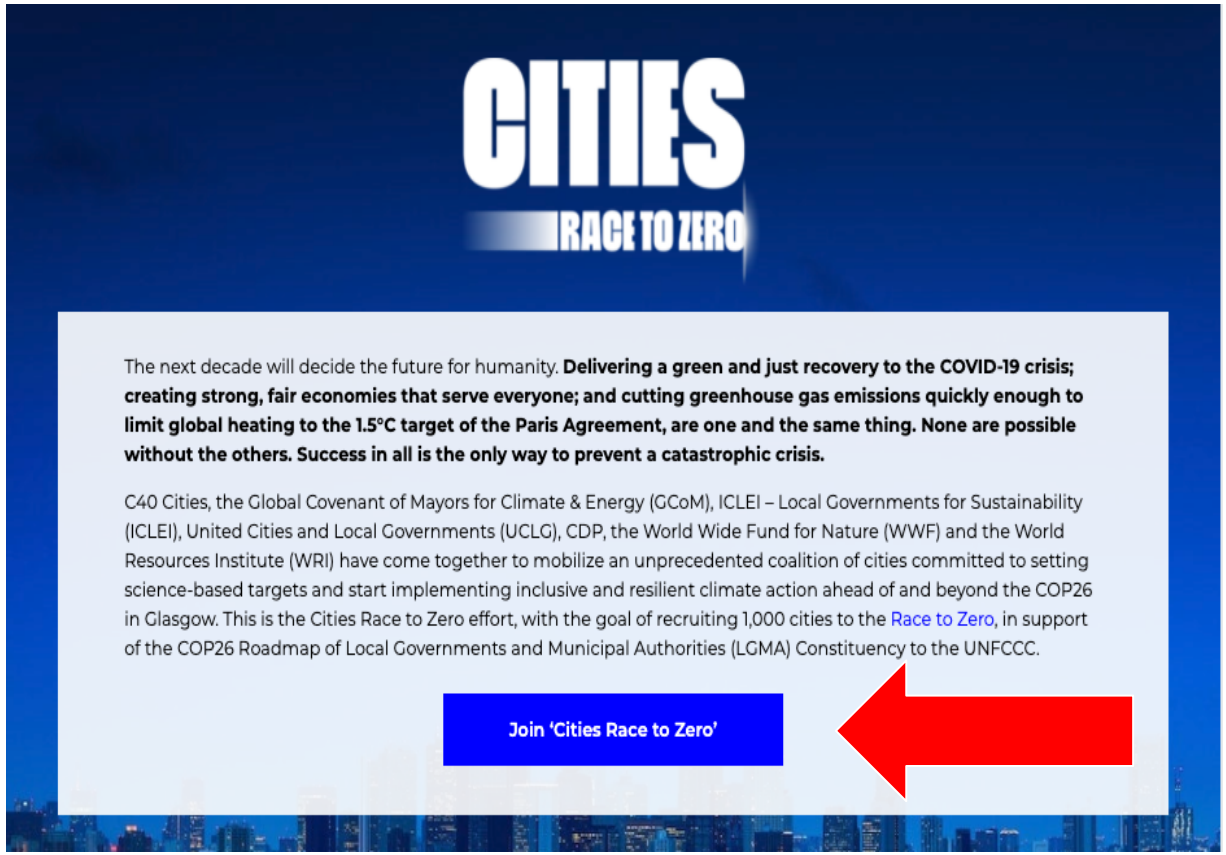
64kW Floating Solar Array

Two Vanadium Redox Flow Batteries

Hydrogen Facility

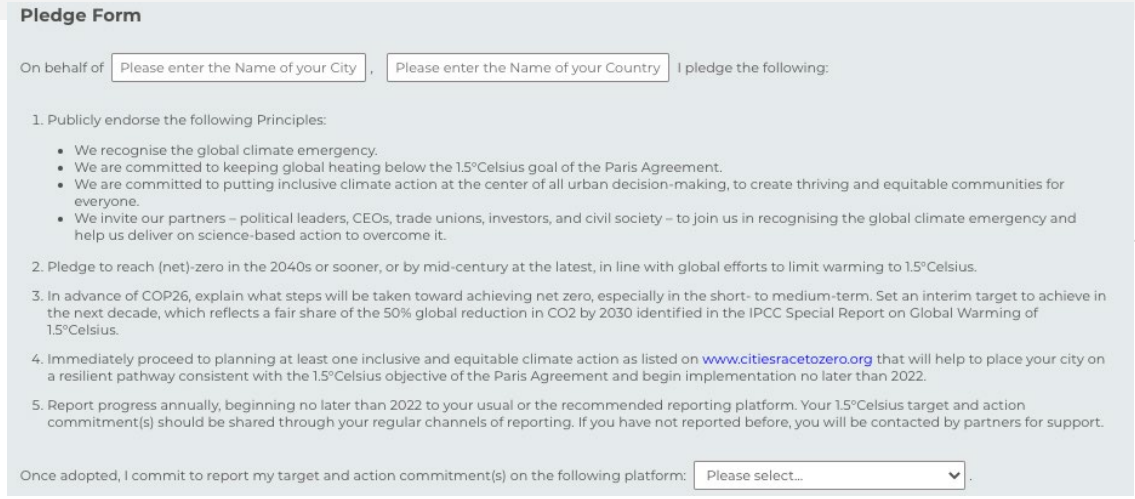
Controller

JOINING the Cities Race to Zero



www.citiesracetozero.org

1.



Pledge Form

On behalf of [Please enter the Name of your City], [Please enter the Name of your Country] I pledge the following:

1. Publicly endorse the following Principles:
   - We recognise the global climate emergency.
   - We are committed to keeping global heating below the 1.5°Celsius goal of the Paris Agreement.
   - We are committed to putting inclusive climate action at the center of all urban decision-making, to create thriving and equitable communities for everyone.
   - We invite our partners – political leaders, CEOs, trade unions, investors, and civil society – to join us in recognising the global climate emergency and help us deliver on science-based action to overcome it.
2. Pledge to reach (net)-zero in the 2040s or sooner, or by mid-century at the latest, in line with global efforts to limit warming to 1.5°Celsius.
3. In advance of COP26, explain what steps will be taken toward achieving net zero, especially in the short- to medium-term. Set an interim target to achieve in the next decade, which reflects a fair share of the 50% global reduction in CO2 by 2030 identified in the IPCC Special Report on Global Warming of 1.5°Celsius.
