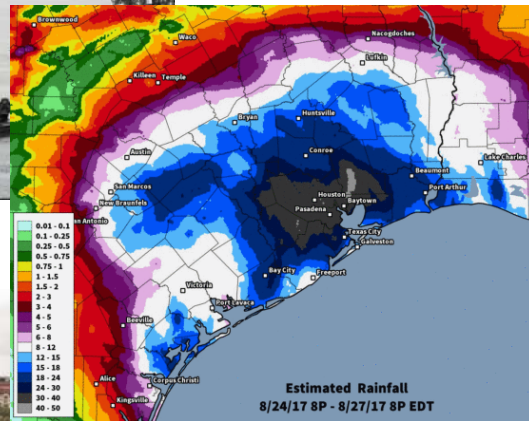




City of Houston Climate Action Plan

March 27, 2019

Why Houston is taking Climate Action

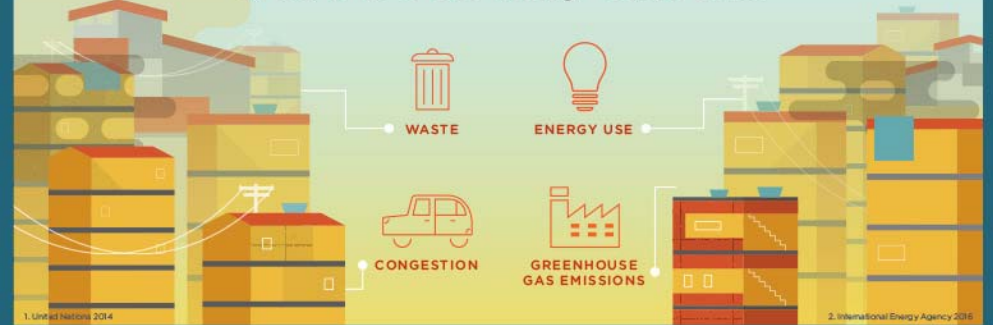


Hurricane Harvey

CITIES ARE BEING PUSHED TO THE LIMIT

of the world's 10 billion people will live in cities¹ ← By 2050 more than **66%** → of the world's energy is likely to be consumed in cities²

Pressure on cities, their infrastructure and the economy causes...



Source: World Bank Group

Houston's Commitment to Climate Action

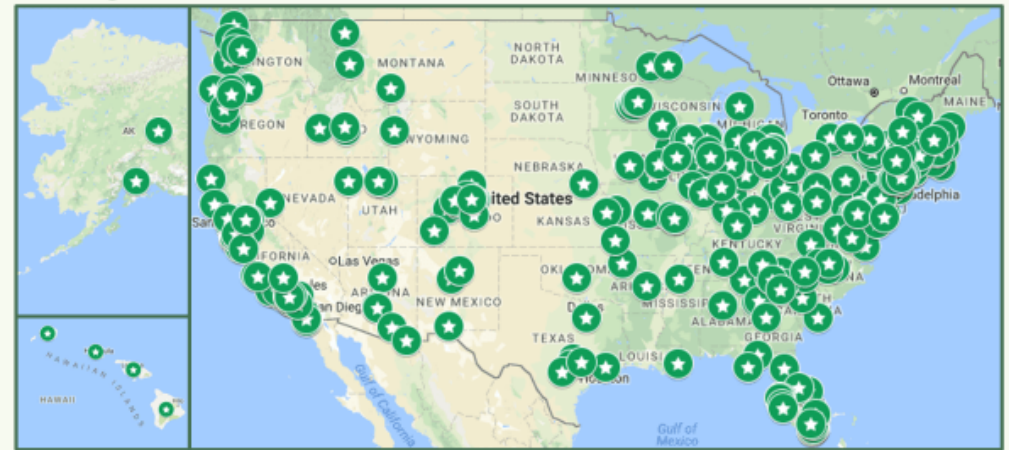


June 1, 2017: The U.S withdraws from the 2015 Paris Agreement

June 24, 2017: Mayor Turner, co-chair of Climate Mayors, commits to adopt Paris Agreement goals in Houston



407 US #ClimateMayors, representing 70 million Americans, have committed to adopt, honor and uphold the climate goals of the Paris Agreement

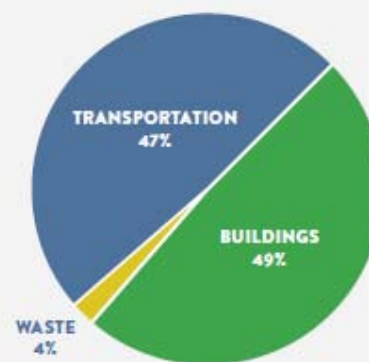


Houston Community Greenhouse Gas Emissions

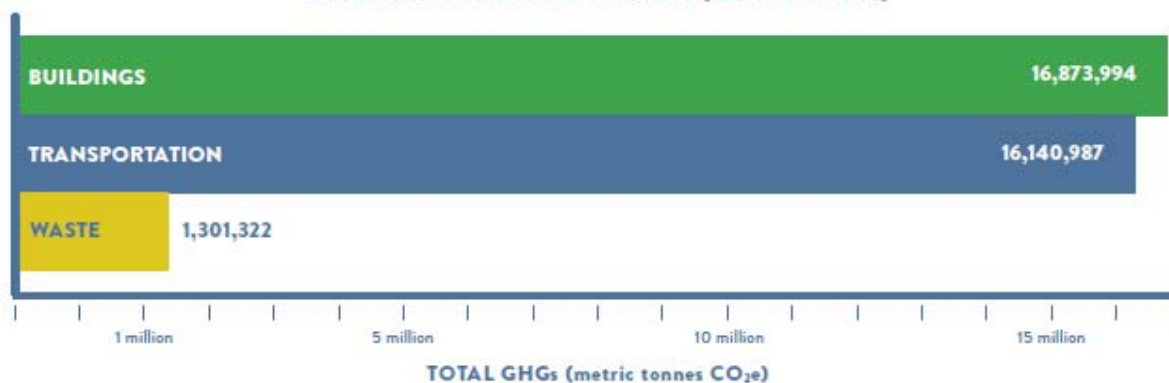
TOTAL ANNUAL EMISSIONS PER CAPITA
(Metric Tonnes CO₂e)



GREENHOUSE GAS
EMISSIONS SOURCES
HOUSTON 2014



GHG EMISSIONS SOURCE (BY SECTOR)



Leading by Example

- **Renewable Energy:**

- The City is the largest municipal purchaser of renewable energy for city operations, receiving 92% of its power from renewable energy

- **Building Optimization:**

- Since 2004, the City has required all new buildings to be LEED Certified; currently have 37 LEED buildings
- Since 2007, the City has invested \$70 million in energy efficiency retrofits: 6 million square feet; achieving greenhouse gas emission reductions of 35%
- Converted ~175,000 streetlights to LED technology; reducing the City's streetlight energy usage by ~50%.

