

# Renewable Energy Strategy for City-Owned Buildings

2017–2040

**City of Vancouver**

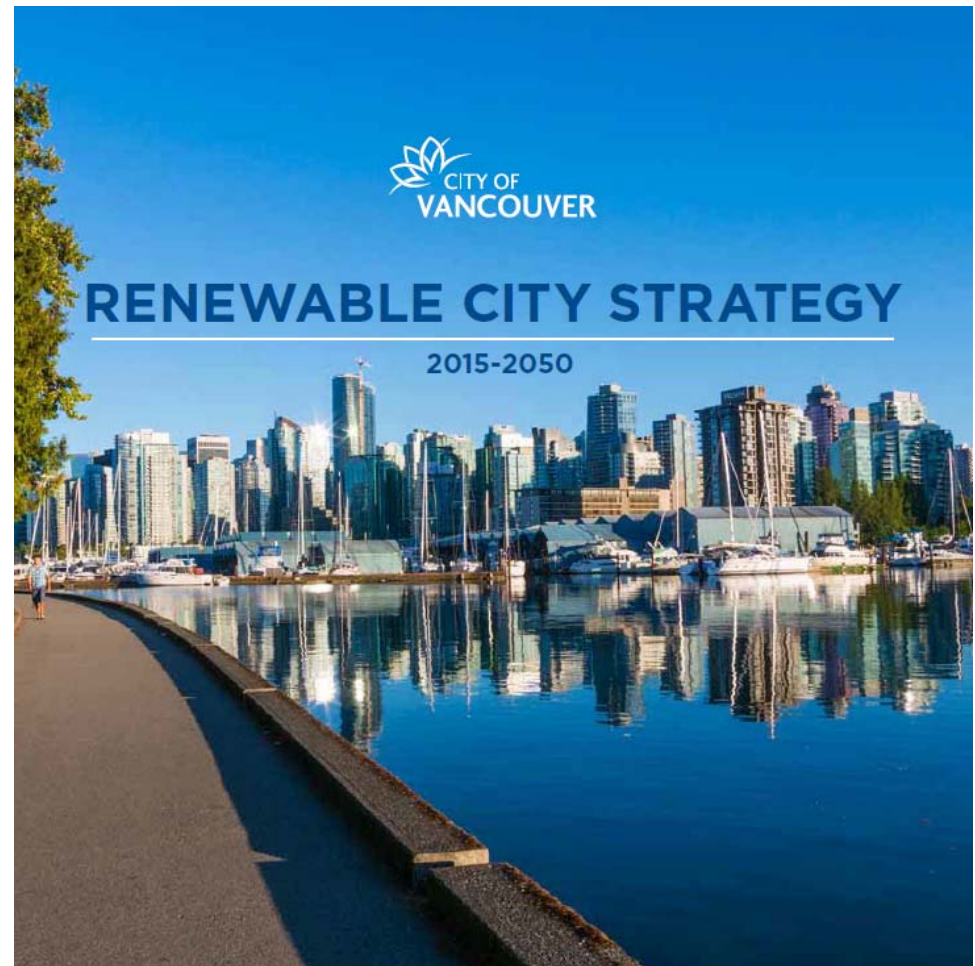
Real Estate and Facilities  
Management Department



# PURPOSE OF PRESENTATION



Present how the City is **demonstrating leadership** in meeting the goals of the Renewable City Strategy.



- Background
- Renewable Energy & GHG Targets for City-owned Buildings
- Renewable Energy Strategy* Framework for City-owned Buildings
  - **Eight Emission Reduction Pillars**
- Educational Demonstration Projects





# Background

Presented to Council in  
February 2016

## SIX POINT STRATEGY

1. Energy Retrofits
2. Continuous Optimization
3. New Buildings
4. Staff Engagement
5. Organizational Potential
6. Renewable Energy

