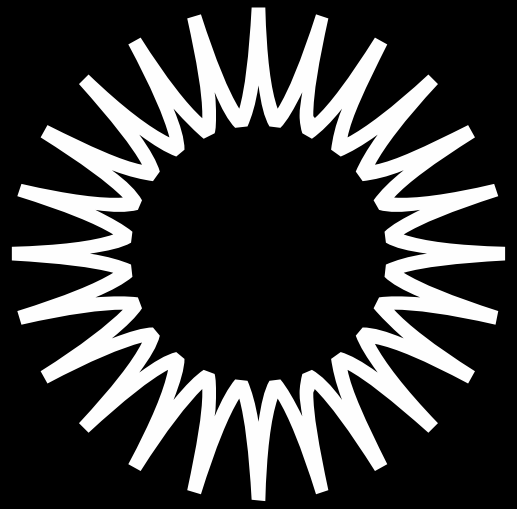

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SIEMENS
Ingenuity for life

Reaching 80x50

Technology Pathways to a Sustainable Future

Find the City Performance Tool online:
Website: www.siemens.com/cypt
Twitter: @SiemensUSA #cityperformancetool

1

The City Performance Tool

San Francisco, Now and in 2050

“Fossil-Free” San Francisco

The Challenge

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Europe
GHG emissions reduction targets

Copenhagen	100% by 2025
Oslo	100% by 2050
Stockholm	100% by 2050
London	60% by 2025
Berlin	40% by 2020
Amsterdam	40% by 2025

Americas
GHG emissions reduction targets

Seattle	100% by 2050
Portland	80% by 2050
Washington DC	80% by 2050
Houston	36% by 2016
Los Angeles	35% by 2030
Vancouver	33% by 2020
Buenos Aires	33% by 2030
Sao Paolo	30% by 2012
New York	30% by 2030
San Francisco	25% by 2017
Boston	25% by 2020
Santiago de Chile	20% by 2020

Asia
GHG emissions reduction targets

Seoul	40% by 2030
Tokyo	25% by 2020
Wuhan	20% by 2015

Australia
GHG emissions reduction targets

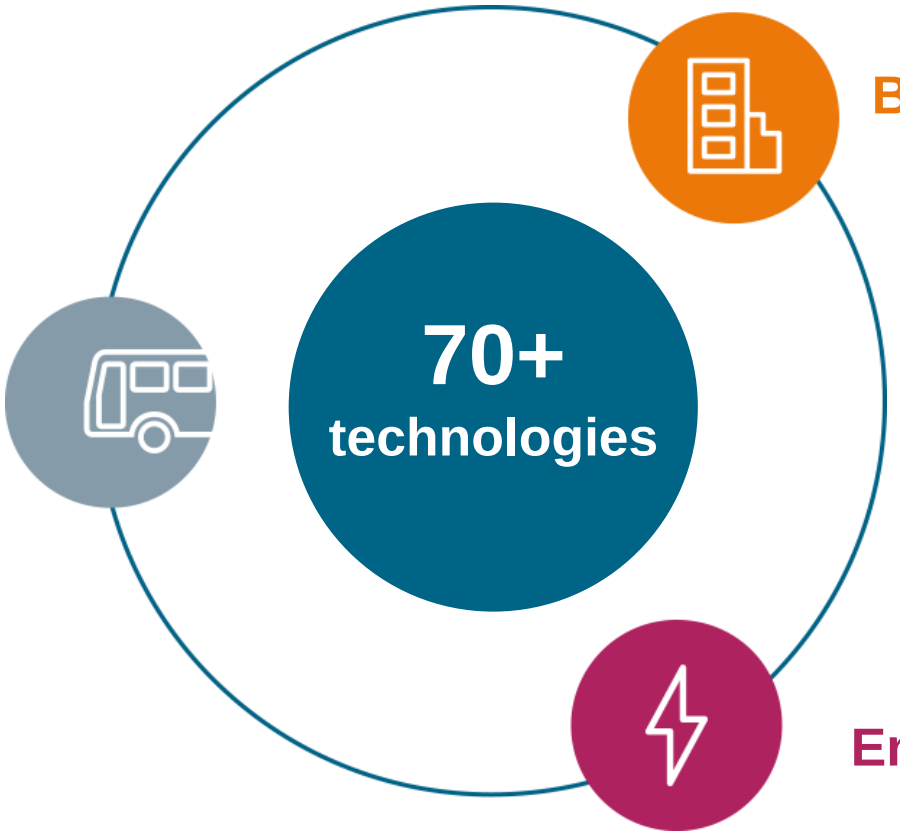
Melbourne	100% by 2020
Sydney	70% by 2030