- **Transportation**

- 6.3% of the City's fleet is hybrid.
- Working to develop ambitious fleet electrification goals.



What is a Climate Action Plan?



What is a Climate Action Plan (CAP)?

- A climate action plan should address the need to reduce greenhouse gas emissions, adapt to the impacts of climate change and deliver wider social, environmental, and economic benefits.
- **Objectives of plan are to:**
 - ❖ Decrease traffic congestion
 - ❖ Improve air quality
 - ❖ Provide better access to green space
 - ❖ Improve quality of life for all
 - ❖ Be Equitable - **all people will have the opportunity to benefit equally from the climate solutions, while also not having to take on an un-equal burden of climate impacts**
 - ❖ Reduce energy costs through energy efficiency and renewable energy
 - ❖ Increase resilience



Process for Plan Development

1

COMMIT & COLLABORATE



- Establish Plan Governance and Coordination
- Equitable Engagement and Communications

2

DEFINE & ANALYZE



- Data Gathering
- Climate Risk Prioritization
- Evidence-Based Scenario Development

3

PRIORITIZE & IMPLEMENT



- Initial Implementation Planning
- Accelerate Actions
- Monitor, Evaluate and Revise

Technical Assistance:



HARC

**C4O
CITIES**
CLIMATE LEADERSHIP GROUP



CURB Tool

Climate Action for Urban Sustainability



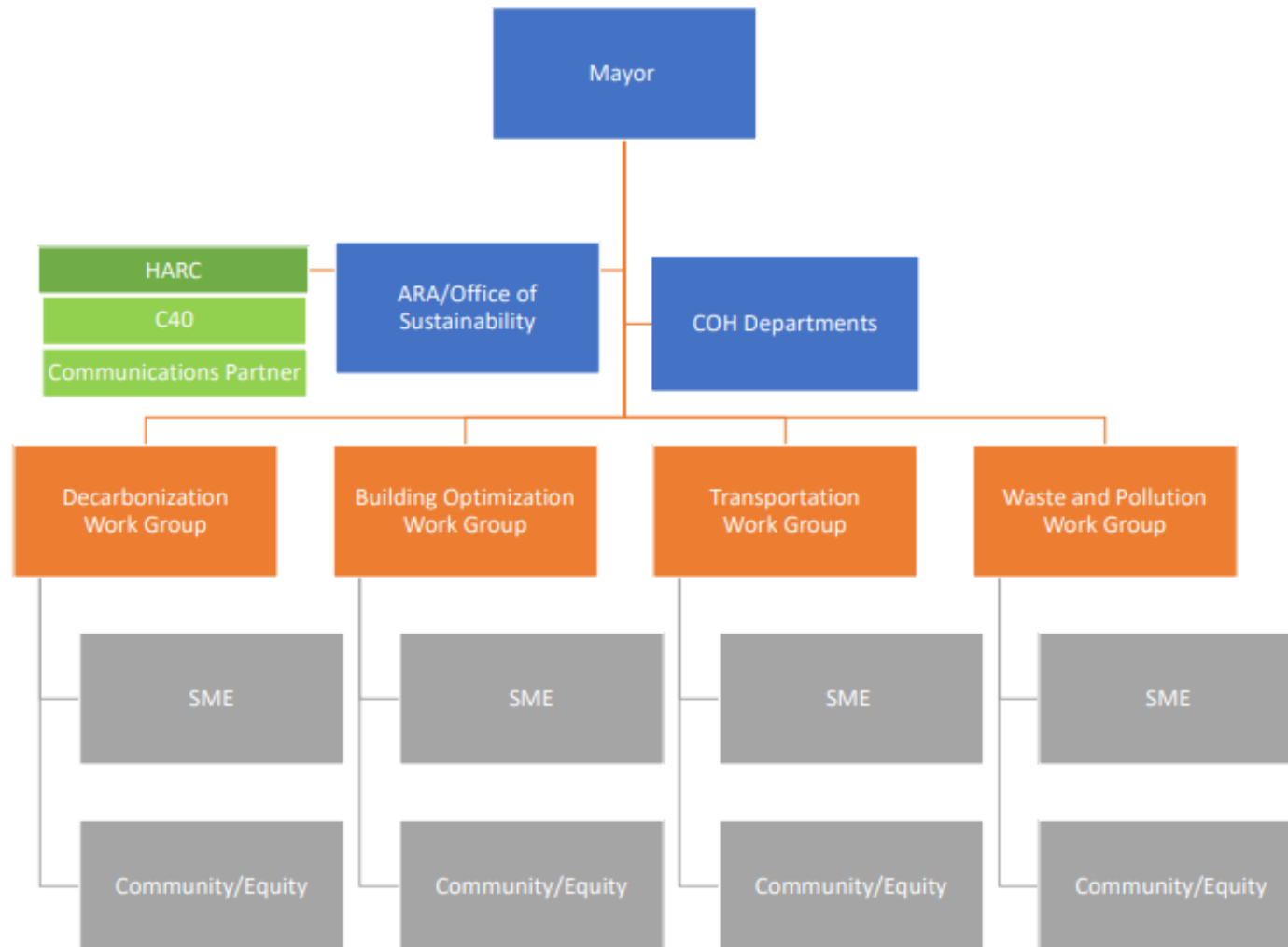
What are the focus areas of the plan?

There are four distinct areas the City is looking to decrease community greenhouse gas emissions. They include:

- **Building Optimization** – improving energy efficiency of residential, commercial and industrial operations
- **Decarbonization** – increasing the amount of renewable energy; using carbon capture and sequestration to reduce amount of greenhouse gases in the atmosphere
- **Waste** – reducing the amount of waste and trash to the landfill by reducing material consumption, recycling, up-cycling and composting
- **Transportation** – identifying transportation options and implementing land-use practices that promote opportunities for multiple, equitable transportation options, movement to electric vehicles and reducing the number of vehicle trips and miles traveled.