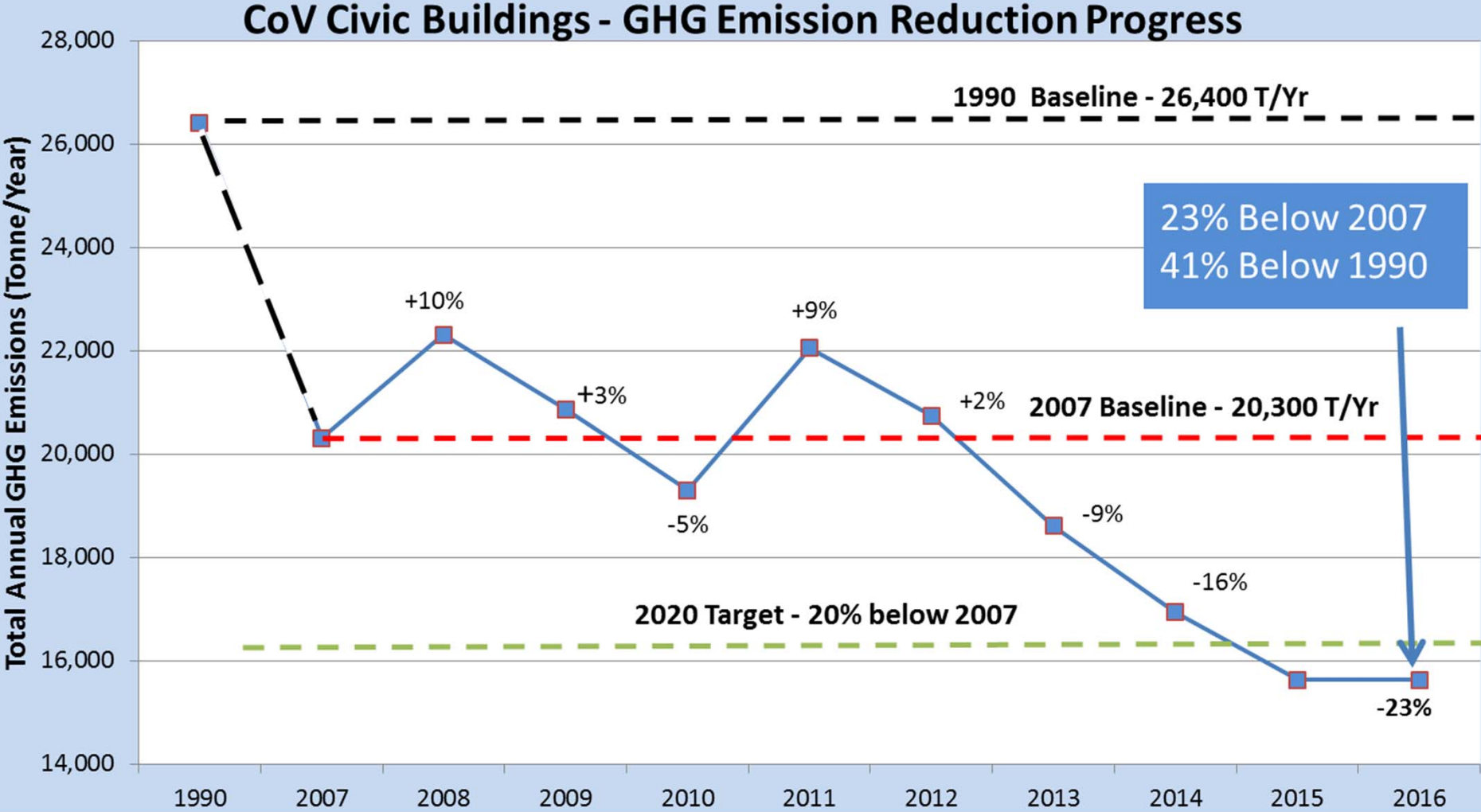


### **Greenest City Action Plan**

#### *Green Buildings:*

- Reduce GHG emissions in existing buildings by 20% by 2020
- Require all buildings constructed from 2020 onward to be carbon neutral in operations

# 2016 GHG Emissions Reductions



## City-Wide Target

*(Renewable City Strategy, Fall 2015)*

Derive 100% of the energy used in Vancouver from renewable energy sources **before 2050**



## City-Owned Buildings Target

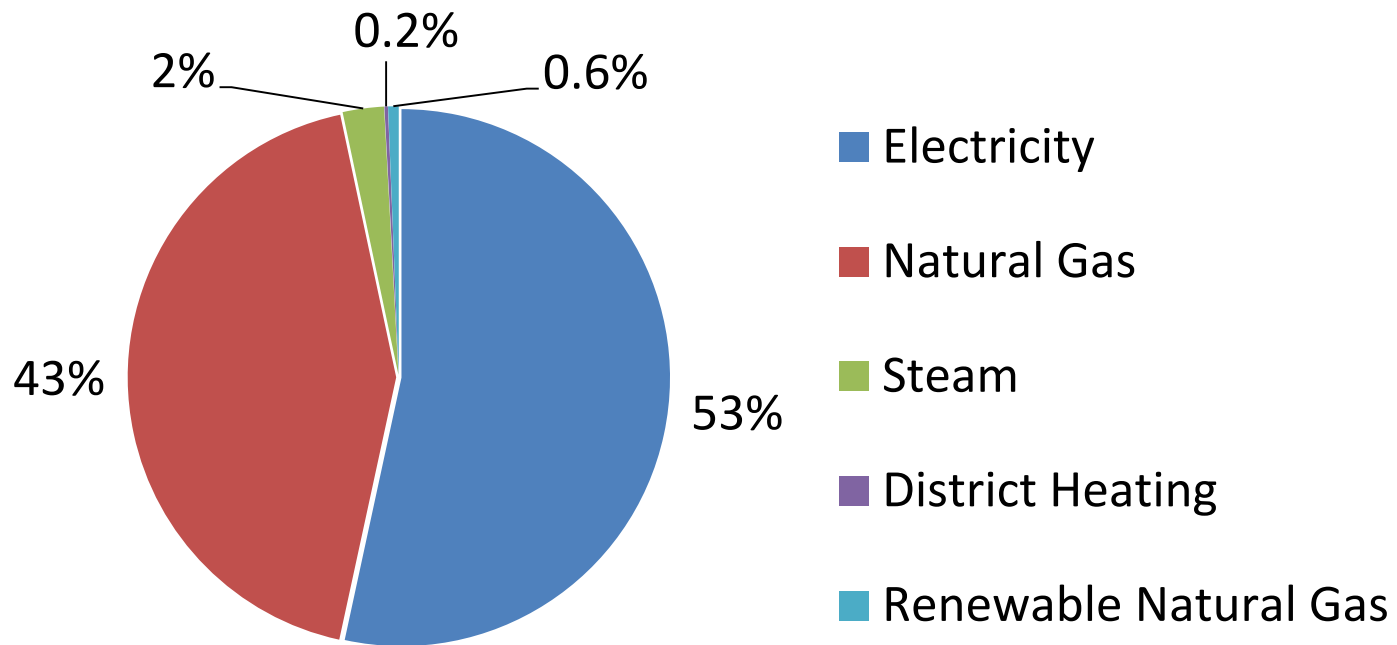
Derive 100% of energy used in city-owned buildings from renewable energy sources (with 100% GHG reduction)  
**before 2040: 10 years ahead of city-wide target**