Africa
GHG emissions reduction targets

Johannesburg	30% by 2025

Siemens Role in Supporting Urban Sustainability

SIEMENS



Buildings

- Building envelope
- Building automation
- Monitoring and optimization

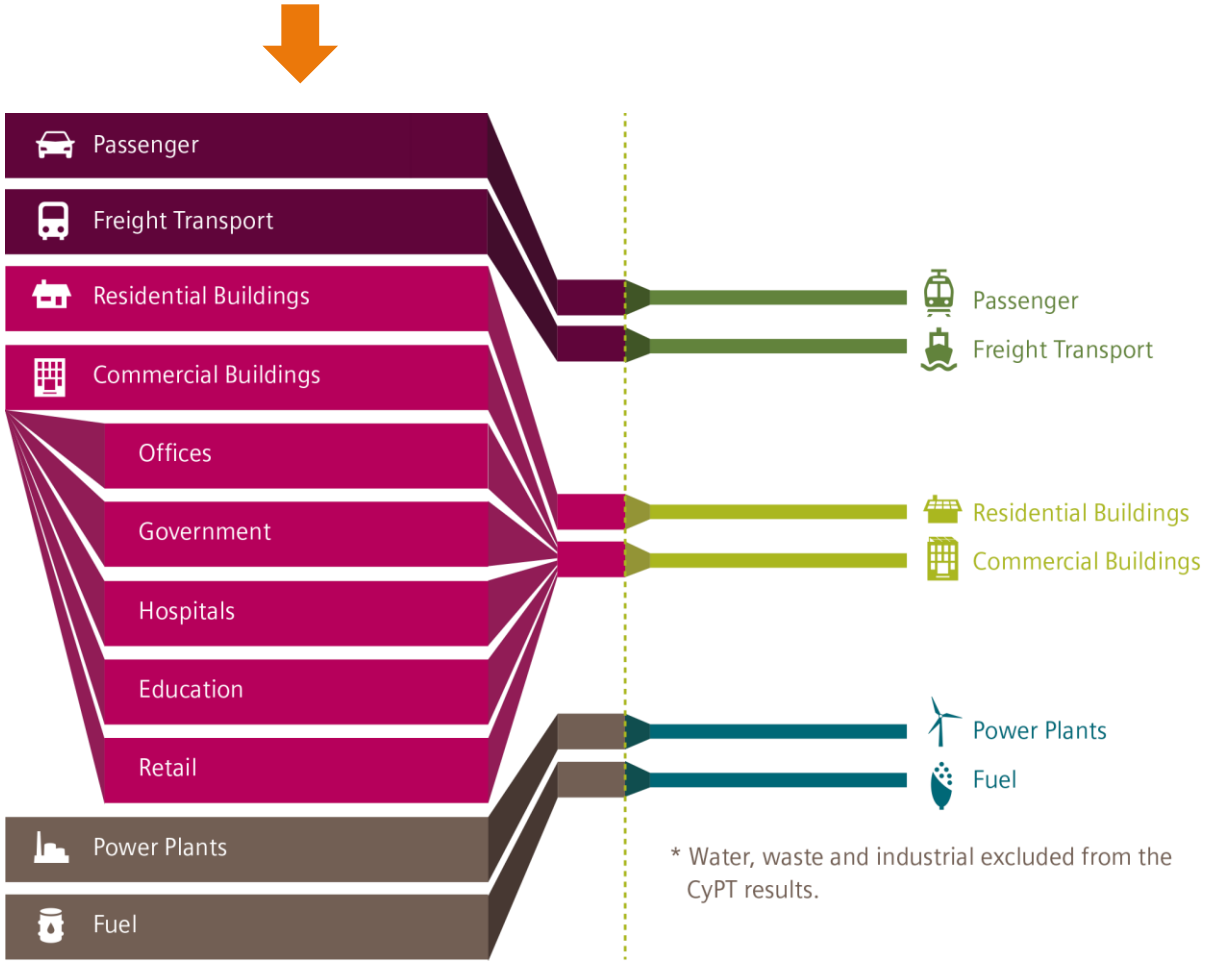
Transport

- Public transport
- Private transport
- Traffic management
- Freight

Energy

- Renewable generation
- Grid management

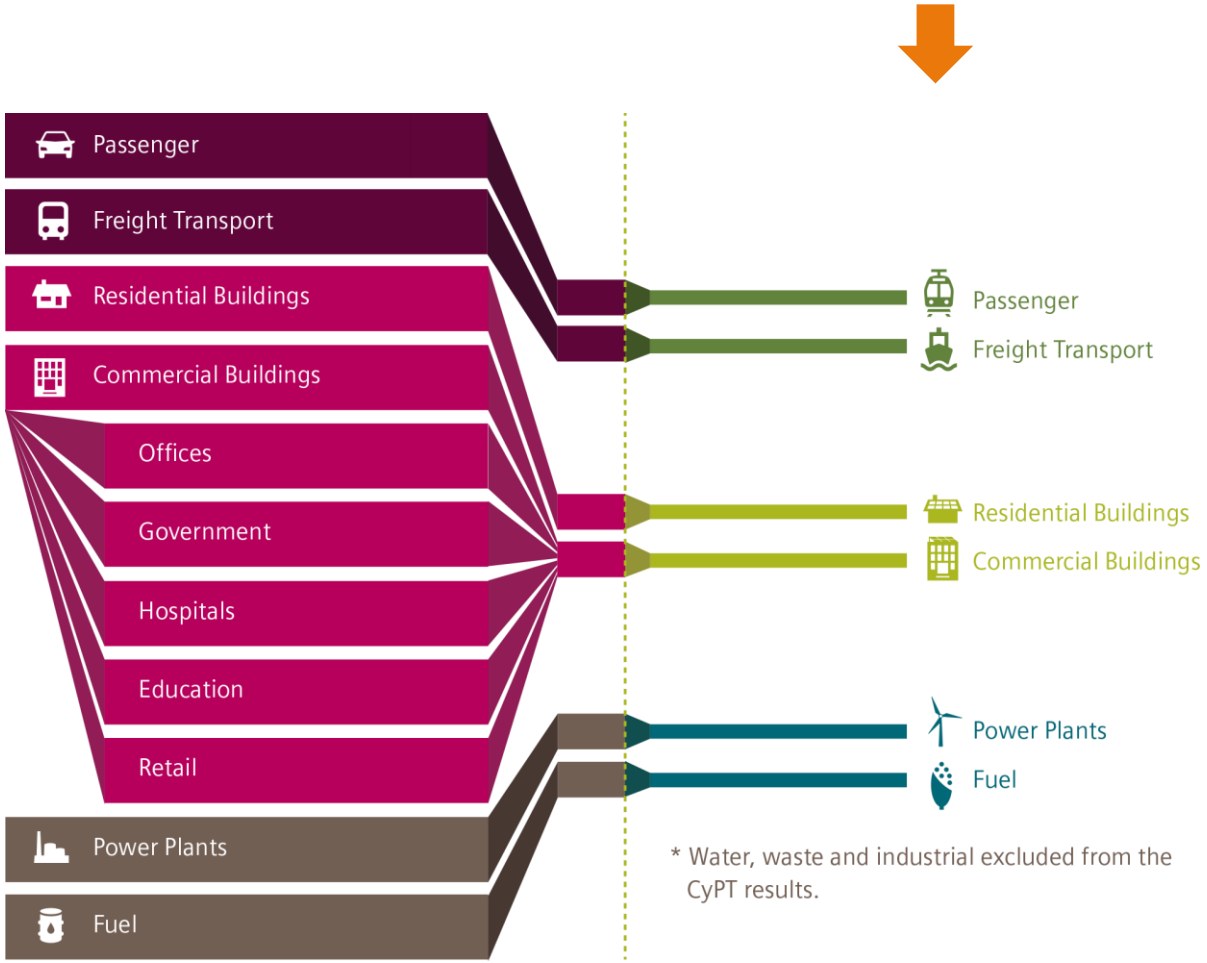
The City Performance Tool (Step 1)



Step 1: Energy Mix Analysis

- 350 data inputs
- Residential and commercial buildings, passenger and freight transport
- Emissions baseline for energy consumption using 2012 GPC Protocol for Community-Wide Emissions

The City Performance Tool (Step 2)



Step 2: CyPT Results

- 73 technologies, each with 3 customizable implementation rates
- Technologies 1) clean underlying energy mix, 2) improve energy efficiency in buildings and transport, and 3) induce modal shift

Outcomes

SIEMENS

Who We're Supporting

SIEMENS

2

The City Performance Tool

San Francisco, Now and in 2050

"Fossil-Free" San Francisco

CyPT Data Inputs

SIEMENS

2% General

- Population
- Geographic size
- Emissions target

15% Energy

- Electricity mix
- Heating mix
- Emissions factors for fuels

39% Transport

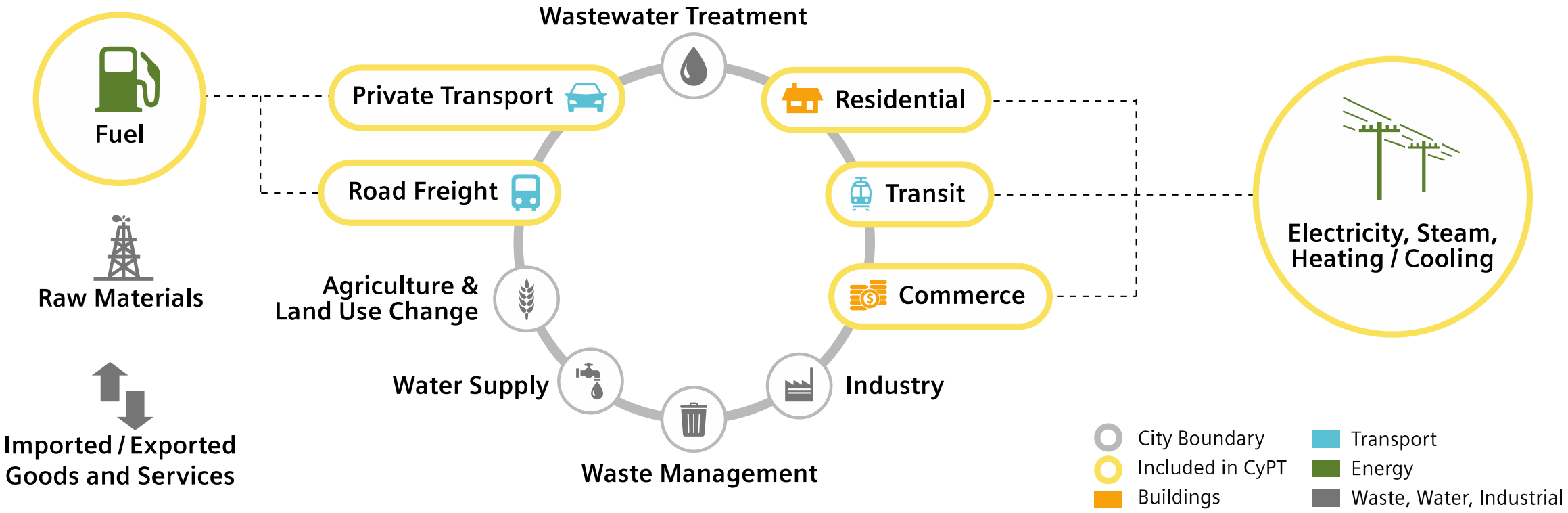
- Annual passenger miles
- Freight ton miles
- Length of road network
- Length of highway network
- Bus, BRT, Street Car, Metro, Commuter / Regional Rail, Taxis, Bicycles, Cars etc.

44% Buildings

- Square footage by building type
- Electricity demand
- Heating demand
- Cooling demand
- End use for electricity, heating and cooling
- Building envelope

CyPT Emissions Scope

SIEMENS



PG&E and SFPUC Cities

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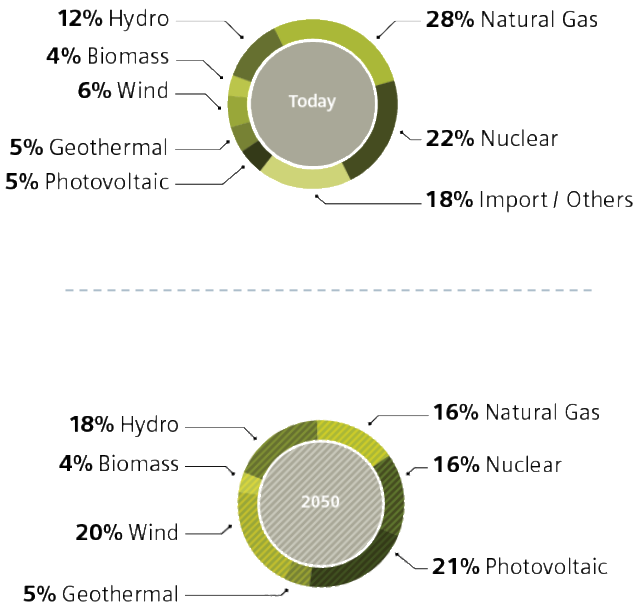
ELECTRICITY MIX



NON-RESIDENTIAL BUILDING STOCKING USING PG&E ELECTRICITY

86%

(209.3 million ft²)