4. Immediately proceed to planning at least one inclusive and equitable climate action as listed on www.citiesracetozero.org that will help to place your city on a resilient pathway consistent with the 1.5°Celsius objective of the Paris Agreement and begin implementation no later than 2022.
5. Report progress annually, beginning no later than 2022 to your usual or the recommended reporting platform. Your 1.5°Celsius target and action commitment(s) should be shared through your regular channels of reporting. If you have not reported before, you will be contacted by partners for support.

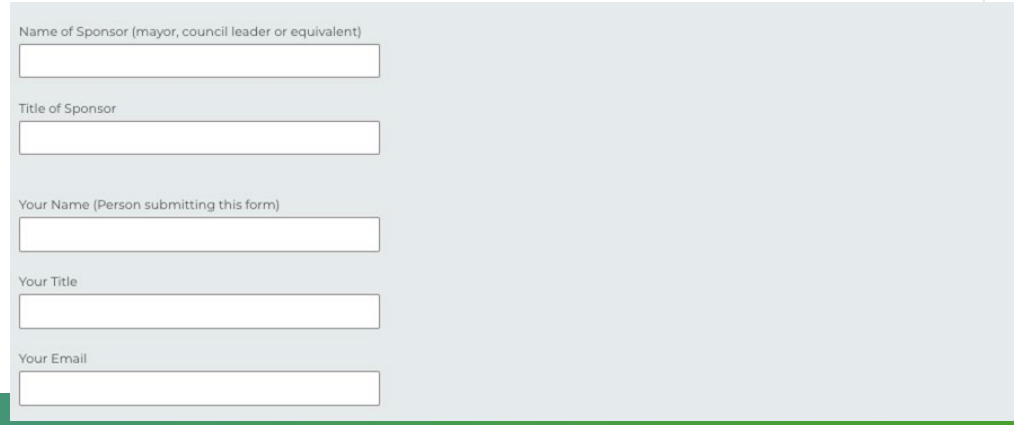
Once adopted, I commit to report my target and action commitment(s) on the following platform: [Please select...]

2.

CREATE A MORE INCLUSIVE SOCIETY

- ☐ Collect information on the needs of frontline communities (including children, workers in transitioning industries, women, refugees, etc) with respect to climate planning and/or implementation.
- ☐ Collect spatial or disaggregated data to inform the design and/or monitor the implementation of climate actions.
- ☐ Demonstrate how actions contribute to delivering social and economic benefits, to reducing inequality and to driving a just transition for workers, through carrying out a wider benefits or equity assessments for at least 2 priority city-wide transformative climate actions.
- ☐ Take action to develop 15- or 30-minute neighborhoods (also known as complete neighborhoods) all throughout the city, where residents are able to meet most of their needs within a short walk or bicycle ride from their homes.