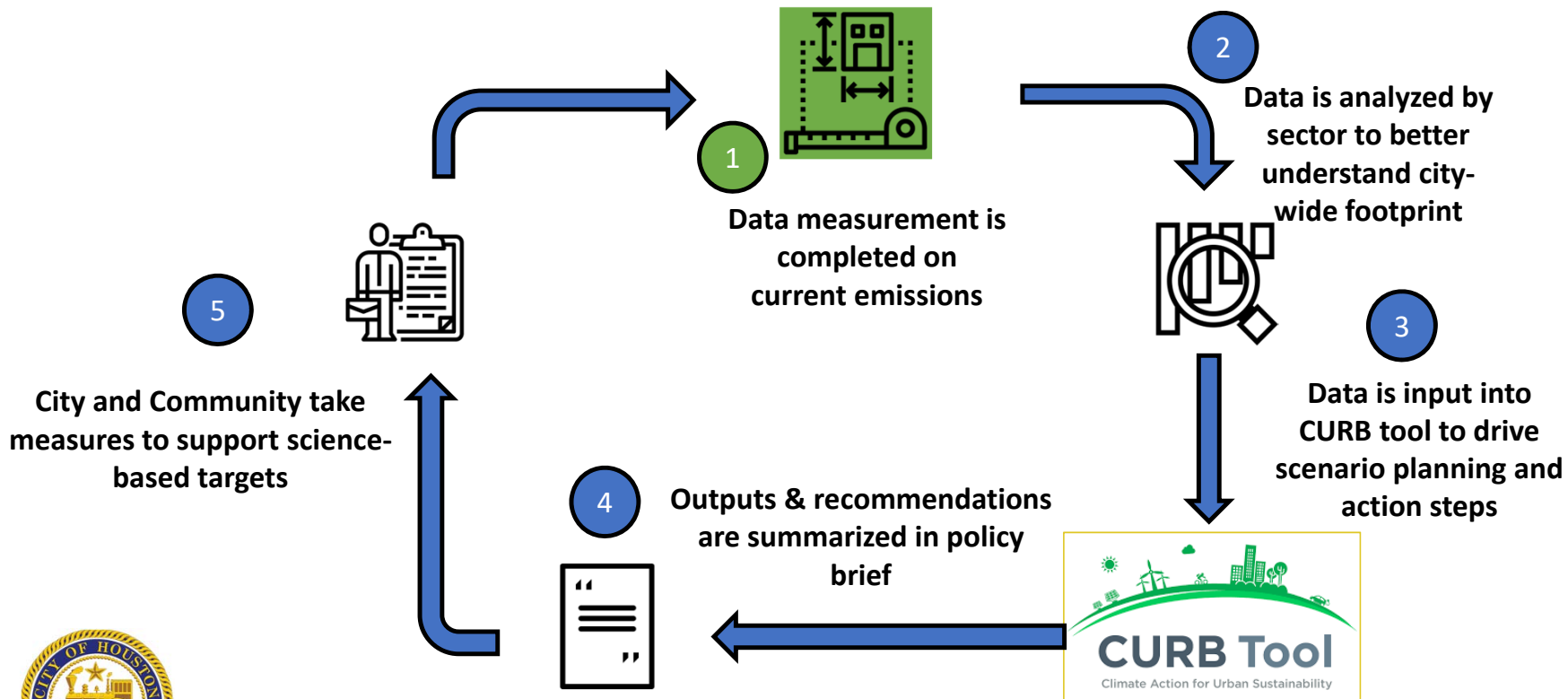
Climate Action Planning: Organizational Structure



Scenario Planning



Using Scenario Planning to Drive Policy










CIRIS – City Inventory Reporting and Information System

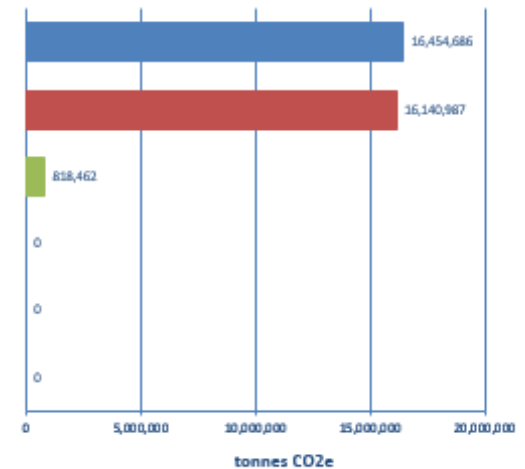
CIRIS	Introduction	Set-up	Inventory	Calculators	Results	Notes
	Summary	Graphs	Overview	Analysis	Net emissions	

SUMMARY

NAME OF CITY: Houston, USA
BOUNDARY: BASIC
INVENTORY YEAR: 2014

POPULATION: 2,240,582
LAND AREA (km2): 1,553
GDP (US\$ million): 522,028

tCO2e	BASIC	Scope 1	Scope 2	Scope 3
	Stationary	2,876,173	13,578,513	
	Transportation	16,140,987		
	Waste	246,859		571,602
	IPPU			
	AFOLU			
	Other Scope 3			
	TOTAL	33,414,135		



CIRIS – Data Resources

- **Stationary Emissions –**

- Sectors:
 - Residential, Commercial and Industrial – electricity and natural gas
 - Fugitive emissions from natural gas distribution lines
- Sources of Data
 - City of Houston Departments – example Solid Waste
 - CenterPoint Energy
 - EPA Flight

- **Transportation Emissions**

- Sectors
 - On-road transportation – public and private sector
 - Freight and Passenger Rail
 - Aviation – City of Houston
- Sources of Data
 - HGAC and TTI
 - City of Houston