Electricity regulated to be 93% renewable in BC. BC Hydro is currently **98% renewable**.

Renewable energy use in City-owned buildings from electricity and renewable natural gas is currently **52%**.

### 2015 City-owned Buildings Energy Consumption (%)

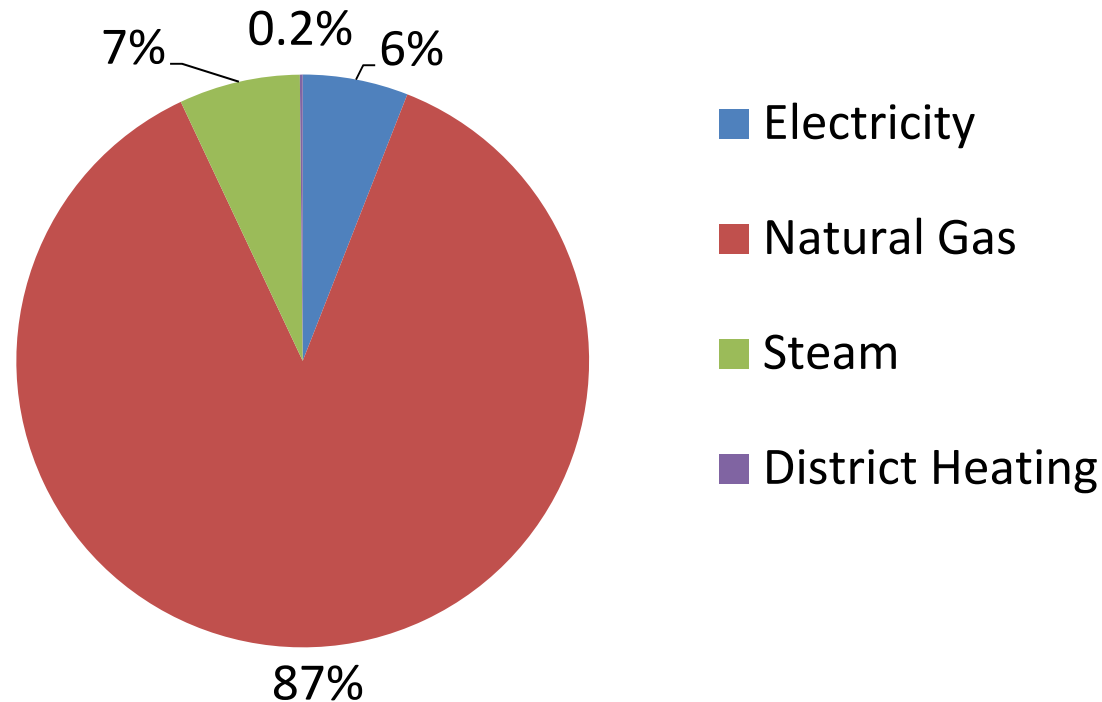




As of 2016, 558 civic facilities emitted ~**16,000 tonnes of CO2e**.

**87%** of these emissions came from natural gas.

## 2015 City-owned Buildings GHG Emissions (%)



An aerial photograph of a modern waterfront residential complex. The buildings are multi-story with large glass windows and balconies. A marina with several sailboats is visible in the foreground. The sky is blue with some clouds. A semi-transparent blue banner with a grid pattern is overlaid across the middle of the image, containing the title text.