3.



Name of Sponsor (mayor, council leader or equivalent)

Title of Sponsor

Your Name (Person submitting this form)

Your Title

Your Email

Chris Castro, LEED GA, CPB
Director, Office of Sustainability & Resilience
Future-Ready co-chair
City of Orlando
chris.castro@orlando.gov

Transportation

The market has rapidly accelerated towards EV adoption with big commitments

CNBC

Biden plans to replace government fleet with electric vehicles

PUBLISHED MON, JAN 25 2021•5:38 PM EST | UPDATED TUE, JAN 26 2021•8:58 AM EST

General Motors to eliminate gasoline and diesel light-duty cars and SUVs by 2035

Big U.S. automaker says it will invest heavily in electric vehicles and be carbon neutral by 2040

SCIENCE \ BUSINESS \ TECH

Lyft vows '100 percent' of its vehicles will be electric by 2030

TECH \ TRANSPORTATION \ CARS

Ford is more than doubling its investment in electric and autonomous vehicles to $29 billion

Jaguar Land Rover Goes Electric

THE WALL STREET JOURNAL.

Jaguar Land Rover will invest $3.5 billion a year to roll out its first fully electric model by 2024

gm

everybody in.

Why 2020 Is the Turning Point for Electric Cars

Major auto brands, startups and opportunistic investors are all joining the electric-vehicle the coming EV revolution

TECHNOLOGY NEWS JANUARY 15, 2018 REUTERS

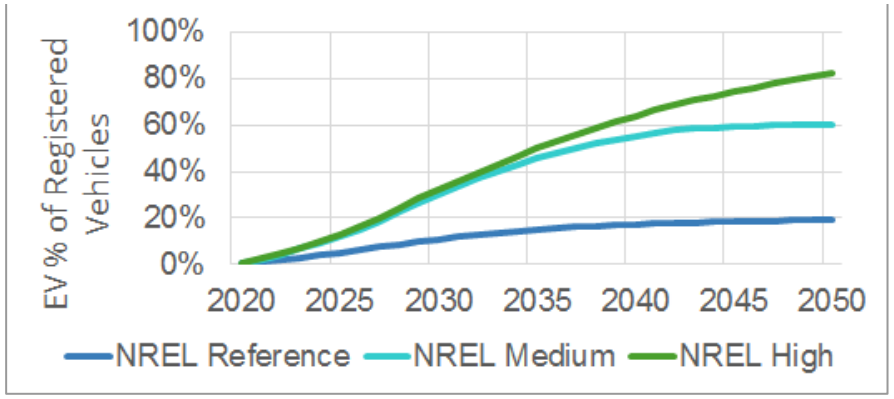
Global carmakers to invest at least $90 billion in electric vehicles