TRANSPORT OPTIONS USING PG&E ELECTRICITY

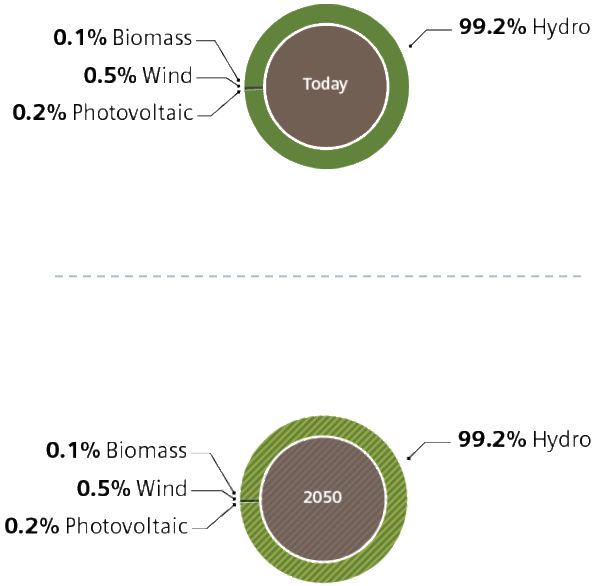
BART

Electric Cars

Electric Car Share

VS

ELECTRICITY MIX



NON-RESIDENTIAL BUILDING STOCKING USING SFPUC ELECTRICITY

14%

(33.3 million ft²)

TRANSPORT OPTIONS USING SFPUC ELECTRICITY

Muni Rail

Muni Bus

eBRT (Bus Rapid Transit)

A Growing City

SIEMENS

POPULATION:

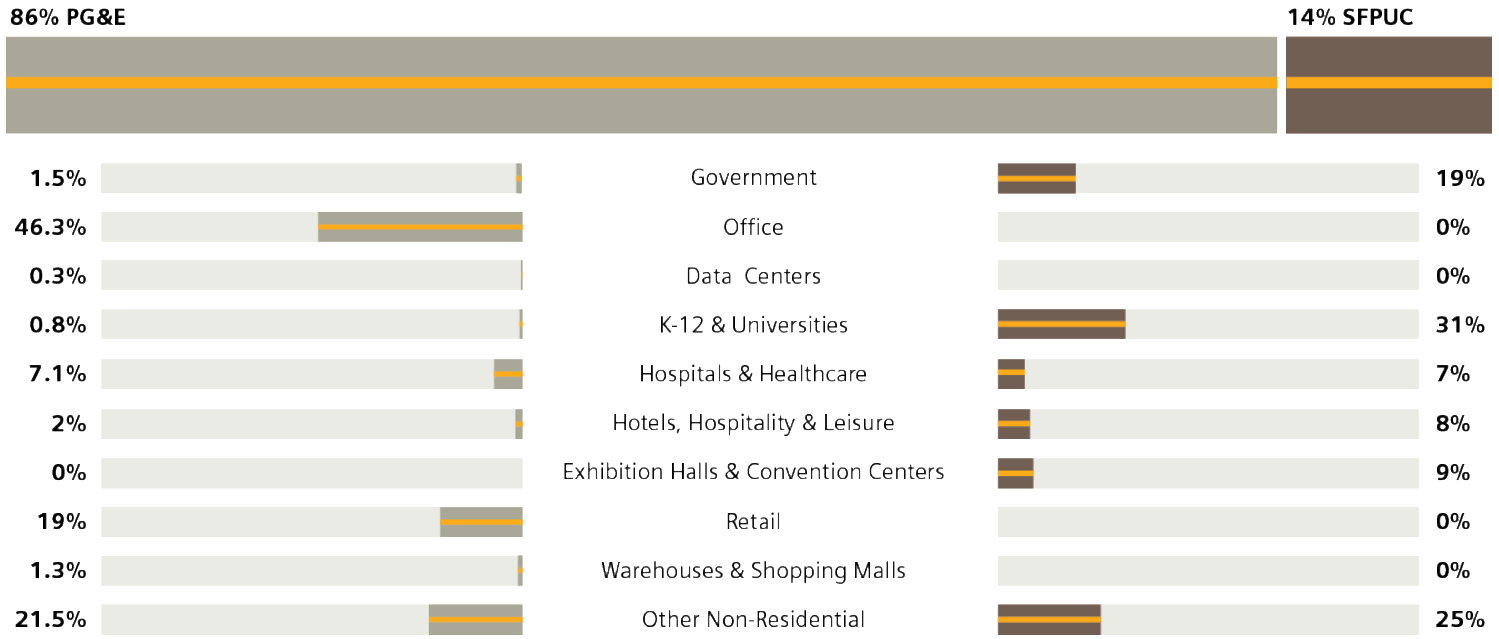
849,744

AVERAGE RESIDENTIAL UNIT SIZE:

1,280 ft^2

TOTAL NON-RESIDENTIAL BUILDING FOOTPRINT:

2.42M ft^2



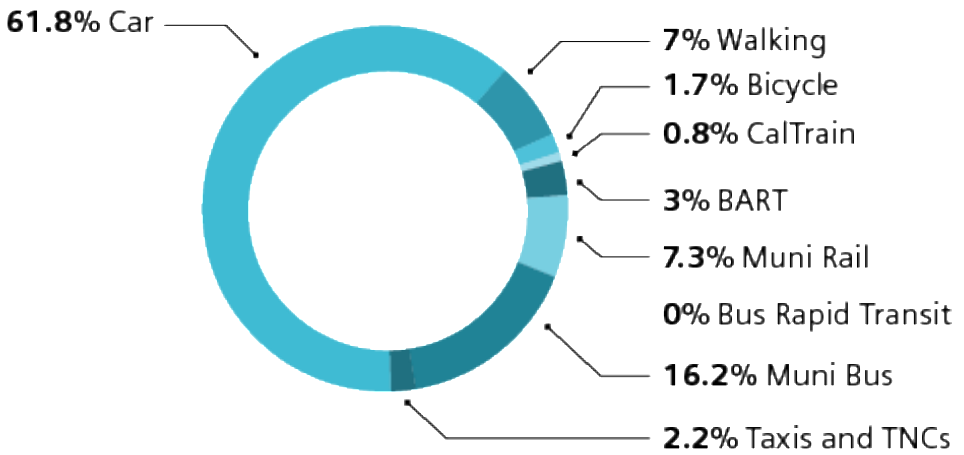
A Moving City

SIEMENS

AVERAGE MILES TRAVELED PER PERSON, PER DAY:

20.6 miles / person / day

% TOTAL OF PASSENGER MILES TRAVELED



3

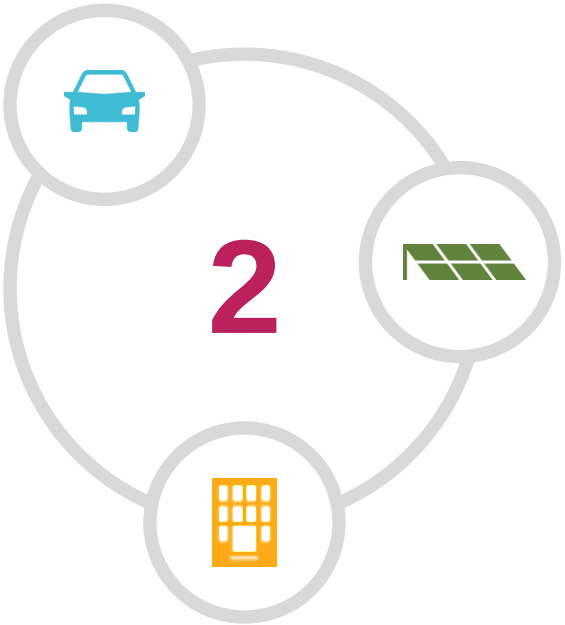
The City Performance Tool
San Francisco, Now and in 2050

“Fossil-Free” San Francisco

SIEMENS

3 Scenarios, **36** Technologies, **3** Objectives

15 Building Technologies + 19 Transport Technologies



15 Building Technologies + 19 Transport Technologies + Rooftop PV

15 Building Technologies + 19 Transport Technologies + Rooftop PV + Electric Heat Pumps

Reduce
15 Building Technologies

SIEMENS

RESIDENTIAL

		TODAY	2050
LED Lighting	(% of existing building stock)	25%	80%
Home Energy Monitoring	(% of existing building stock)	0%	80%
Home Automation	(% of existing building stock)	0%	80%
Building Envelope	(% of existing building stock)	53%	80%

NON-RESIDENTIAL

		TODAY	2050
LED Lighting	(% of existing building stock)	50%	80%
Demand-Oriented Lighting	(% of existing building stock)	5%	80%
Building Efficiency Monitoring	(% of existing building stock)	0%	80%
Building Performance Optimization	(% of existing building stock)	4%	80%
Demand Controlled Ventilation	(% of existing building stock)	2%	80%
Heat Recovery	(% of existing building stock)	0%	80%
Building Envelope	(% of existing building stock)	50%	80%
Building Automation, BACS B	(% of existing building stock)	22%	80%
Efficient Motors	(% of existing building stock)	5%	80%
Room Automation, HVAC+Blinds+Lighting	(% of existing building stock)	0%	80%
Building Remote Monitoring	(% of existing building stock)	0%	80%

Electrify and Decarbonize

19 Transport Technologies, 2 Energy Technologies

SIEMENS

PUBLIC

		TODAY	2050
Electric Buses	(Share of Fleet)	36%	100%
BART – New Lines	(Total # of Lines)	4	6
Muni Rail – New Lines	(Total # of Lines)	6	10
e-BRT (Bus Rapid Transit) – New Lines	(Total # of Lines)	0	8
Muni Rail – New Vehicles	(Share of Fleet)	0%	100%
Bike Lanes	(Miles)	33	275
Bikeshare	(# of Bikes)	350	7,000
Public Transport – E-Ticketing	(Share of total ticketing)	70%	100%