# Renewable Energy Strategy for City-Owned Buildings

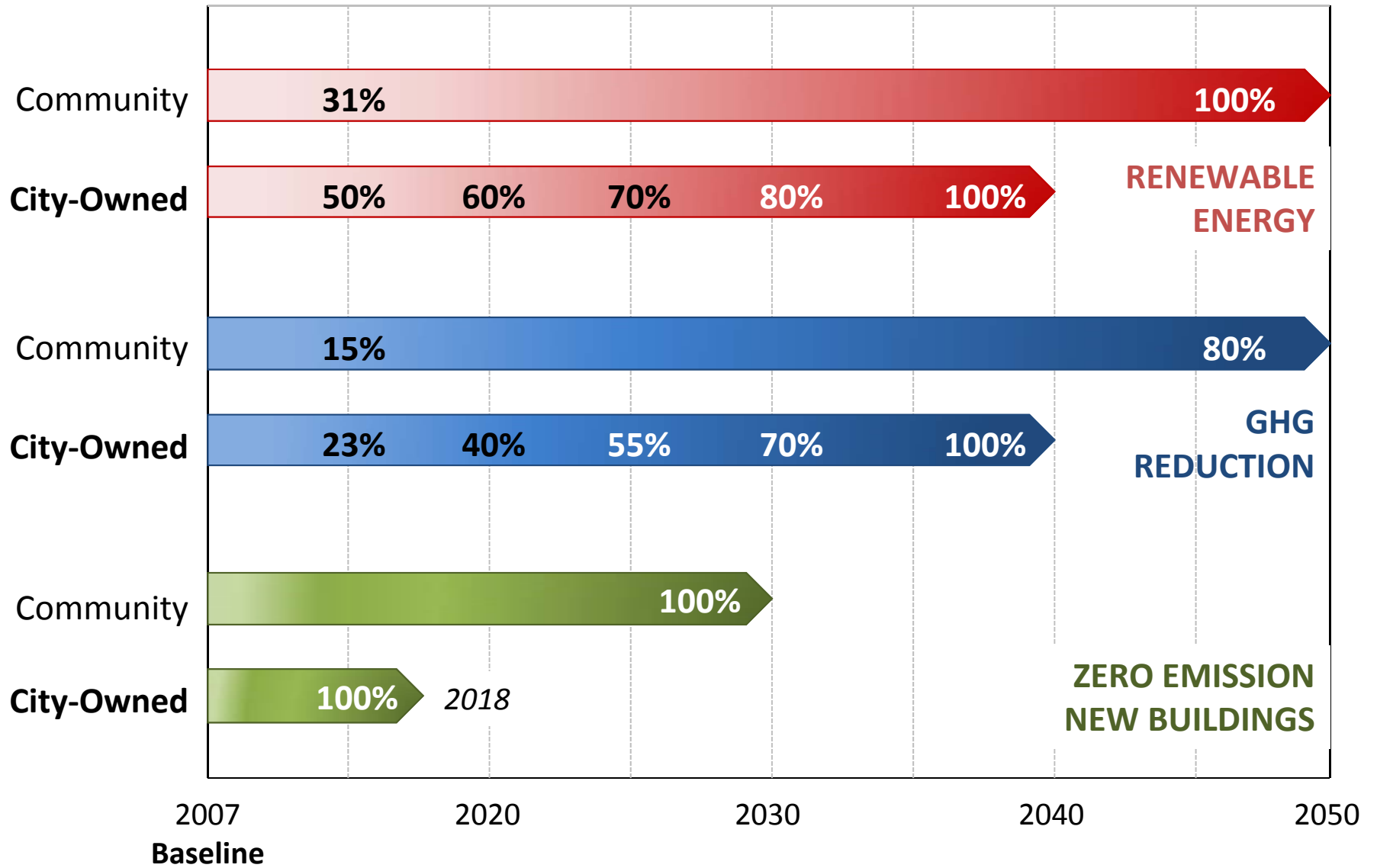




**Show leadership** by achieving GHG emission reductions and the renewable energy transition *before* community-wide targets.

Achieve the transition to 100% renewable energy **in the most cost-effective way.**

# Renewable Energy Targets and Milestones





# Strategy Development Process

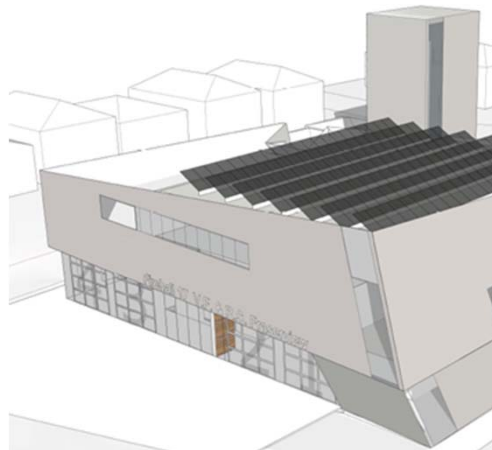
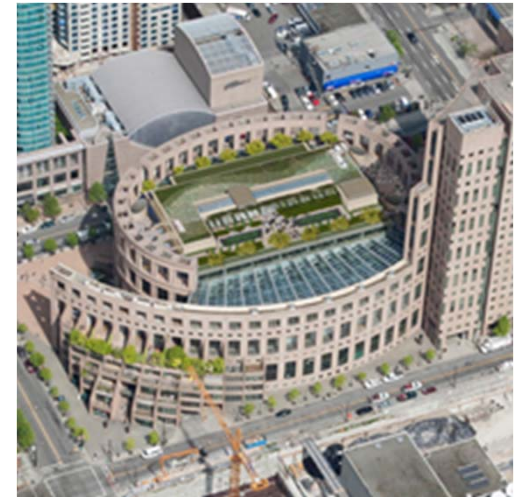