Volvo says it will make only electric cars by 2030

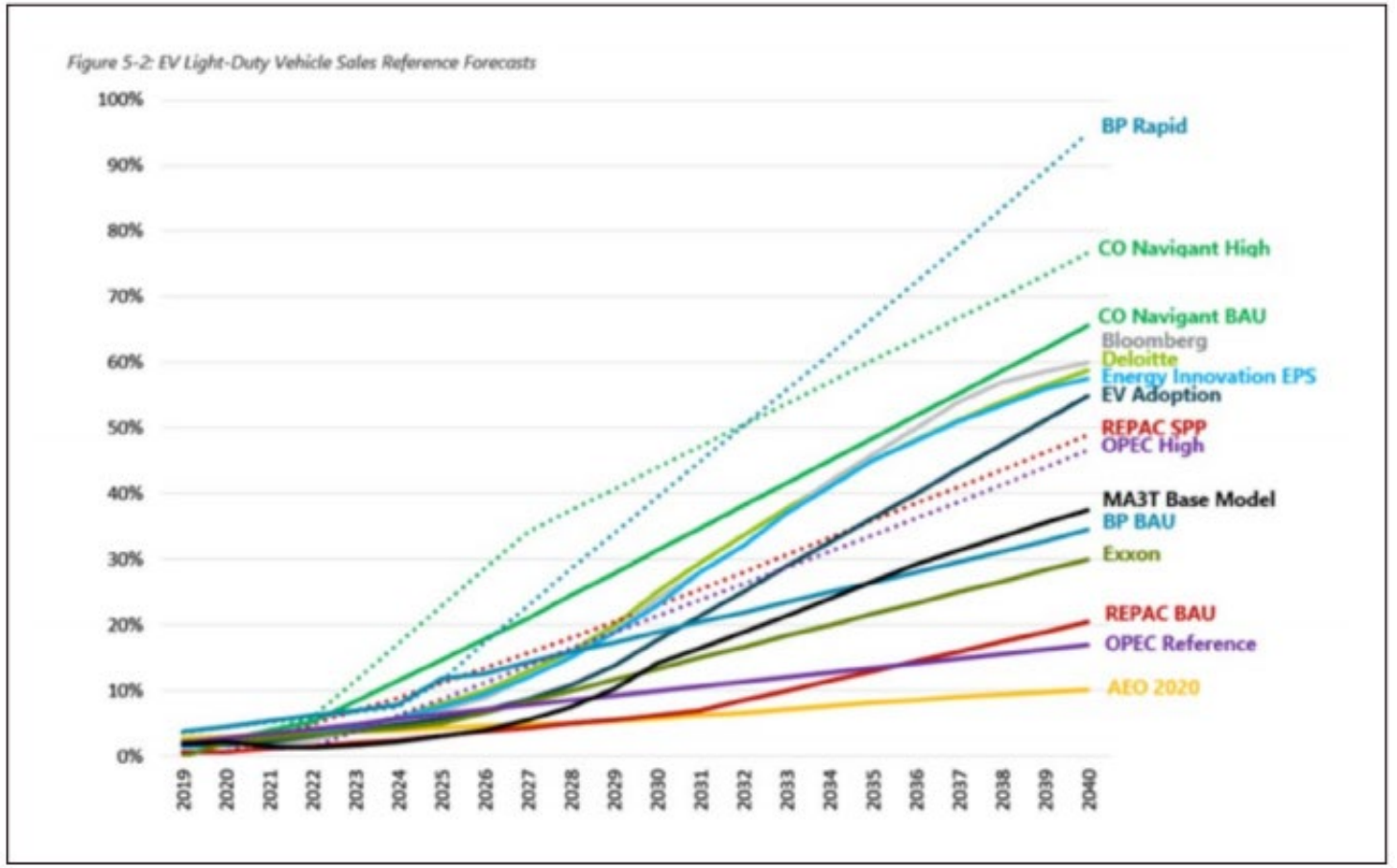
Requirements Added To St. Louis Codes, Local Electricians Are Ready

Trajectory for electric vehicle (EV) adoption and charging demand…

- By 2025, EV adoption is projected to more than double in the Orlando metro area.
- By 2030, EV adoption is projected to reach 10-30% of registered vehicles, and by 2050, nearly 70%.



Source: National Renewable Energy Lab



Source: FDAC

We are creating an e-mobility ecosystem and preparing for a rapid and massive transformation ahead

?

EV Readiness (Development)

Consumer rebates

EV consumer education

Fleet electrification

EV charging access

?

?

?

Municipal EV Fleet - ~3,000 vehicles

- **Goal:** 100% Electric and Alt. Fuel for all City Fleet by 2030
- **200+ EV & Hybrids in City Fleet**
  - 15 new Chevy Bolts EV's for City Hall motor pool
  - 15 Nissan Leafs
  - 4 EV Motorcycles for OPD
  - Solar golf cart pilots
- Submitted LOI for 100 F-150 EV Trucks
- Fleet electrification study by ATLAS
- **EV Purchasing Collaborative with Climate Mayors**