PRIVATE

		TODAY	2050
Reduction in Car Demand	(Shift in person miles from cars to all other modes equally)	0%	20%
CNG Cars	(Share of Fleet)	0%	1%
Electric Cars	(Share of Fleet)	1%	20%
Hybrid Electric Cars	(Share of Fleet)	0%	60%

PRIVATE

		TODAY	2050
Electric Taxis	(Share of Fleet)	0%	100%
Electric Car Sharing	(Total # of Shared eCars)	200	20,240
Congestion Charging	(% Reduction in Road Traffic)	0%	15%

INFRASTRUCTURE

		TODAY	2050
Eco-Driver Training & Consumption Awareness	(Participation of Eligible Drivers)	0%	8%
Smart Street Lighting	(Share of Lights)	0%	100%
Intelligent Traffic Light Management	(Share of Lights)	40%	100%
Intermodal Traffic Management	(Share of Integrated Users)	30%	100%

ENERGY

		TODAY	2050
Rooftop PV Panels	(Share of Electricity Consumption)	n.a.	11%
Electric Heat Pumps	(Share of Heat Consumption)	2%	80%

Top Performing Technologies across Sectors

SIEMENS

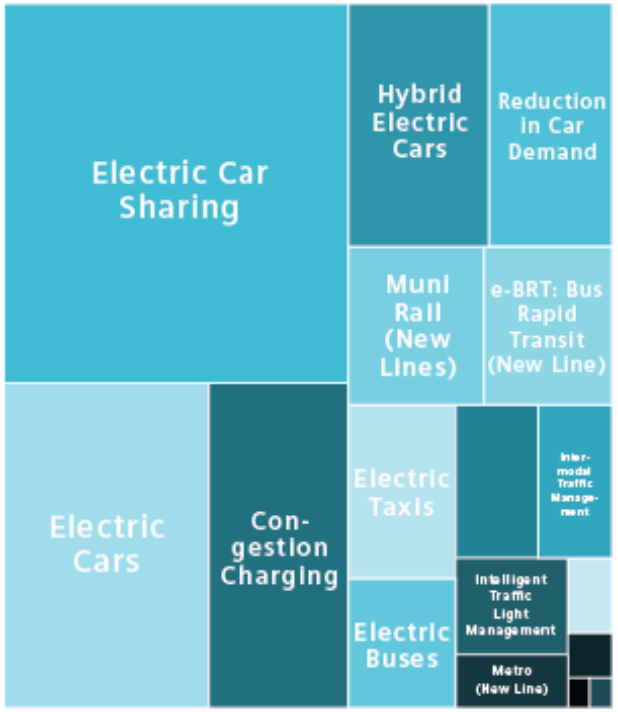
COST EFFICIENCY	GHG REDUCTION	AIR QUALITY IMPROVEMENT	JOB CREATION*
Congestion Charging	Electric Heat Pumps	Electric Car Sharing	Electric Car Sharing
Electric Taxis	Electric Car Sharing	Electric Buses	Muni Rail (New Lines)
Intermodal Traffic Management	Electric Cars	Electric Cars	Room Automation, HVAC + Lighting (Non-Residential)
Eco Driver Training Consumption Awareness	Rootop PV Panels	Hybrid Electric Cars	Heat Recovery (Non-Residential)
Electric Cars	Congestion Charging	Muni Rail (New Lines)	eBRT (New Lines)

***** Job creation and cost efficiency were not estimated for electric heat pumps and rooftop PV.

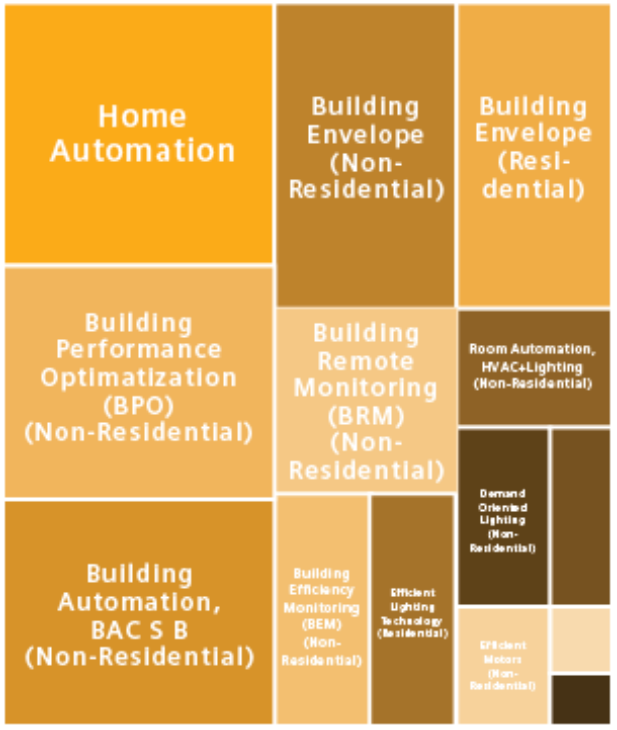
Technologies' Contribution to Carbon Reduction