Outline **main opportunities** for renewables & carbon reductions and their potential contributions

Identify civic buildings **best suited** for each conversion strategy

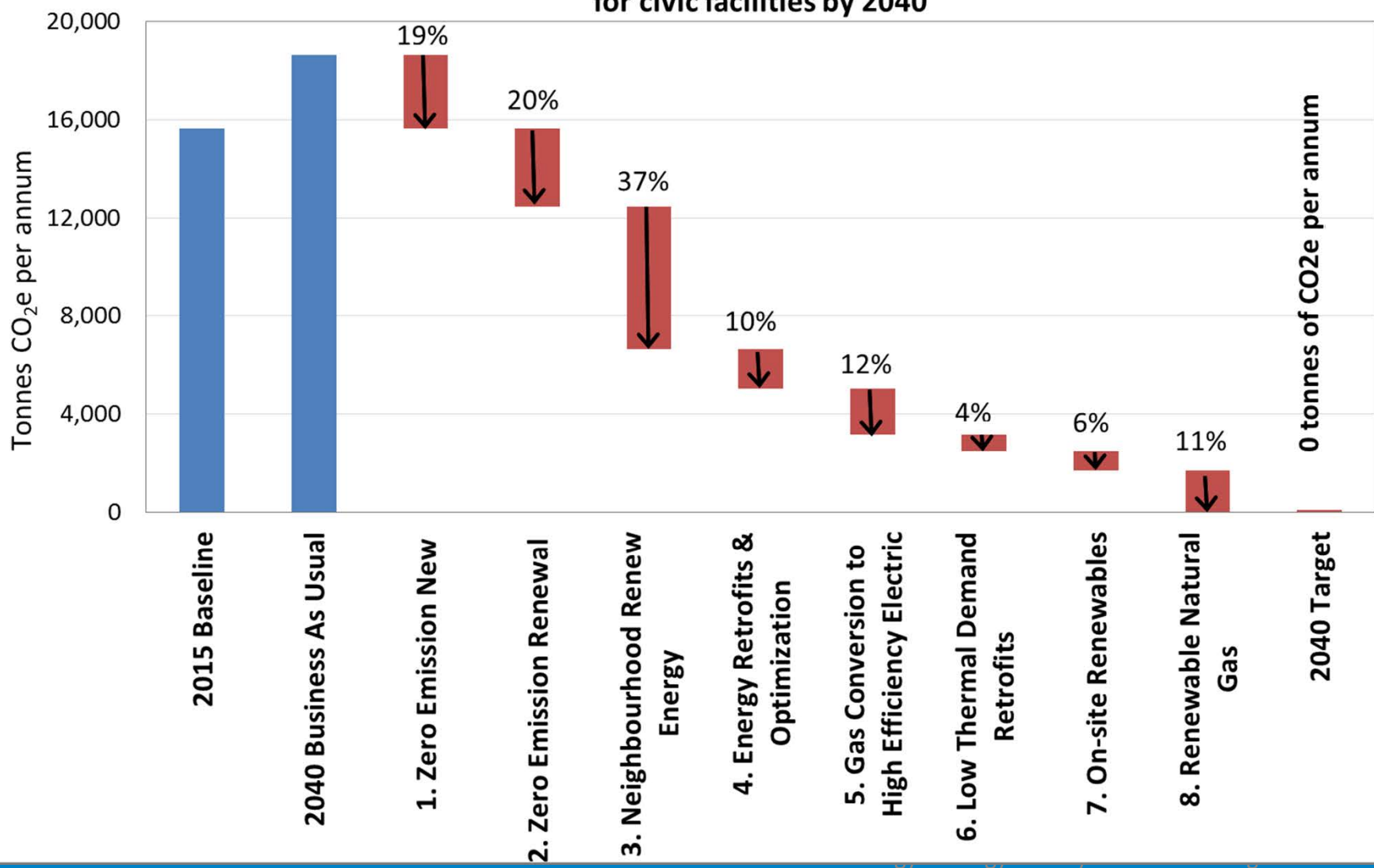
Include **retrofits** of existing facilities and **new construction**

Evaluate **life-cycle cost** of opportunities and focus on those most cost effective first



# Eight Pillars to Achieve 100% GHG Reduction

Estimated contribution of each pillar to the 100% GHG emission reduction target for civic facilities by 2040