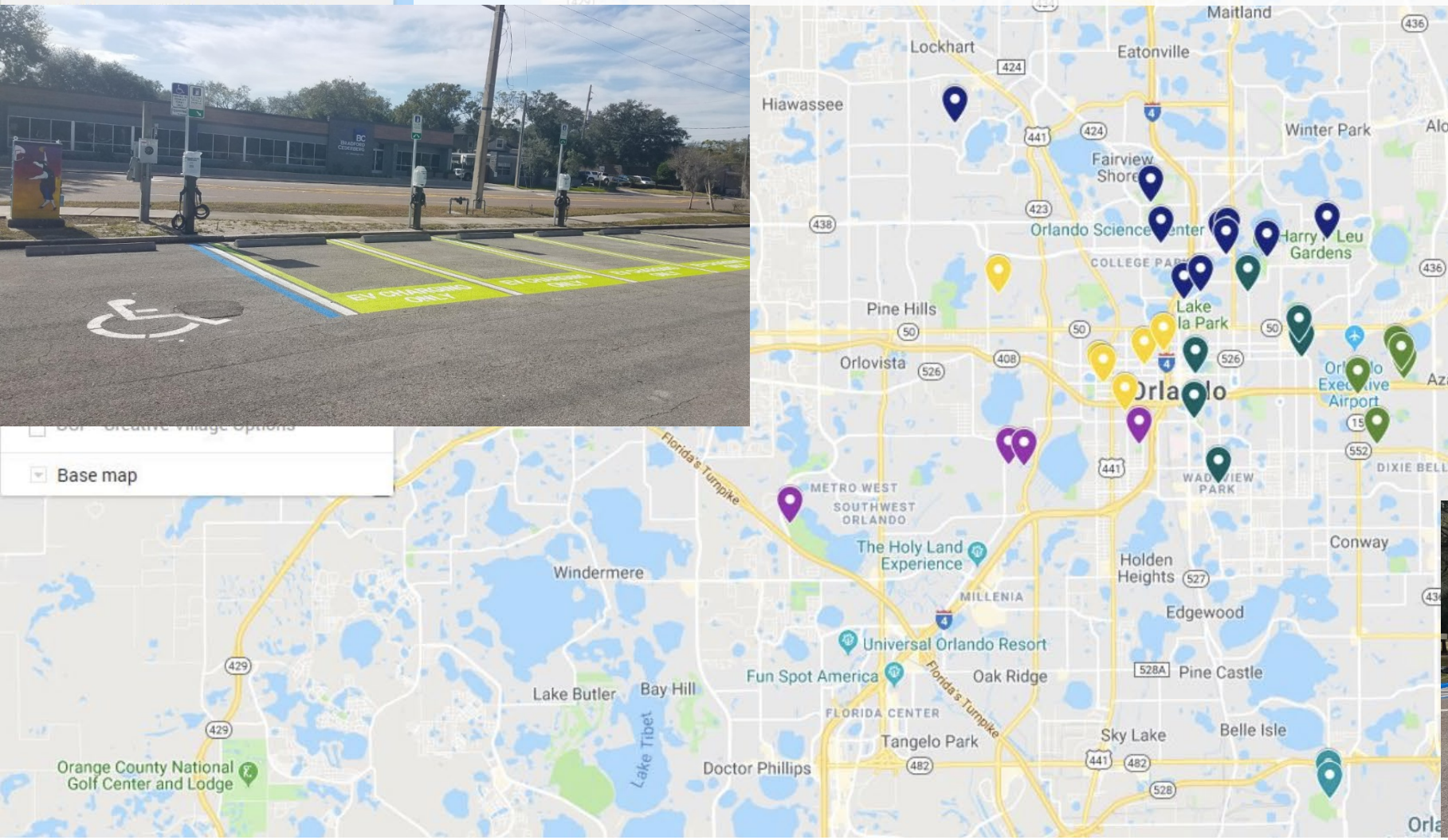
Starting April 2021, the City of Orlando and OUC will be enabling 100+ new Level 2 EV charging stations throughout City parks, Rec centers, parking garages, and more.

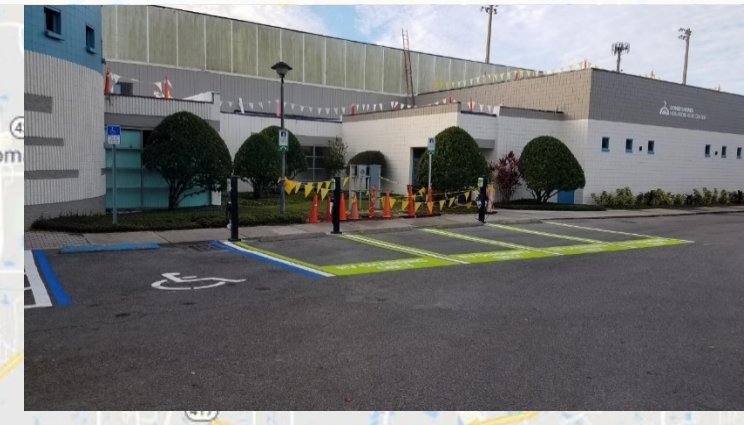
EV Charging Locations - City-Wid...

A map of the recommended locations to implement public facing EV chargers
94 views

All changes saved in Drive

Base map





EV Recharge Mobility Hubs

Electrified Dealership Program

Launch: November 2020

Progress:

- 3 dealerships participating with a goal of 15 participating in 2021
- Diversity in branding. Nissan, Jaguar, Volvo confirmed
- 8 of 30 sales reps trained
- Chevrolet (3), Audi, Ford and Mini all introduced to the program

Next steps: Continue to build dealership pipeline. Continue to train more salespeople.