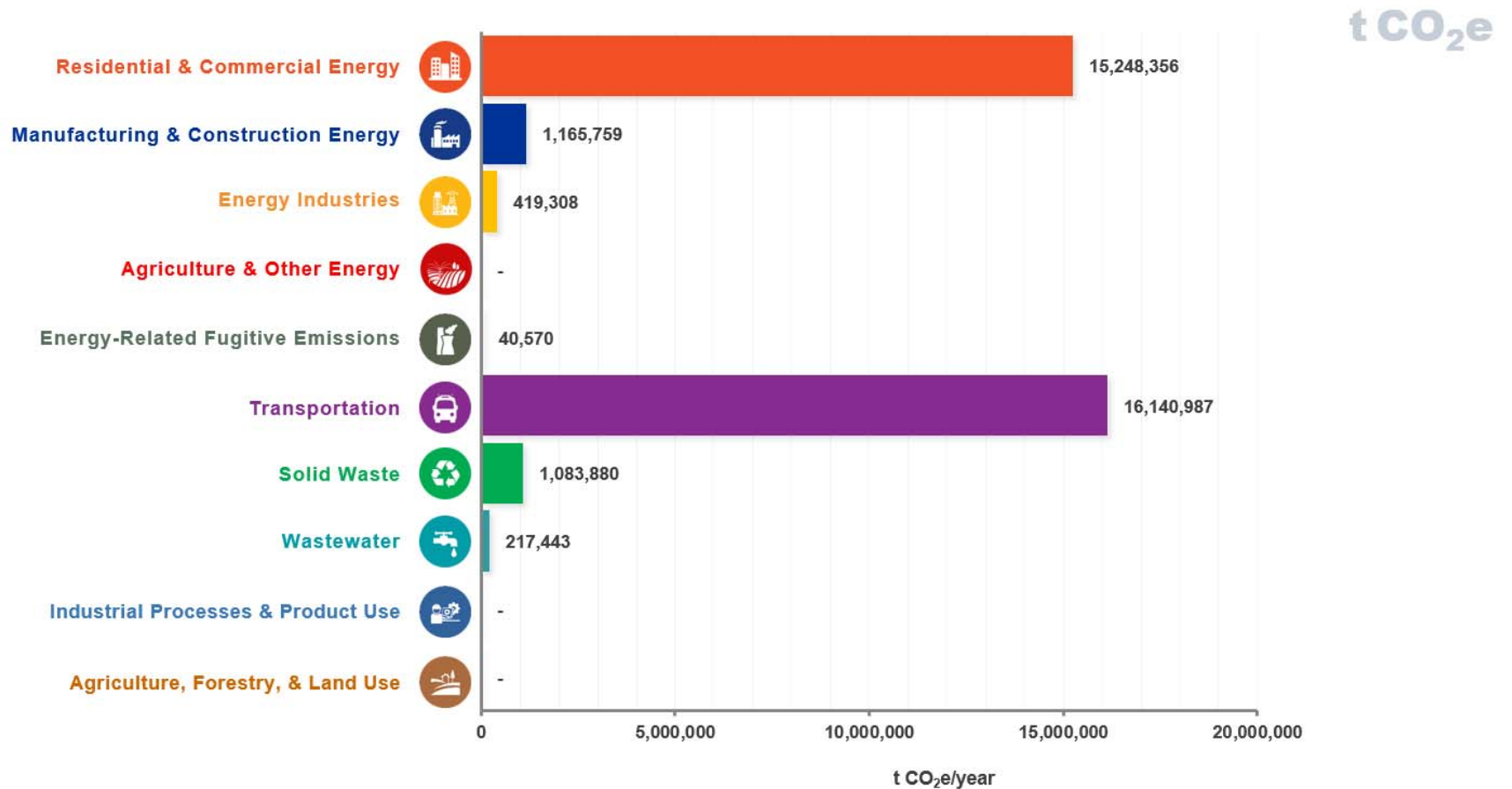
- **Solid Waste Emissions**

- Sectors:
 - Residential and Commercial Waste sent to Landfill – within and outside of City
 - Waste generated outside of City and brought to McCarty
 - Organic Waste
 - Wastewater Treatment
- Sources of Data
 - City of Houston
 - US EPA

Base Year Inventory

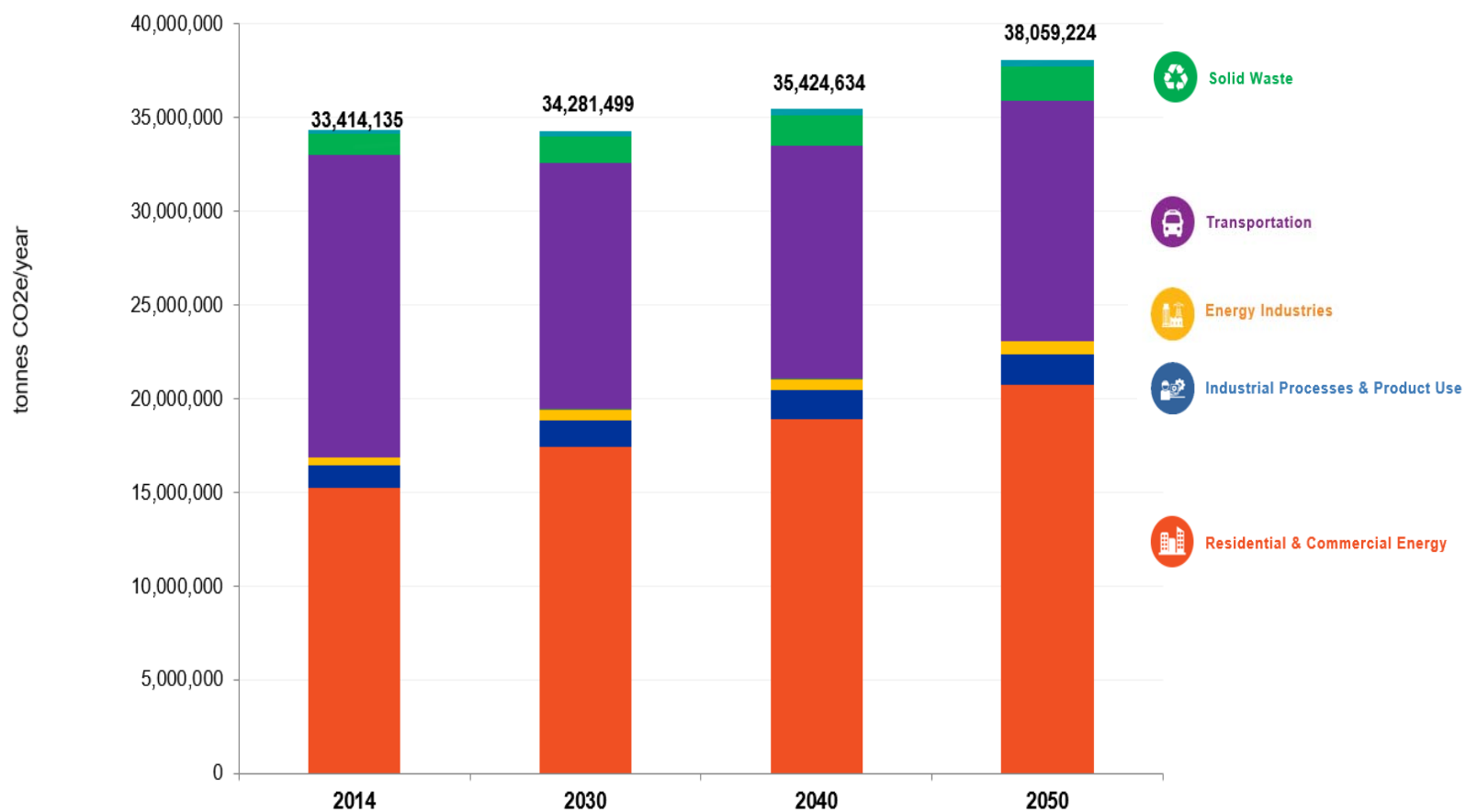
2014 Base Year Community Emissions by Sector

Note: Click on icons below for definitions of the emission sector or sub-sector.