SIEMENS

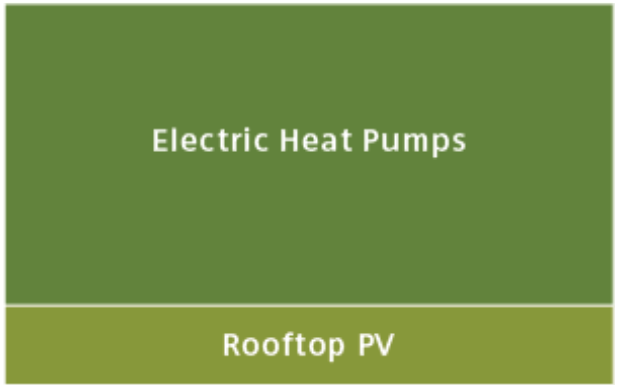
TRANSPORT: -30.8% CO_2eq



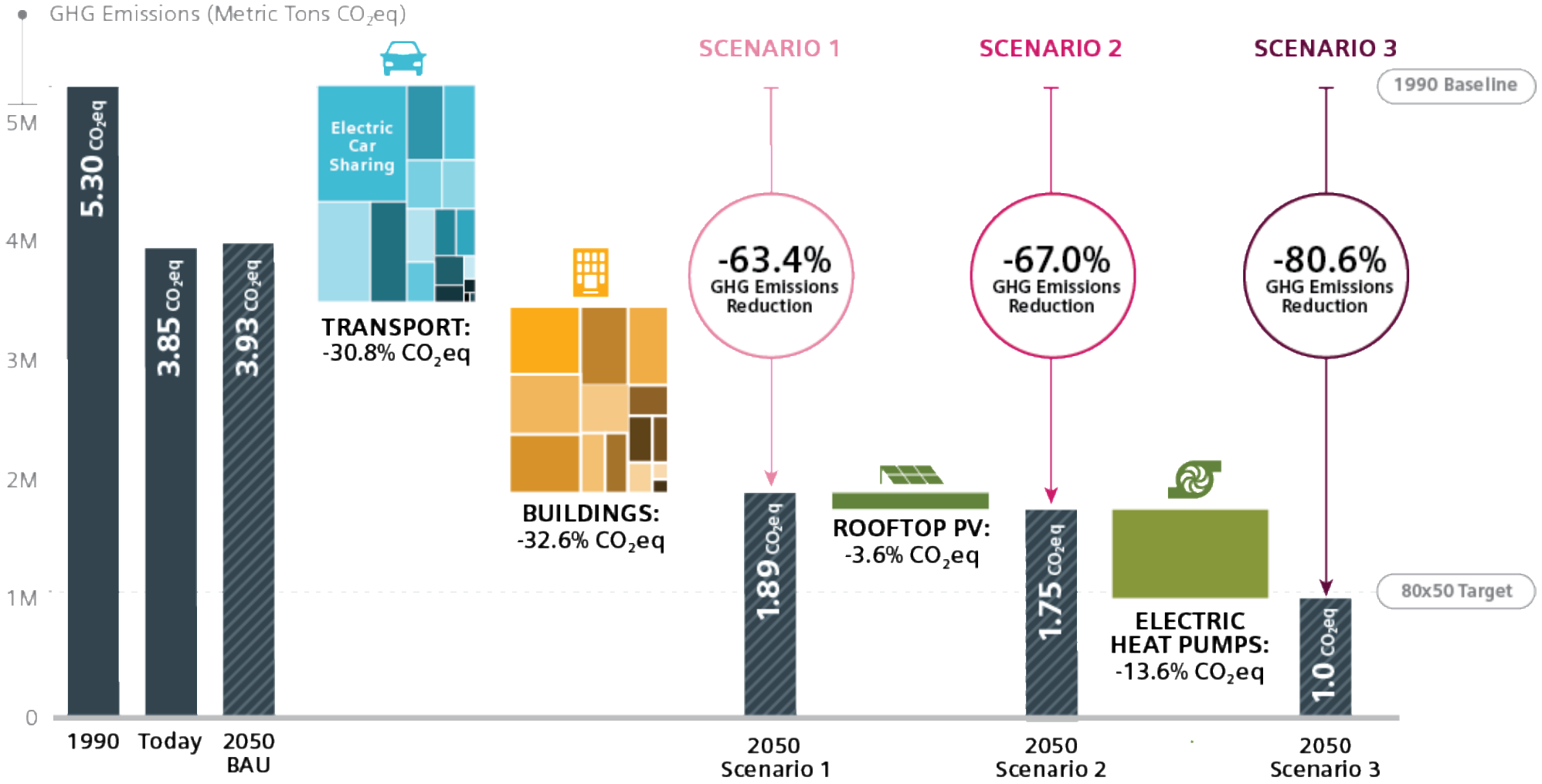
BUILDINGS: -32.6% CO_2eq



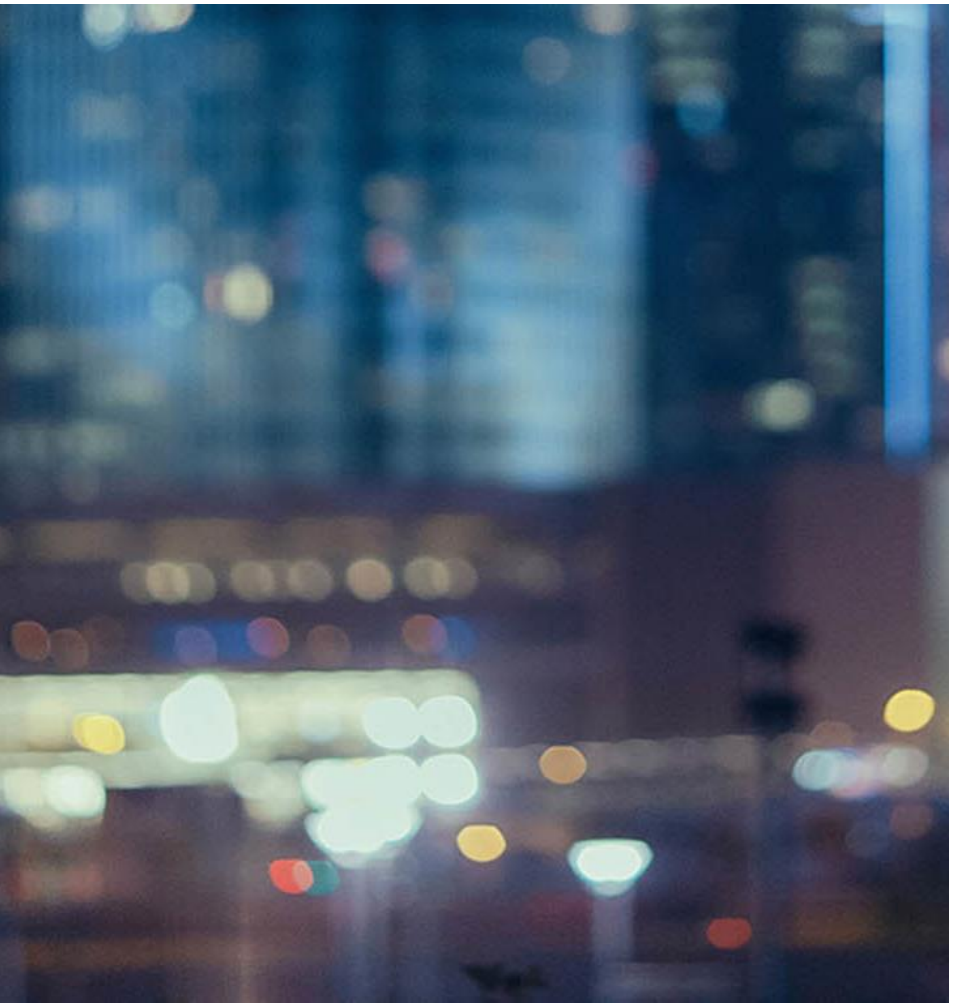
ENERGY: -17.2% CO_2eq



Reaching 80x50



Contact



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SF Environment

Our home. Our city. Our planet.

A Department of the City and County of San Francisco

What does the future hold?

January 18, 2016

Barry Hooper
San Francisco Department of Environment

20 Years

Photo credit: Merri, Flickr

14.6%
Population

49.1%
GDP

23.3%
GHG Emissions

SAN FRANCISCO CLIMATE ACTION

0 50 100

Zero Waste

Composting & Recycling Everywhere

50 Sustainable Transit

SAN FRANCISCO CLIMATE ACTION | 0 50 100 ROOTS

100 Renewable Energy

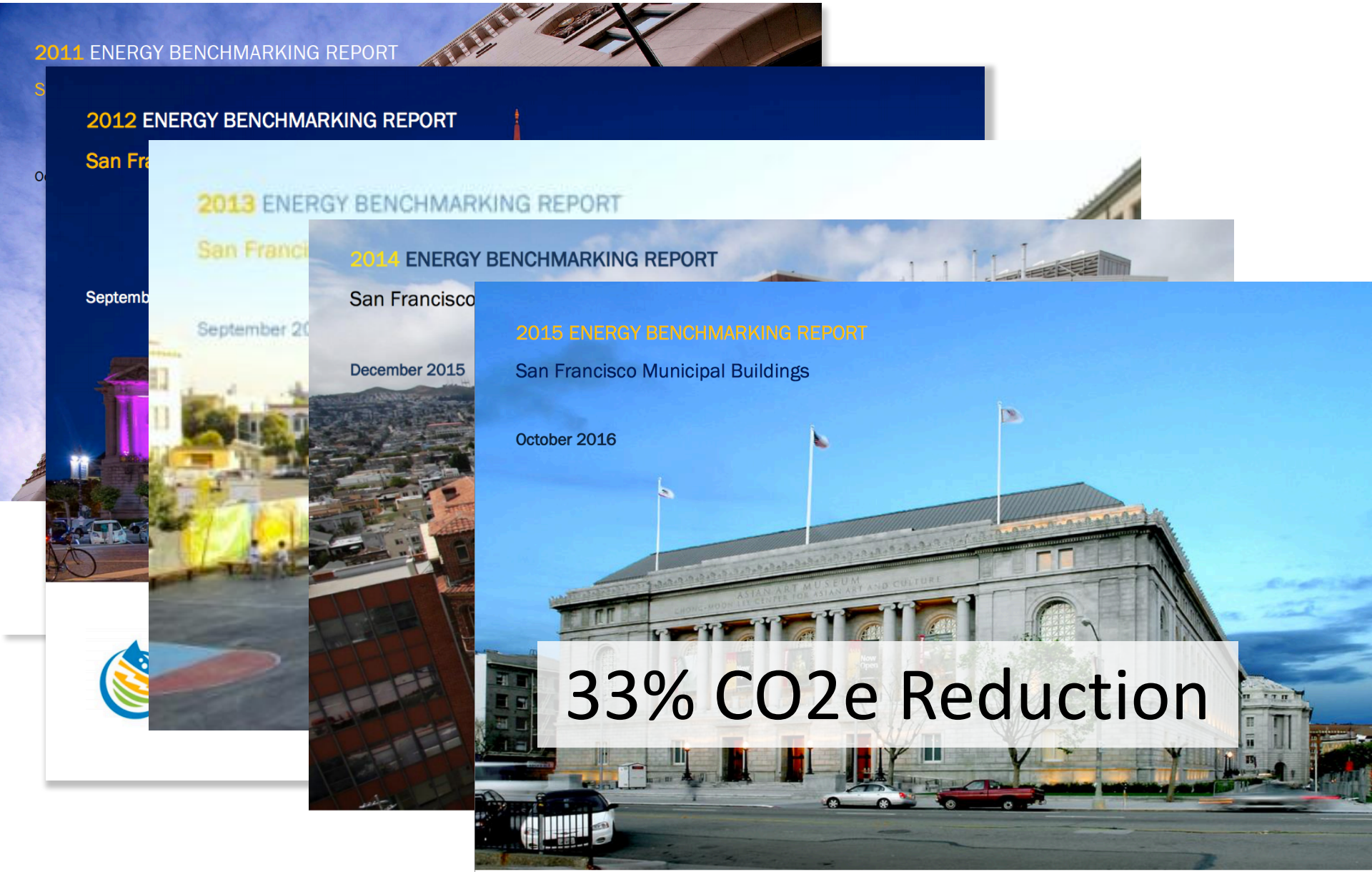
SAN FRANCISCO CLIMATE ACTION | 0 50 100 ROOTS