# RENEWABLE ENERGY STRATEGY FRAMEWORK



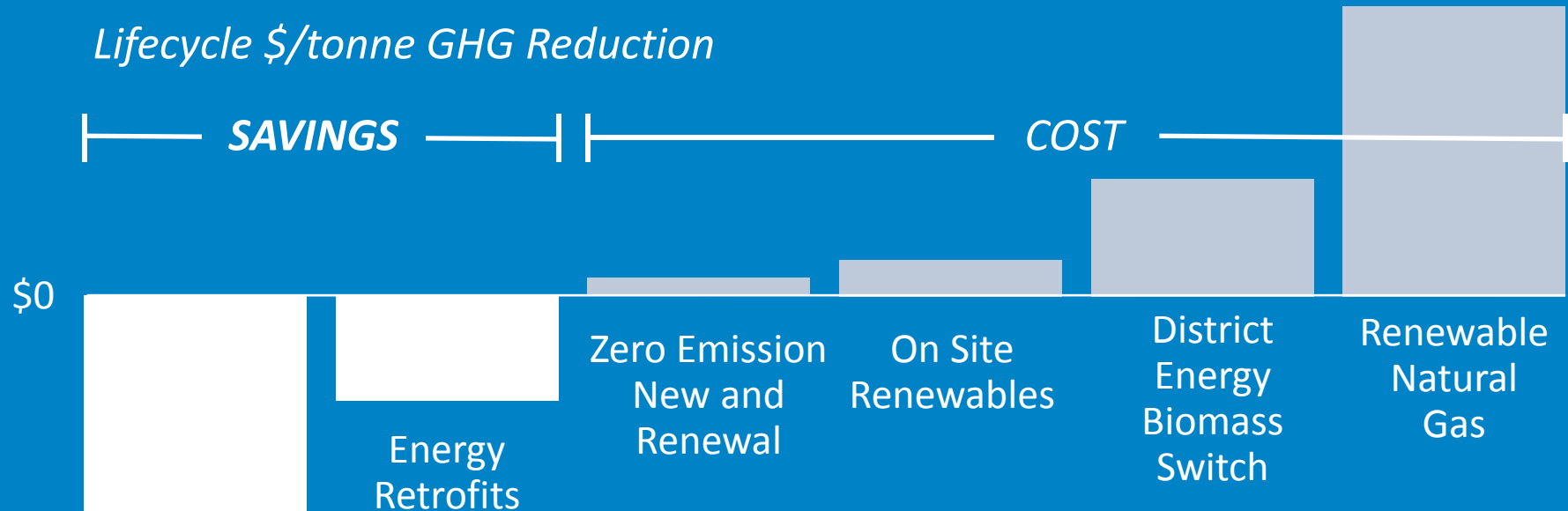
Pillar #	Eight Pillars	Potential GHG savings (%)
1	Zero Emission New	19%
2	Zero Emission Renewal	20%
3	Neighbourhood Renewable Energy Systems	37%
4	Energy Retrofits & Optimization	10%
5	Gas Conversion to High Efficiency Electric Heating	12%
6	Low Thermal Demand Retrofits	4%
7	On-site Renewables	6%
8	Renewable Natural Gas	11%
	<b>TOTAL</b>	<b>100%</b>

**Three major opportunities: achieve 3/4 of desired emission reduction target.**



# Life Cycle Costing

*Lifecycle \$/tonne GHG Reduction*



- ❑ \$16M in energy retrofit and optimization projects completed in last 10 years have resulted in \$2M/yr energy cost savings and 5,600 T/yr ghg reduction
- ❑ Future projects will be approved on a case-by-case basis, seeking **best value**.





# Eight Emission Reduction Pillars

# Pillar #1. Zero Emission New Construction

19%  
Contribution 

## Zero Emission Building Plan

- New City-owned projects to be certified to *Passive House standard* or alternative zero emission standard.
- Use *low carbon fuel* sources.
- Support *renewable educational* demonstration projects.
- Establish a zero emission requirement for new City-owned buildings *starting in 2018, well before city wide target date of 2030.*



*Belgium's golden Passive House library*



*801 Pacific*



*Water/Cordova  
Childcare on Parkade*



## Pillar #2. Zero Emission Renewal

20%  
Contribution 

~20 of 75 largest GHG emitting civic facilities will likely be renewed by 2040, based on capital development indicator

(residential buildings, firehalls, office buildings, pools and community centres)





## Pillar #3. Neighbourhood Renewable Energy Systems

37%  
Contribution



- Dozens of City-owned buildings located adjacent to existing and future district energy systems that could potentially be connected
- Neighbourhood energy systems assumed *100% renewable* by 2040
- Fuel sources:
  - Sewage heat recovery
  - Wood waste biomass
  - Renewable natural gas



## Pillar #4. Energy Retrofits & Optimization

10%  
Contribution 

- Capital upgrade projects - boiler replacements, HVAC upgrades, lighting, building control tune-ups.
- ~60 projects currently underway
- Greater GHG reduction contribution as further opportunities are identified.