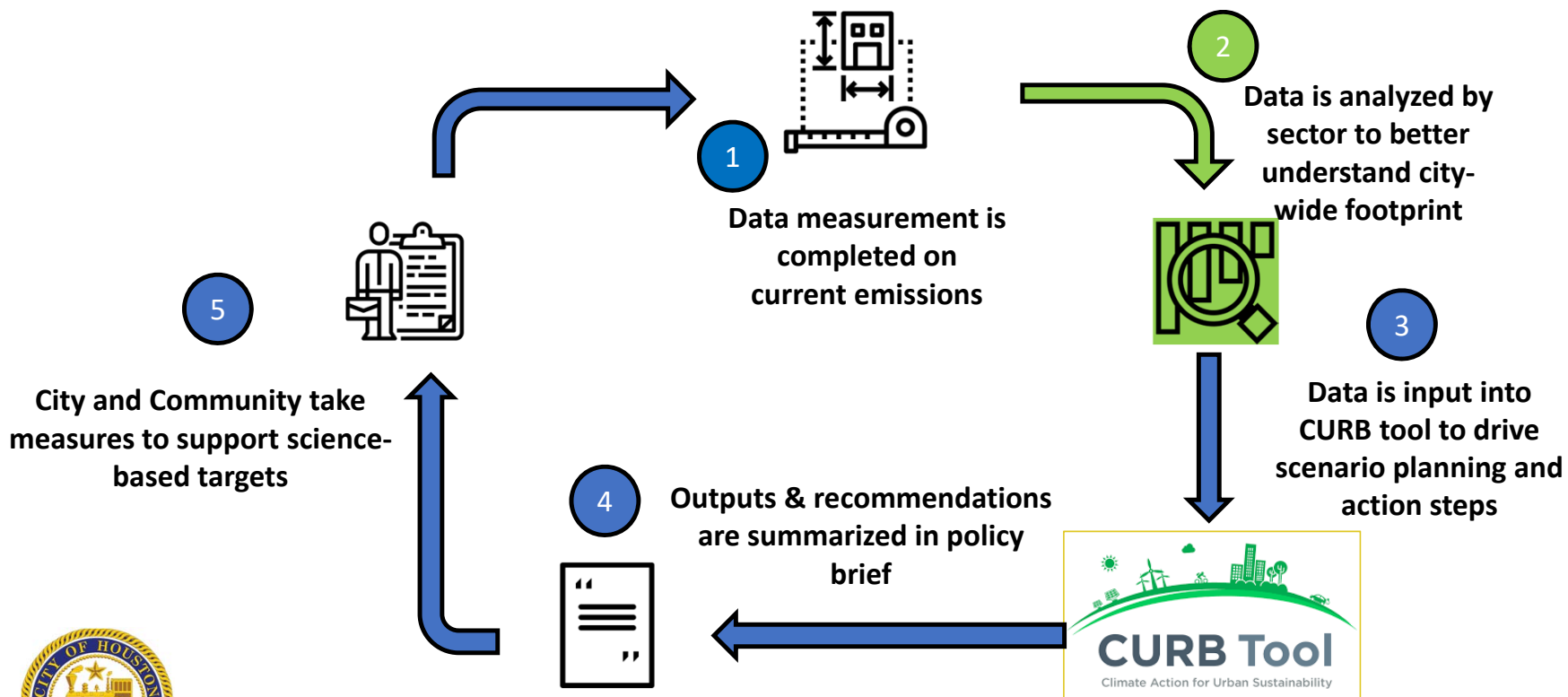


Emissions Projections

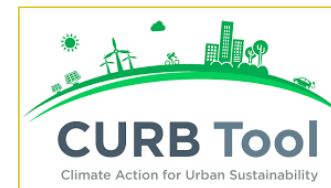
Community Emissions by Sector 2014 to 2050



Using Scenario Planning to Drive Policy



Overview of CURB Model



- The **CURB tool** is an integrated model that measures GHG emissions among 6 different sectors



Private Building
Energy



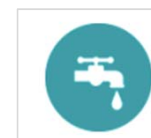
Municipal
Buildings &
Lighting



Electricity
Generation



Solid Waste



Water &
Wastewater



Transportation

- ❖ Model is **data-driven and city-specific** with 500+ data fields to complete
- ❖ CURB uses population growth, GDP growth or International Energy Agency's methodology to estimate future emissions
- ❖ 100+ cities have adopted the CURB model, allowing for comparability and benchmarking



Implementation Criteria Matrix

Which Actions Does the City Wish to Implement?

The following table summarizes the results of the 'City Powers' survey and provides information on difficulty of implementation, cost, and emission reduction potential. The user should review this information and consider which actions the City would like to pursue. Navigate the the 4.B Action Development to define the implementation assumptions for each action.

Sector / Action Category / Action	Level of City Authority	Level of Technical Difficulty	Implementation Cost	Payback Duration	Emissions Reduction Potential	
PRIVATE BUILDING ENERGY						
ENERGY EFFICIENCY & FUEL SWITCHING						
EXISTING RESIDENTIAL BUILDINGS						
Lighting - Residential	Moderate	Low	Low	Short	2.3%	Go to Action
Appliance and Electronics - Residential	None	Low	Low	Short	2.0%	Go to Action
Space Heating - Residential	Moderate	High	Moderate	Moderate	2.5%	Go to Action
Cooling - Residential	Moderate	High	Moderate	Moderate	3.4%	Go to Action
Water Heating - Residential	Moderate	Moderate	Moderate	Moderate	1.9%	Go to Action
Water Fixtures - Residential	Moderate	Low	Low	Short	<1%	Go to Action
Building Envelopes - Residential	Moderate	Moderate	Moderate	Moderate	<1%	Go to Action
EXISTING INFORMAL RESIDENTIAL						
Lighting - Informal	Moderate	Low	Low	Short	0.0%	Go to Action
Space Heating - Informal	None	Low	Low	Short	0.0%	Go to Action
Cooling - Informal	None	Low	Low	Short	0.0%	Go to Action
Water Heating - Informal	Moderate	Moderate	Moderate	Moderate	0.0%	Go to Action



Planning Decision Matrix

Policy/Program	Sector	Sub-sector	Time Frame Short-term, Mid-term, Long-term	Impact on Equity Positive, Negative, Neutral	Likelihood of Adoption High, Medium or Low	Implementation Rate High, Medium or Low	Lead Implementation Organization	Barriers to Success
Ensure building codes (ECC, etc) are continually enforced and updated working toward net zero for all new buildings and major renovations	Building Optimization	Codes	ST - Enforce & update LT- Net Zero	Positive	High	High	City of Houston	1. Cost to small business to comply 2. Residential minimum "penalty" energy rate have high price pts under 500 KWH
Build out and promote financing programs, such as PACE, that promote resource efficiency and conservation.	Building Optimization	Retrofits	ST - Commercial MT - Residential	Positive	High	High	Private Sector	Need Tweaks - Technical
Promote and educate building owners/operators on Energy Management System	Building Optimization	Energy Management	ST	Neutral	Medium	Low	City of Houston/Private Sector	None
Coordinate with Educational providers (SPEER, community colleges, universities) in developing building operator/facility manager training programs.	Building Optimization	Energy Management	ST - Non residential	Positive	High	High	City of Houston/Education	Existing small buildings - MF and Non residential
Improve efficiency and demand on wastewater and water treatment	Building Optimization	Infrastructure/Codes	ST-MT	Neutral	High	High	City of Houston	Cost/funding/incentive
Update utility rebate and incentive programs on annual basis to provide support for clean energy measures that would result in greatest GHG reduction potential	Building Optimization and Decarbonization	Clean Energy	LT	Negative unless items are addressed	High	High	City of Houston/CenterPoint	Residential access to capital for construction solar.
Develop voluntary building benchmarking and energy auditing program that complements utility incentive program	Building Optimization and Decarbonization	Clean Energy	ST-LT	Positive	Medium	Medium	City of Houston/Private Sector	