Incentives

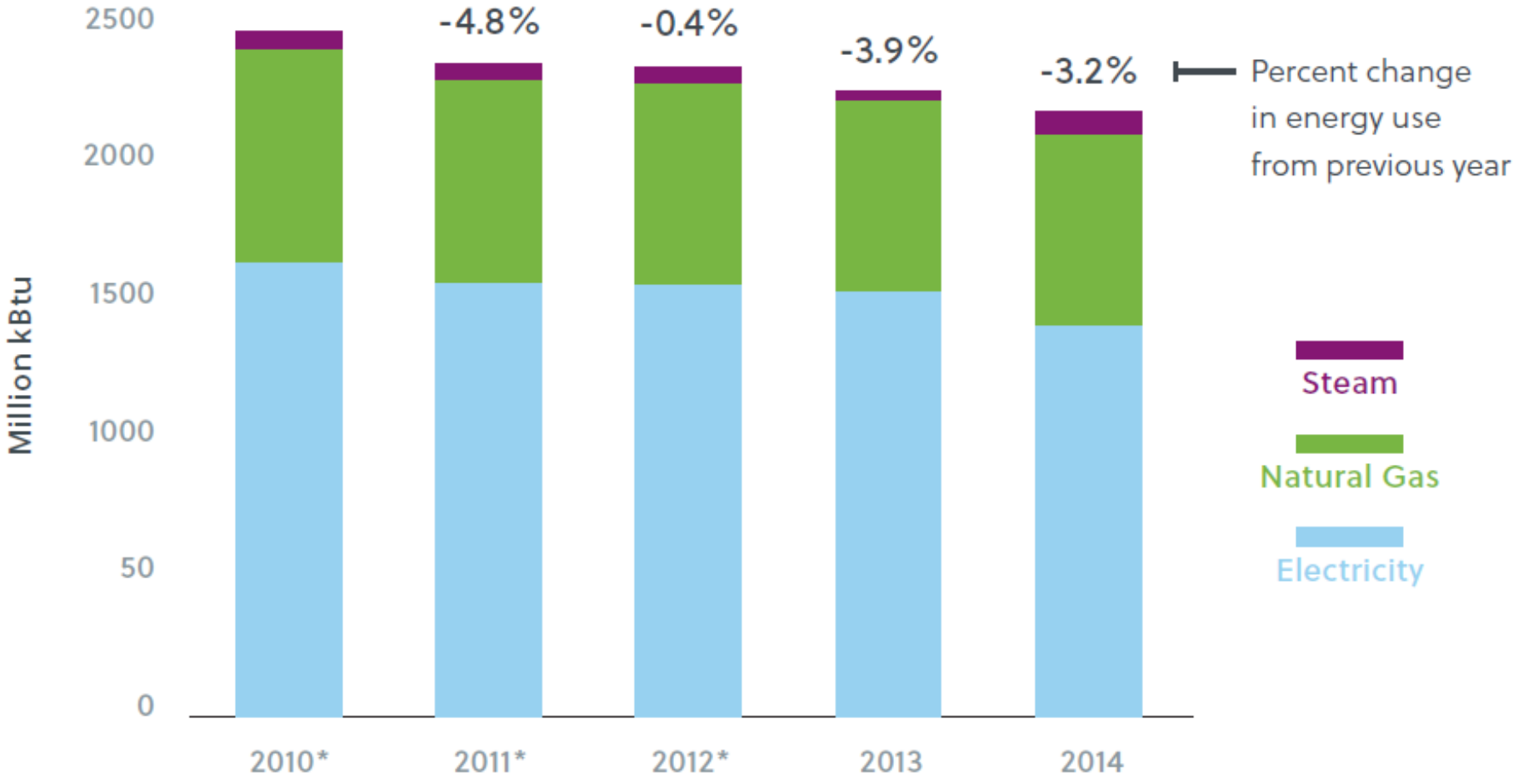
Financing

Benchmarking and Audits

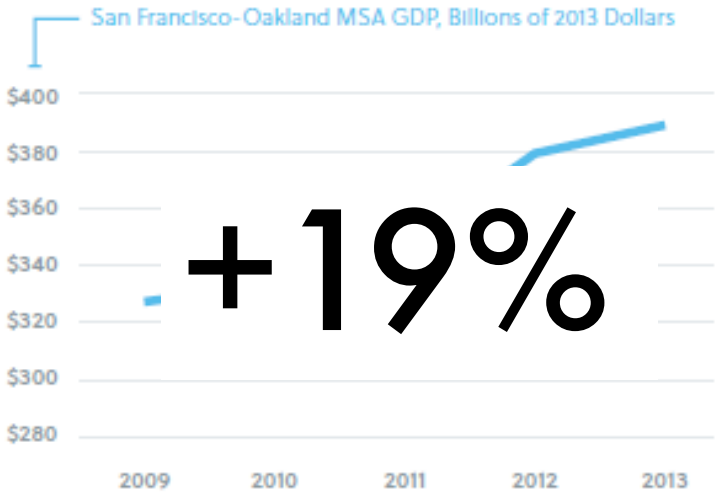
Municipal Facilities: Since 2009

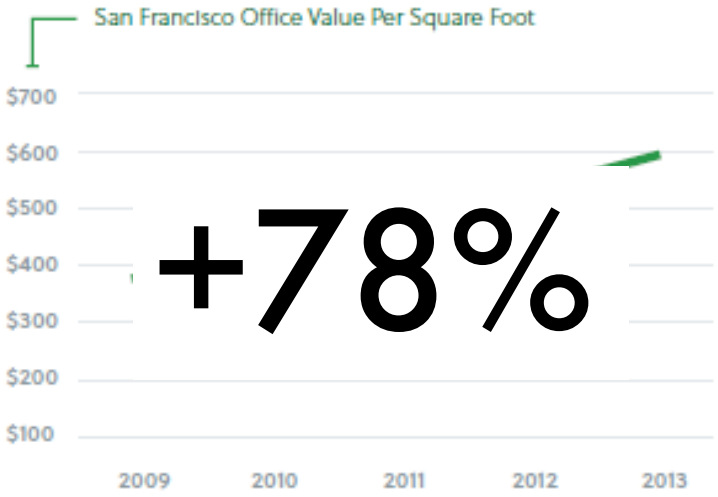


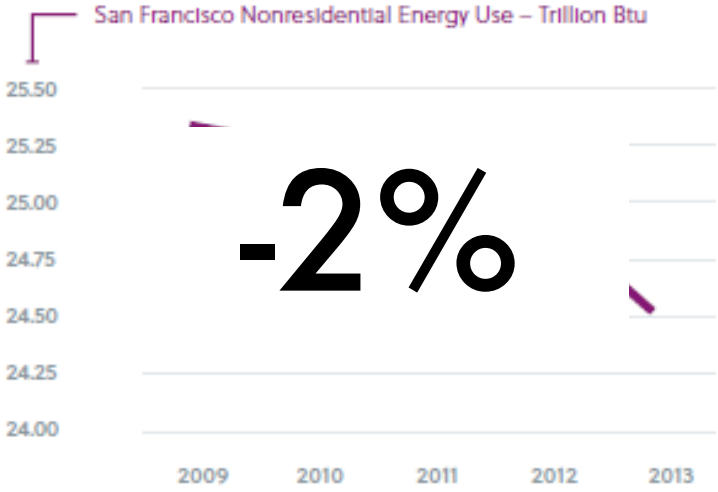
Office: 3% Annual Reduction



Energy and Economic Growth

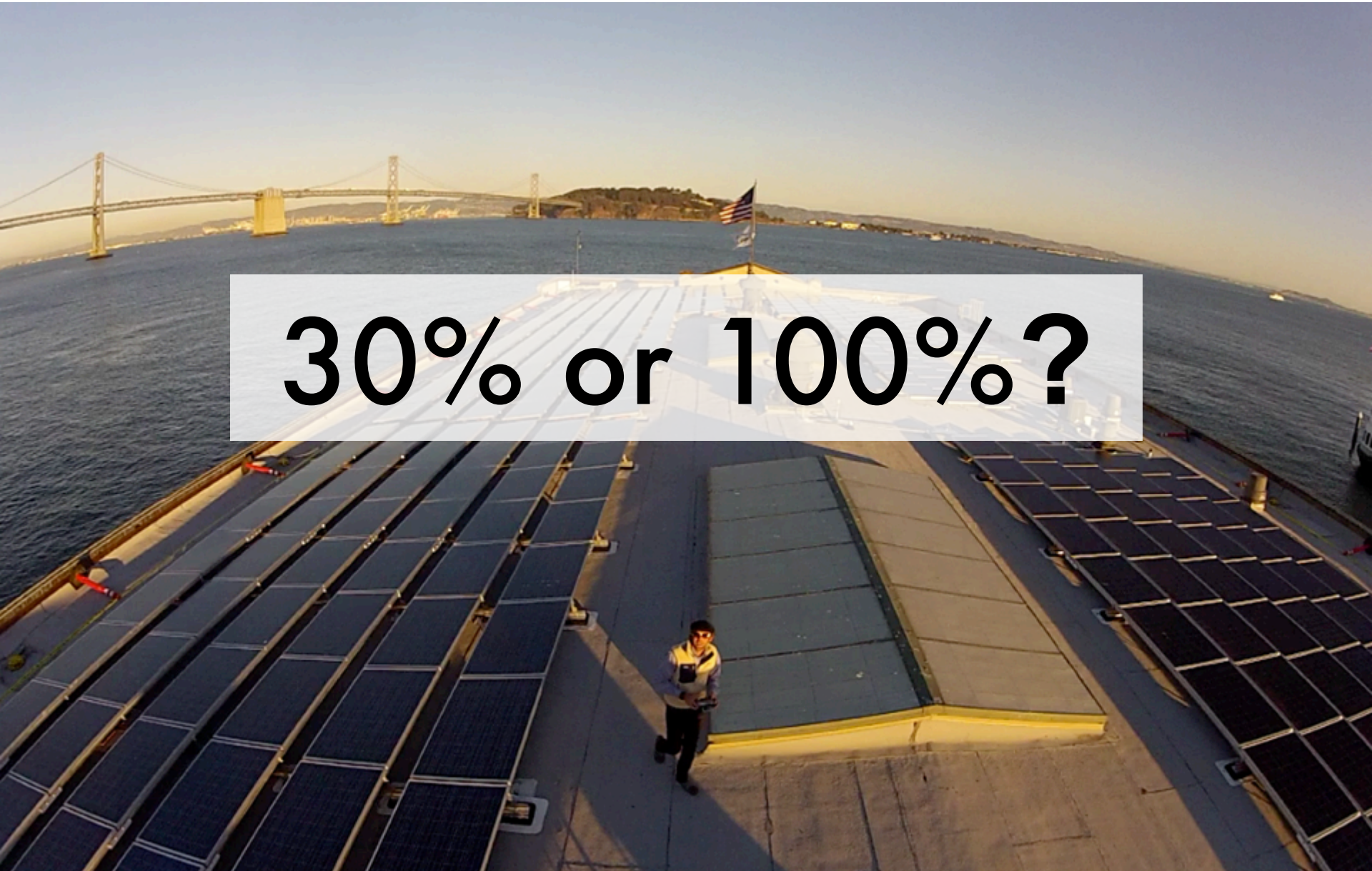






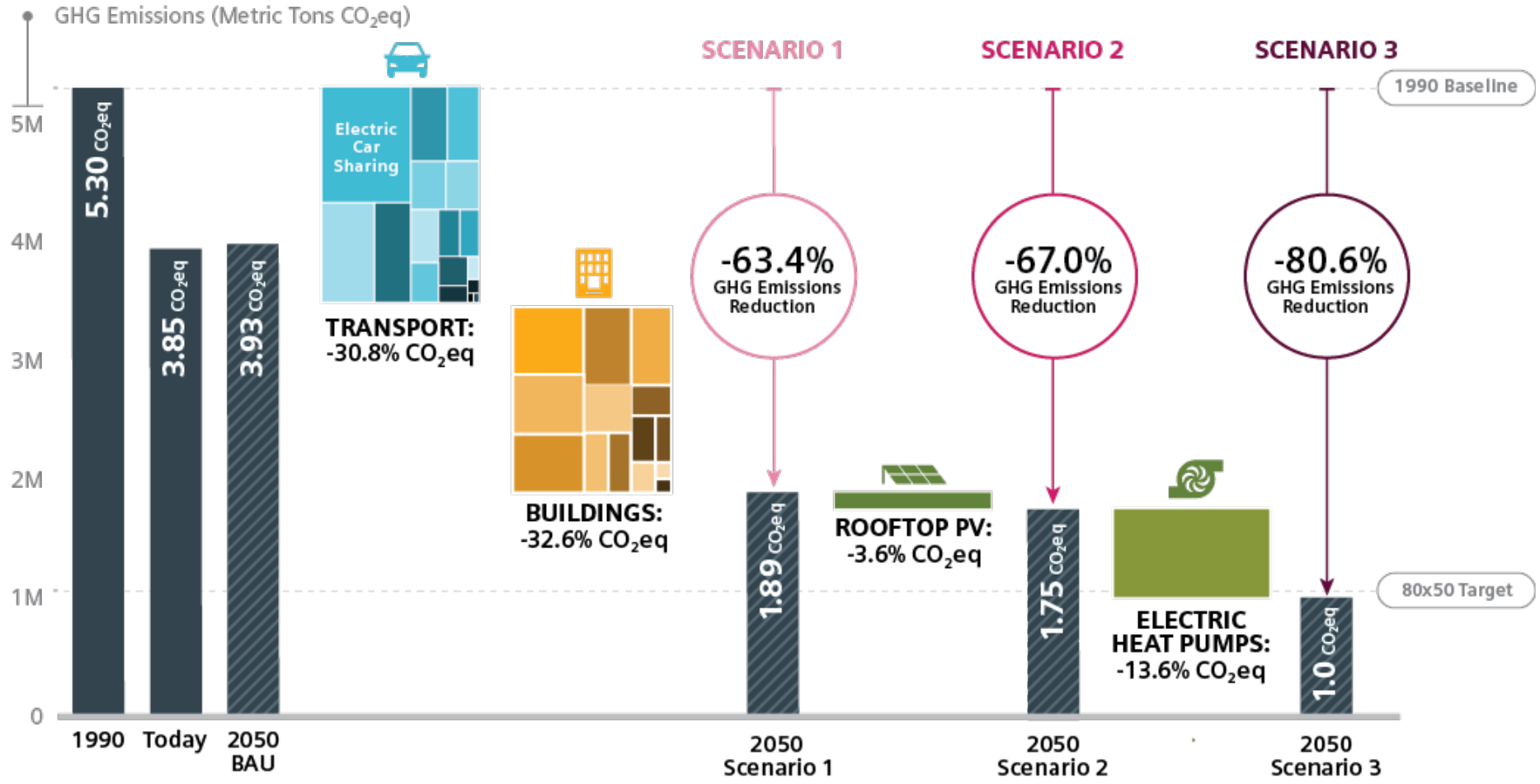
Sources: National Council of Real Estate Investment Fiduciaries (NCREIF) reference
US Bureau of Economic Analysis (http://www.bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1&acrdn=2#)