*Example projects:*

### Kitsilano Community Centre

Waste heat recovery from the ice rink refrigeration plant, heat pumps replacing gas boilers

### Killarney Community Centre

- Upgraded water treatment, ice rink waste heat recovery
- Old boiler replacement, connection to new Seniors Centre



## Pillar #5. Gas Conversion to High Efficiency Electric Heating

12%  
Contribution 

- Conversion from gas to high efficiency electricity brings large GHG emission savings.
- Electricity is currently 98% renewable in Vancouver.
- High efficiency electric conversions :
  - GeoExchange heat pump systems
  - Air source heat pumps
  - Heat pump ambient loop systems
  - Variable Refrigerant flow systems
  - Waste heat recovery heat pump systems
  - Electric resistance heating



*City Hall building in 1946*

*Example project:*

### Main City Hall building

Replacement of boiler and chiller plant with air source heat pumps and variable refrigerant flow heat pump systems.

## Pillar #6. Low Thermal Demand Retrofits

4%  
Contribution 




- Deep building envelope performance refurbishments: walls, roof, windows, doors, floor
- Most appropriate buildings: heat load-dominated facilities: residential housing
- ~30 suitable civic housing facilities identified





# Pillar #7. On-Site Renewable Energy

6%  
Contribution 

Solar Photovoltaic	<ul style="list-style-type: none"><li>▪ Offset remaining emissions from electricity.</li><li>▪ Reduce electricity demand and cost. Solar PV electricity generation costs are decreasing over time.</li></ul>
Solar Thermal	<ul style="list-style-type: none"><li>▪ Offset natural gas use for space heating and domestic hot water</li></ul>

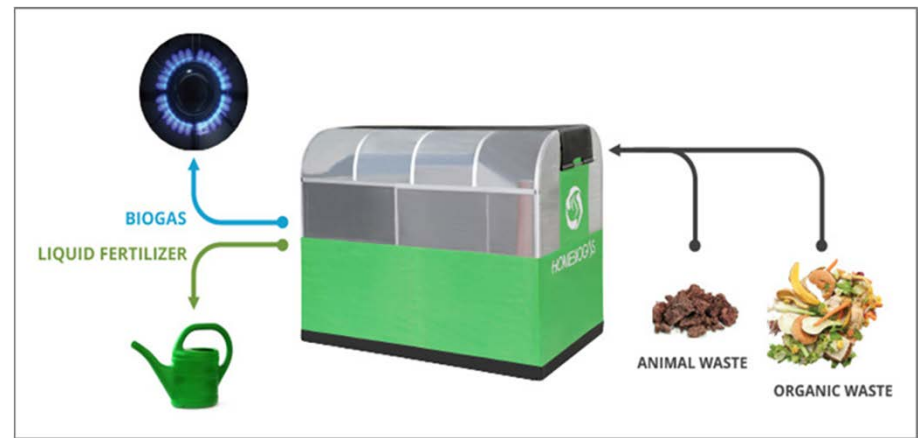





# Pillar #7. On-Site Renewable Energy

6% Contribution 

<b>Biomass</b>	<ul style="list-style-type: none"><li>▪ Combustion of wood waste is considered carbon neutral.</li><li>▪ Potential to integrate biomass boilers at city owned buildings with district energy systems.</li></ul>
<b>Anaerobic Digestion</b>	<ul style="list-style-type: none"><li>▪ On-site biogas production from high quality organic material.</li><li>▪ Locations with greatest potential:<ul style="list-style-type: none"><li>▪ Large organic waste production – Restaurants, multi family</li><li>▪ Near transfer stations</li></ul></li></ul>



## Pillar #8. Renewable Natural Gas

11%  
Contribution 

- Pipeline quality biomethane, based on upgraded biogas, supplied through existing natural gas infrastructure
- Considered 100% renewable, zero GHG emissions
- Higher cost than natural gas and limited availability
- Best long term use as renewable transportation fuel
- Use to achieve last step towards 100% renewable energy use in City-owned buildings:
  - Shift RNG purchases to facilities with greatest need as others are upgraded
  - Phase out RNG as more buildings are renewed/refurbished







# Renewable Energy Educational Demonstration

## Solar energy installations at City-owned buildings

### Solar Thermal:

- VanDusen Visitor Center
- Creekside Community Center
- Templeton Pool
- Athletes Village

### Solar PV:

- VanDusen Visitor Center
- Strathcona Community Garden Eco-Pavilion



*Creekside Community Centre: solar thermal*



*Athletes Village: solar thermal*



*Strathcona Community Garden Solar PV*



*VanDusen Visitor Centre Solar PV*



## Geo-exchange installations at City-owned buildings

### Geo-exchange Systems:

- VanDusen Visitor Center
- Sunset Community Center
- Mount Pleasant Center
- National Works Yard
- Rodden Lodge