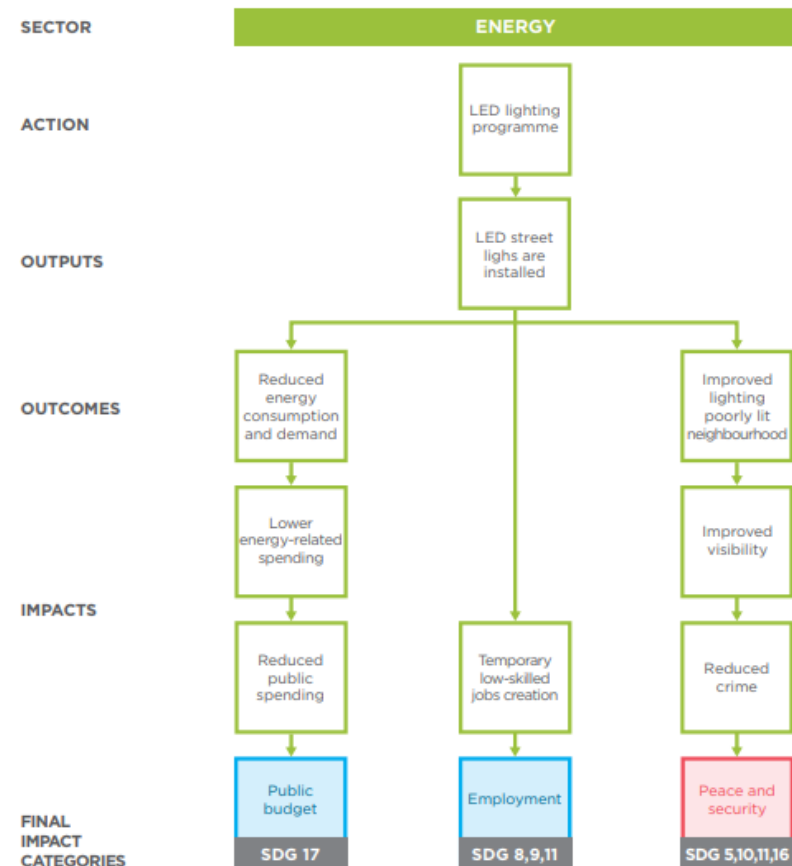


Thinking Through Climate Action Planning

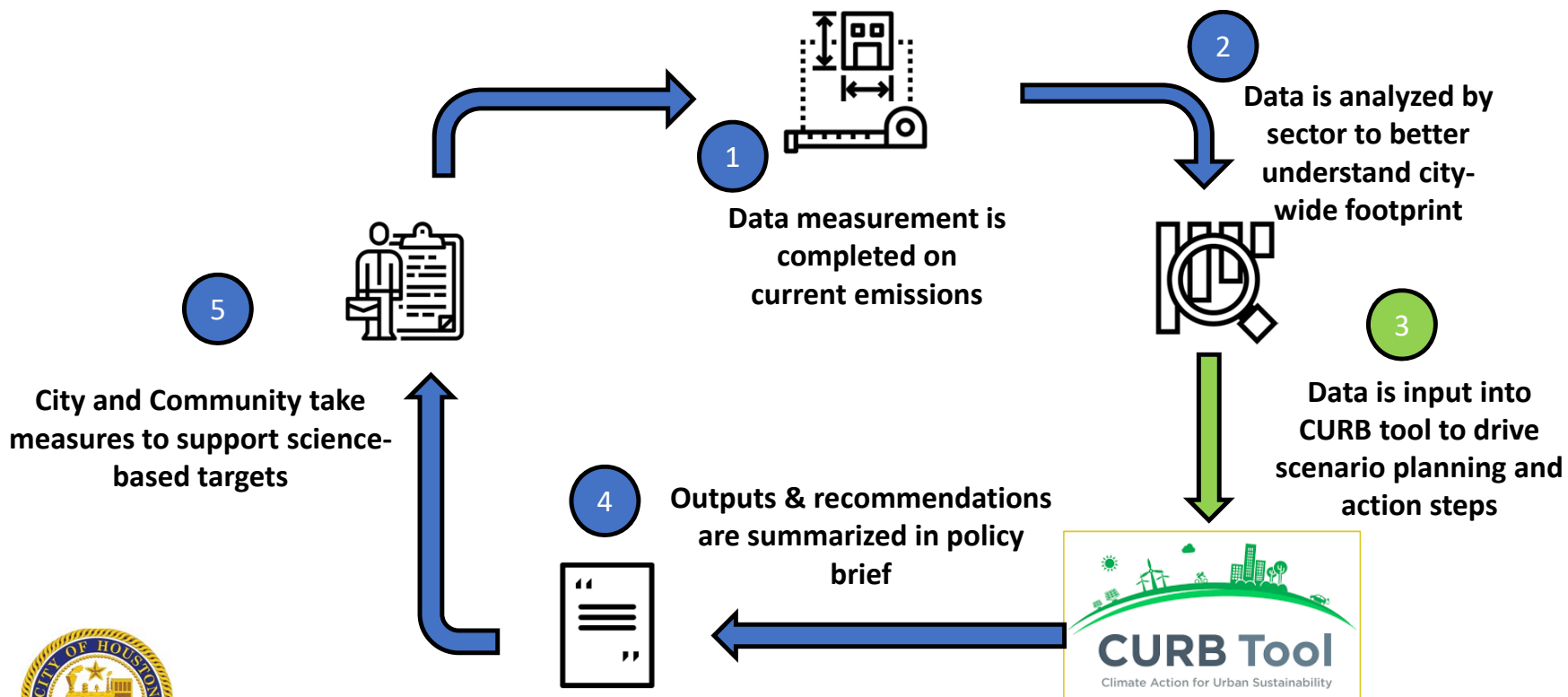
- This is an example used by C40 to help structure thinking around the Outputs, Outcomes and Impacts of each Action.
- An action is the policy/program in place that will lead to a GHG reduction