California Employment Development Department and the Bureau of Labor Statistics, Quarterly Census on Employment and Wages. http://sfbarometer.weebly.com/economic-indicator-sources-and-notes.html#sthash.NG2qbIKx.dpuf
PG&E Green Communities (2014)

Grid Renewables



Better Roofs – New Construction

80x50 is Viable

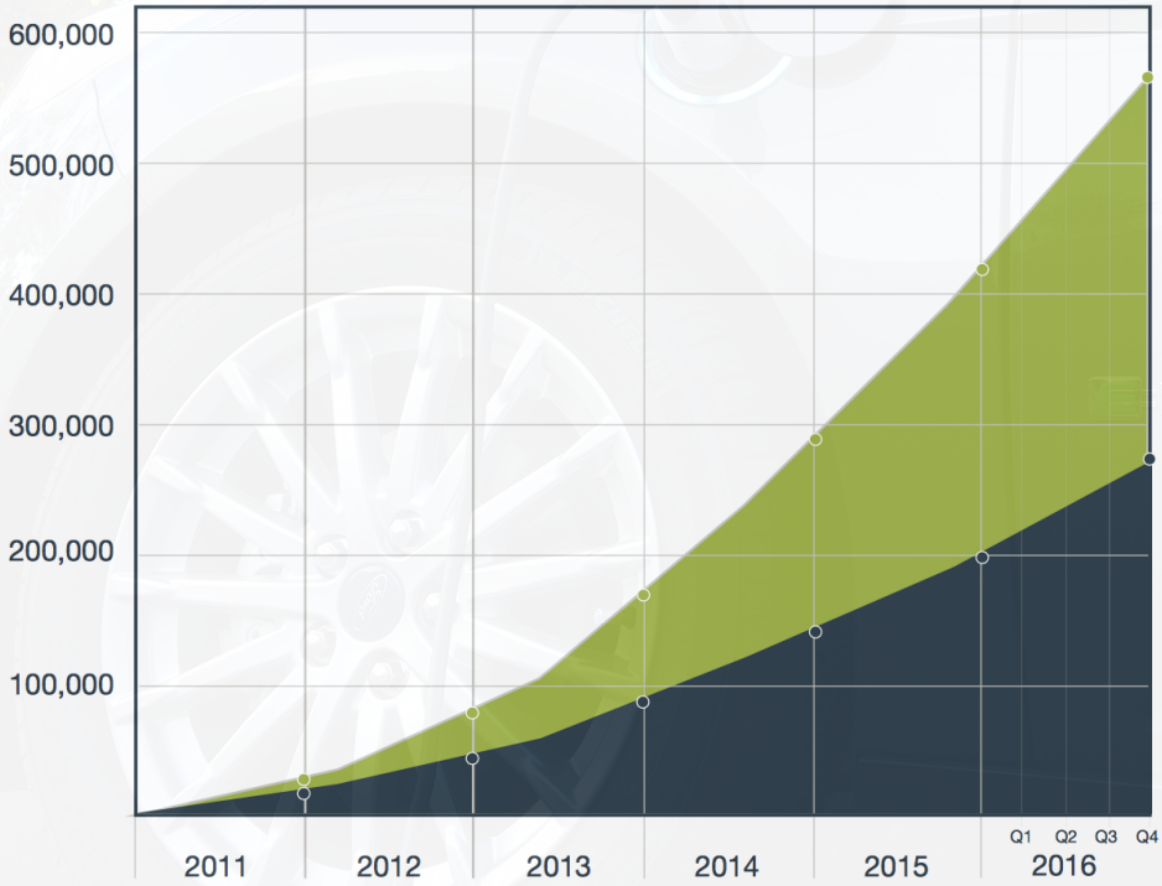


Siemens, *Reaching 80x50: Technology Pathways to a Sustainable Future in San Francisco* – sfenvironment.org/climate_reports