*Mt. Pleasant  
Community Centre*



*National Works Yard*

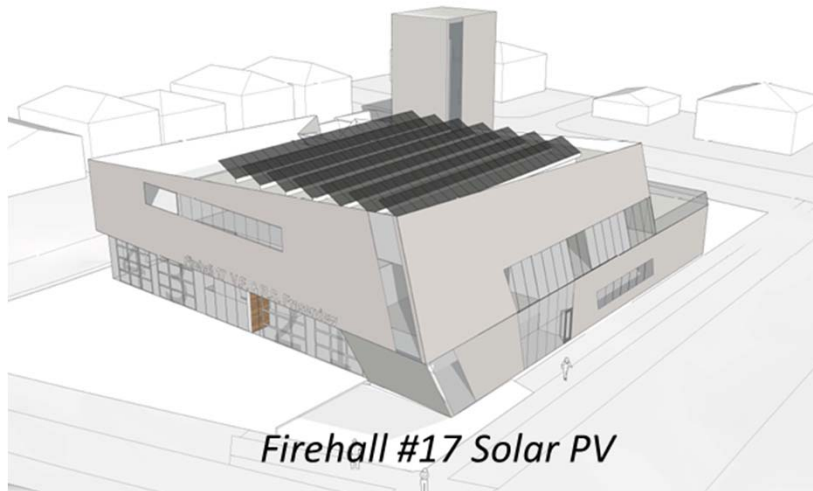


*VanDusen Visitor Centre*



## Clean Energy Canada Partnership

- Foundation funding for Solar PV systems on prominent public buildings
- Communications about how solar PV is a viable way to produce energy
- Signage and energy displays



## Public Art

### CityStudio SFU Sustainable Interactive Design Course

Project Goal:

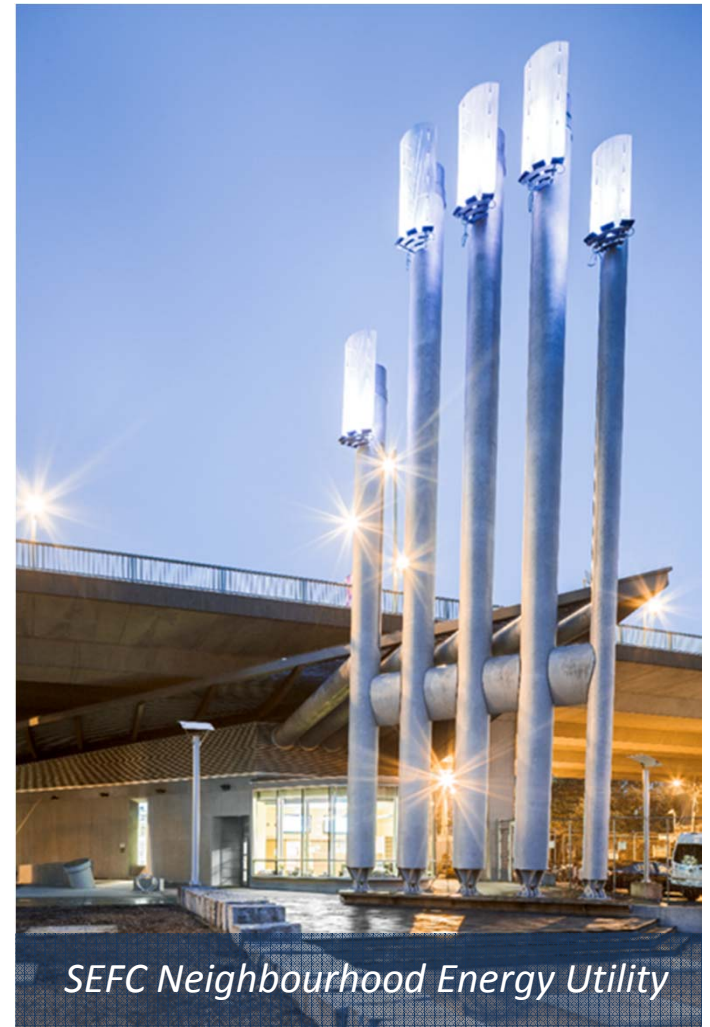
*Visually represent greenhouse gas emissions reduction in City-owned buildings*



*Van Dusen Visitor Center –  
Wall display changes colour  
based on solar pv generation*

## Communications Plan

- Integrating city owned building renewable energy demonstration into the broader **Renewable City Communication Plan**
  - New zero emission buildings:
    - Signage, branding, displays
    - Tours
    - Conference Presentations
  - Sharing best practice information with Zero Emissions Building Center of Excellence
  - Public art projects
  - Partnerships with universities and non profits
  - Public reporting on energy performance through Energy Star Portfolio Manager





## Renewable Energy Strategy for City Owned Buildings

- Show leadership by achieving 100% renewable energy use within city owned buildings.
- Achieve 100% renewable target with no net cost.
- Demonstrate cost effective zero emission and renewable energy strategies to the public

## Benefits

- Contribute to restoring our climate & environment.
- Catalyzing change and creating know-how and employment in local construction industry
- Reducing CoV operating costs
- Creating a more resilient city



THANK YOU