Click to add text

Source: C40 Climate Actions Impact Framework



Using Scenario Planning to Drive Policy

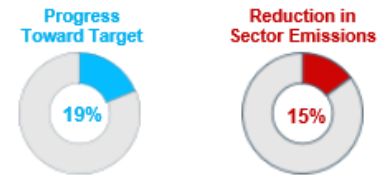


CURB Inputs from Recommendations

Action	Sector	Value	Notes
Low Carbon Urban Design - Transit Oriented Development	Transportation	Proportion of Households	Proportion of households close to TOD
Passenger Mode Shift	Transportation	Percent change in mode share	Percent population in automobiles, motorcycles, taxi, light rail, BRT, bus, bicycle, bus
Vehicle Fuel Switch	Transportation	Percent of vehicles using specific fuels	Gasoline, Diesel, CNG, Electricity, Biofuel
External Transportation Model	Transportation	Inputs from External model	This includes emission reduction; energy reduction kWh; trip reduction, reduction in VMT;
Grid Decarbonization	Decarbonization	Generation Mix	Percent of ERCOT Portfolio based on each generation type
Grid Decarbonization	Decarbonization	Generation Capacity	Generation in MW of each generation type on ERCOT grid
Paper Waste Management	Waste	Percent sent to specific end-use	Percent to recycling, landfills, open dumps, compost incineration; done for commercial and for residential
Food and Yard Waste Management	Waste	Percent sent to specific end-use	Percent to recycling, landfills, open dumps, compost incineration; done for commercial and for residential
Plastic Waste Management	Waste	Percent sent to specific end-use	Percent to recycling, landfills, open dumps, compost incineration; done for commercial and for residential
Other Organic Waste Management	Waste	Percent sent to specific end-use	Percent to recycling, landfills, open dumps, compost incineration; done for commercial and for residential; includes woodwaste, rubber; textile; leather
Optimize Waste Incineration	Waste	Volume of waste in tonnes	Baseline and Proposed volume of waste incinerated
Methane Recovery Rate	Waste	Proposed methand recovery rate	Current rate is reported to be 85%
Rooftop Solar Residential	Building Optimization	Percent of households/ average system size	Number of rooftops
Lighting	Existing and New Residential Build Opt	Saturation Rate	Proportion of square feet with measures; percent for new and percent for existing
Appliances	Existing and New Residential Build Opt	Saturation Rate	Proportion of square feet with measures; percent for new and percent for existing
Space Heating	Existing and New Residential Build Opt	Saturation Rate	Proportion of square feet with measures; percent for new and percent for existing
Cooling	Existing and New Residential Build Opt	Saturation Rate	Proportion of square feet with measures; percent for new and percent for existing
Water Heating	Existing and New Residential Build Opt	Saturation Rate	Proportion of square feet with measures; percent for new and percent for existing
Water Fixtures	Existing and New Residential Build Opt	Saturation Rate	Proportion of square feet with measures; percent for new and percent for existing
Building Envelope	Existing and New Residential Build Opt	Saturation Rate	Proportion of square feet with measures; percent for new and percent for existing
Lighting	Existing and New Commercial Build Opt	Saturation Rate	Proportion of square feet with measures; percent for new and percent for existing
Appliances	Existing and New Commercial Build Opt	Saturation Rate	Proportion of square feet with measures; percent for new and percent for existing
Space Heating	Existing and New Commercial Build Opt	Saturation Rate	Proportion of square feet with measures; percent for new and percent for existing



Example Sector GHG Reductions



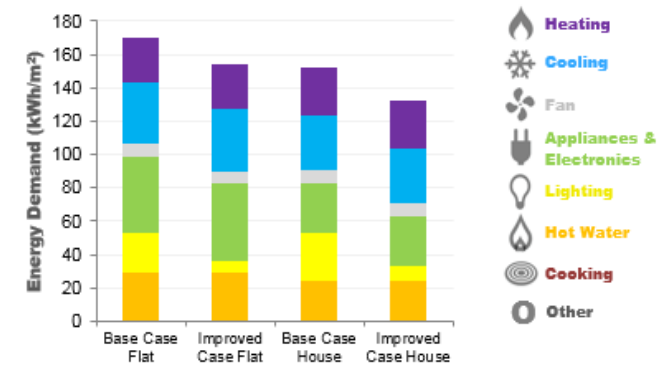
Residential Lighting Efficiency & Controls - Existing

CO ₂ Emissions Reduction Tonnes CO ₂ e/Year	% of Building Energy Emissions Reduced	Energy Reduction kWh/Year	Implementation Cost \$US1000	Payback Period Years	TARGET YEAR	2030	2040	2050
1,214,665	7.3%	2,335,129,507	\$415,439	1.5	2030			

Residential - High Income

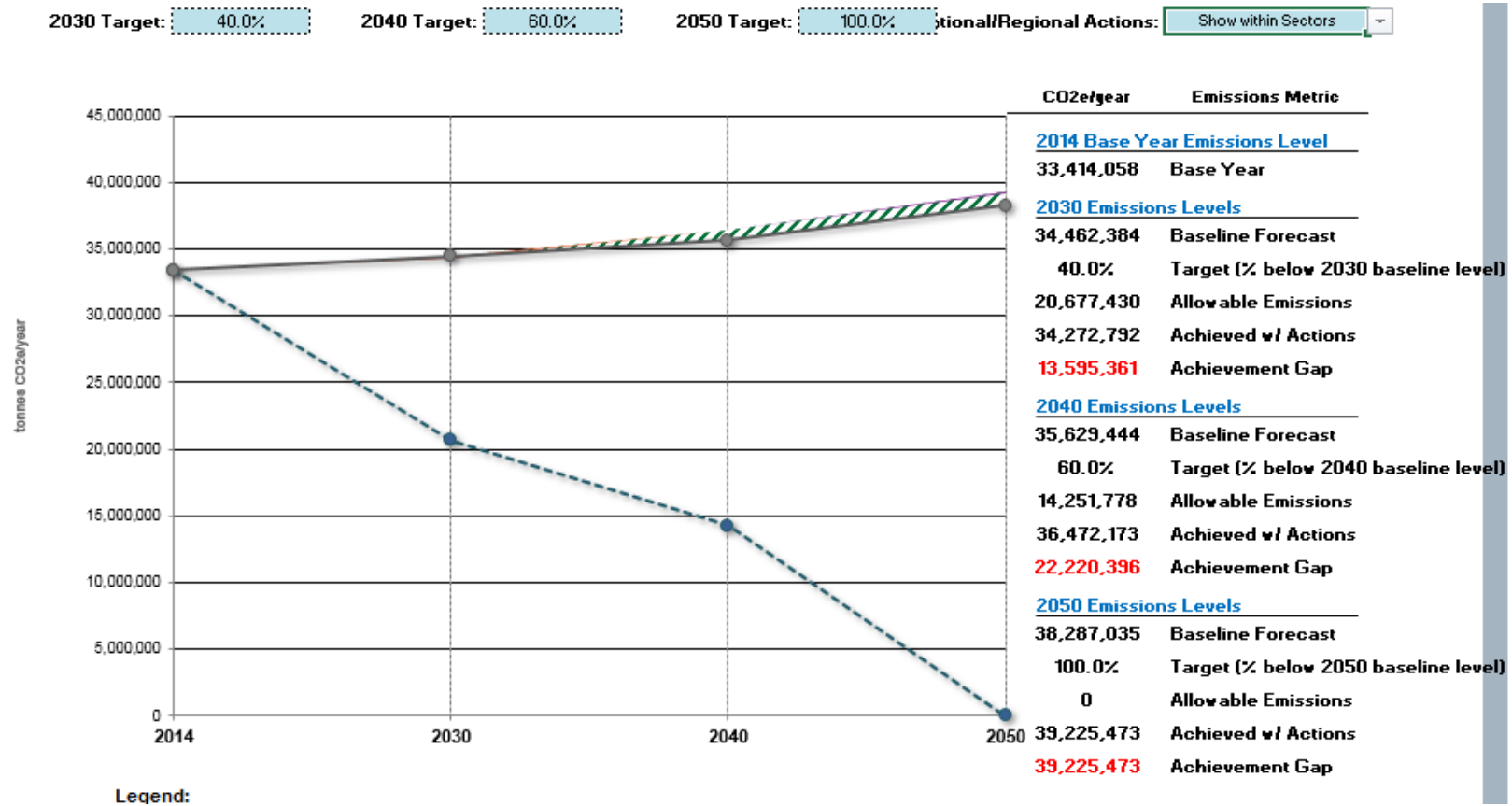
Strategy 1	Fixture	Control
Baseline	Incandescent	None
Proposed	LED	Occupancy Controls
Saturation	Percent of Total	Floor Area
	50%	62,613,178 m ²