E-LECTRIC
MICHELIN

CALIFORNIA
PLUG-IN ELECTRIC VEHICLE
COLLABORATIVE

CUMULATIVE SALES



- NATIONAL SALES

  December 2016: 23,288
  2016 Sales: 160,357
  Cumulative 2011-present: 561,022

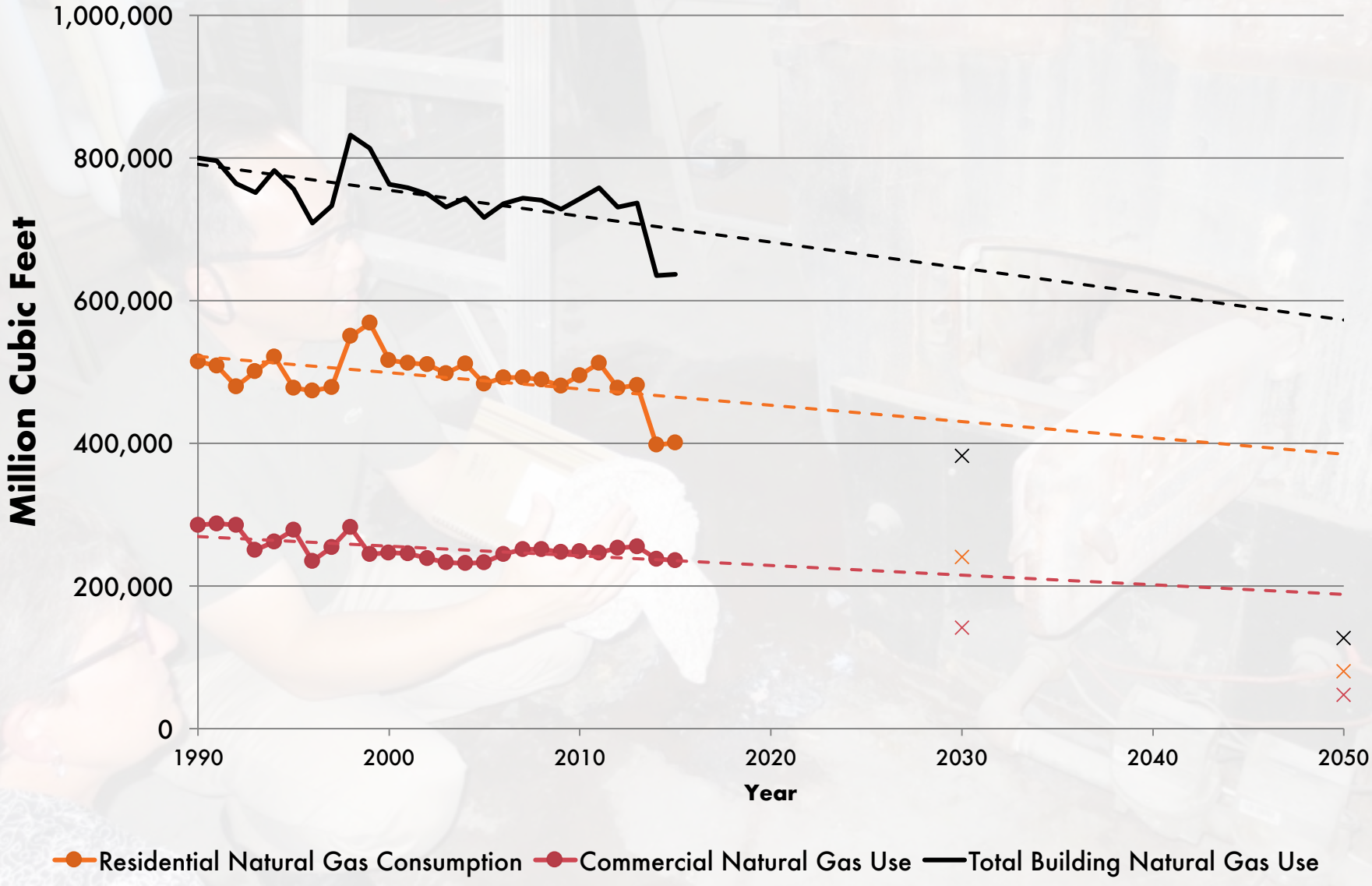
- CALIFORNIA SALES*

  December 2016: 12,110
  2016 Sales: 83,510
  Cumulative 2011-present: 265,195

View Data Calculation
www.pevcollaborative.org/data-caculation »

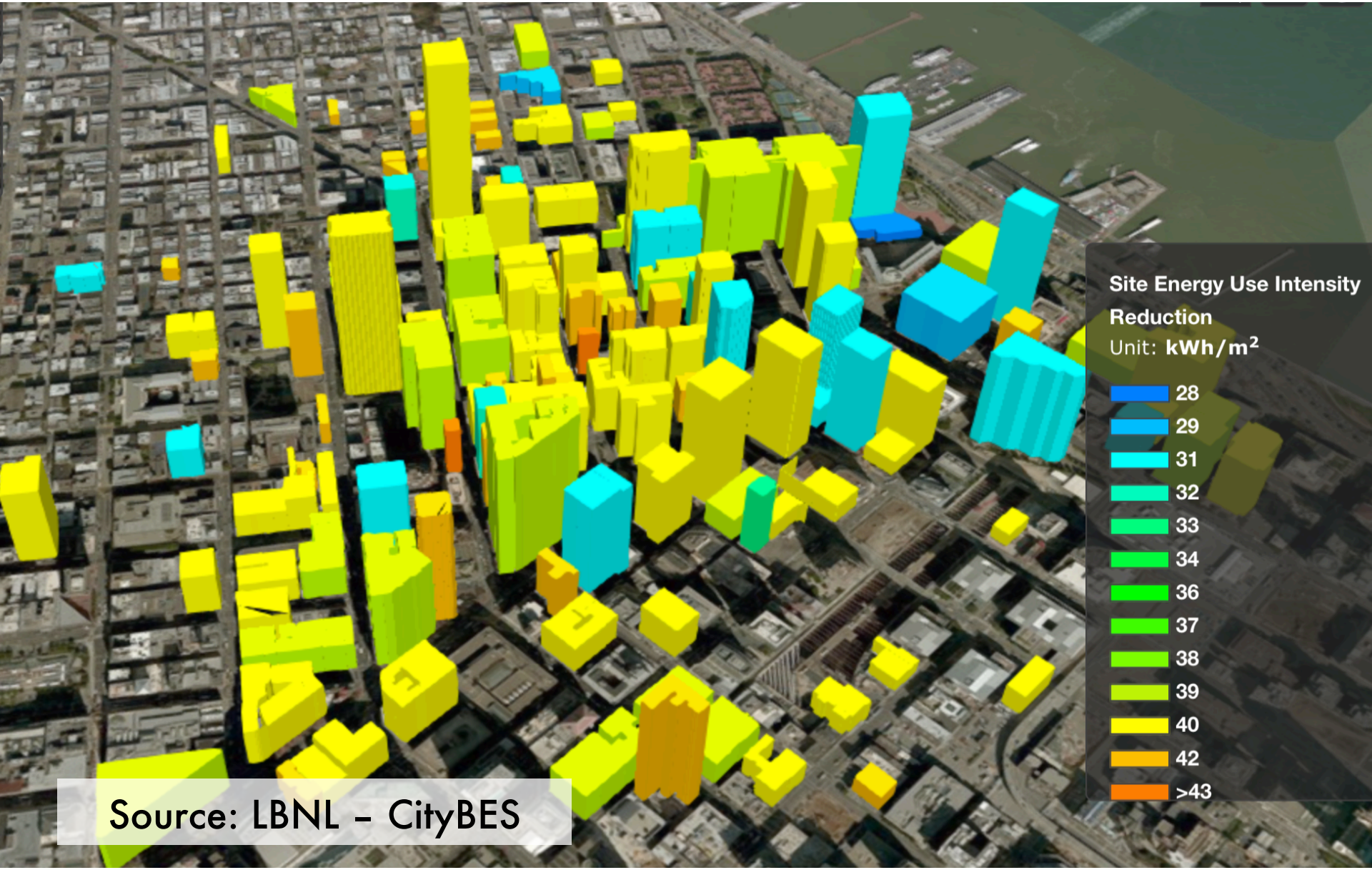
* Approximation assumes CA sales are 52% of National Sales
Reference: www.hybridcars.com

California Building Natural Gas Use



Source: US Energy information Administration

Technology to 'Map the Formation'



Source: LBNL – CityBES

More Detail

Existing Commercial Buildings Ordinance www.sfenvironment.org/ecb
80x50: Technology Pathways for San Francisco *sfenvironment.org/climate_reports*

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San Francisco Dept of Environment
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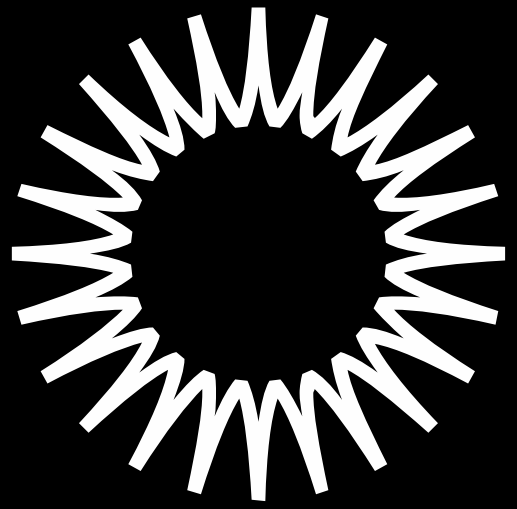

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