Strategy 2	Fixture	Control
Baseline	Incandescent	None
Proposed	LED	None
Saturation	Percent of Total	Floor Area
	100%	125,226,357 m ²

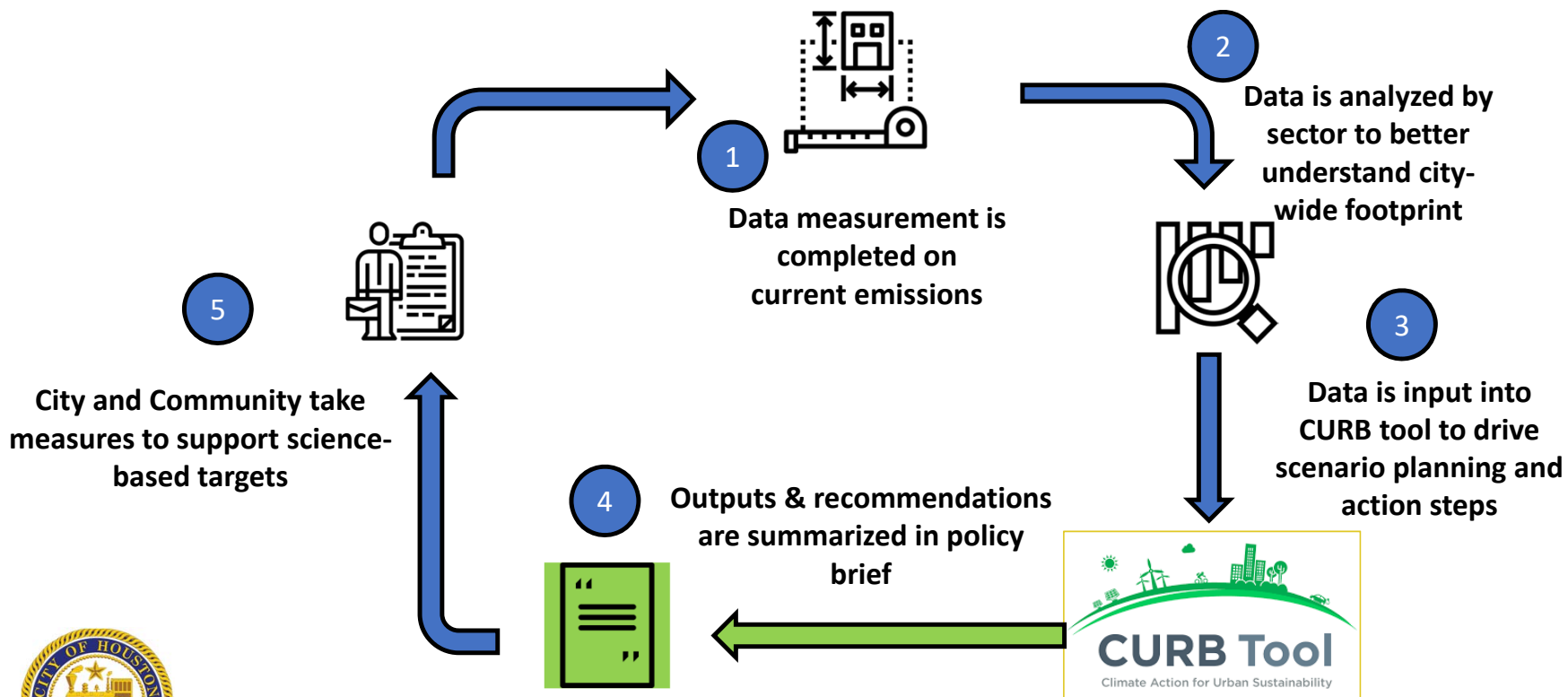


Goals of the Houston CAP

- Goal:** Lay the foundation for actions that will make the City carbon-neutral by 2050.



Using Scenario Planning to Drive Policy



Timeline



Timeline



Schedule of Planned Events

- **Date: March 19, 2019**
Event Name: Climate Action Plan Community Meeting
Location: Sunnyside Multiservice Center / 9314 Cullen / Houston, TX 77051
Time: 6:00 pm – 08:00 pm
- **Date: April 1, 2019**
Event Name: Climate Action Plan Community Meeting
Location: Acres Homes Multiservice Center / 6719 W. Montgomery / Houston, TX 77091
Time: 6:00 pm – 08:00 pm
- **Date: April 6, 2019**
Event Name: Climate Action Plan Community Meeting
Location: Southwest Multiservice Center / 6400 High Star / Houston, TX 77074
Time: 10:00 am – 12:00 pm
- **Date: April 16, 2019**
Event Name: Climate Action Plan Community Meeting
Location: Denver Harbor Multiservice Center / 6402 Market Street / Houston, TX 77020
Time: 6:00 pm – 08:00 pm
- **Date: May 2, 2019**
Event Name: Climate Action Plan Community Meeting
Location: Northeast Multiservice Center / 9720 Spaulding / Houston, TX 77016
Time: 6:00 pm – 08:00 pm



Previous and Upcoming Events can be found at <http://greenhoustontx.gov/climateactionplan/events.html>

Climate Action Plan Resources

- Climate Action Plan Community Survey
 - www.greenhoustontx.gov
- Host-A-Meeting Toolkit
 - www.greenhoustontx.gov



Thank you! Questions?



Learn more:
<http://bit.ly/Houston-CAP>



C40
CITIES
CLIMATE LEADERSHIP GROUP