Transforming Community Energy Systems

Deep Greening and Carbon Neutrality

Peter Garforth & Herbert Sinnock

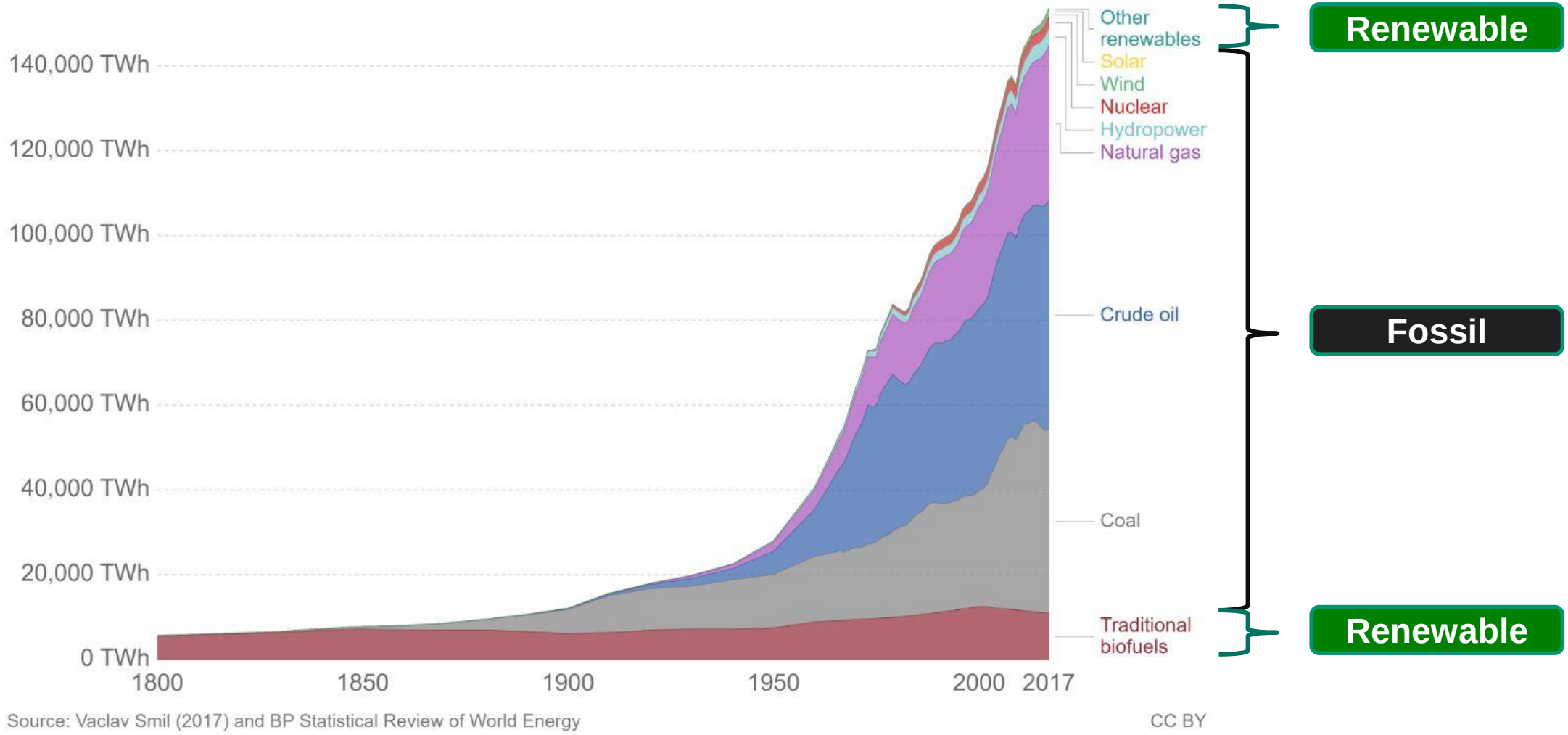
Pathway to Carbon Neutrality for Buildings and Communities
Ottawa, ON, February 26th, 2020

Garforth International llc
Energy Productivity Solutions

Community Energy & Climate Master Plans

Road Maps to Breakthrough Performance

Global Appetite for Energy
Cost ~ $16 Trillion



~ 80% of GHG Emissions

Confronting the False Dilemma
The New Climate Economy

- False Dilemma
  - *"Fighting climate change sacrifices economic growth and job creation"*
- Key Drivers of New Climate Economy
  - *Communities - Compact, Efficient & Resilient*
  - *Energy – Clean, Renewable & Affordable*
  - *Land-use change*
- Global Estimates to 2030
  - *$26 Tn growth opportunity*
  - *65 M jobs – many at community level*
  - *$2.8 Tn carbon revenues and subsidy savings*
  - *700,000 less premature deaths*

"We Can do Well by Doing Good"

Energy Productivity Differences
How well do we spend our $250 Bn energy dollars?

Region	Population	GDP	Energy	Energy/ Capita	Energy/ GDP
USA	4.3%	21.7%	15.4%	100	100
Canada	0.5%	2.3%	2.1%	120	124
EU	5.9%	19.9%	9.9%	47	69
Japan	1.7%	7.7%	3.1%	52	57
China	18.4%	12.7%	21.9%	33	243
India	17.8%	3.3%	6.3%	10	270
World	100%	100%	100%	28	140

National Competitiveness

Why Communities Care
New Energy Realities…

- Community values and image
- Investment and green jobs
- Energy affordability
- Supply quality and security
- Support climate goals
- Manage energy & climate risks

Community Competitiveness

Community Energy Plan Implementation
Typical Benefits

Competitiveness

1. Energy cost
2. Employment
3. Investment

Security

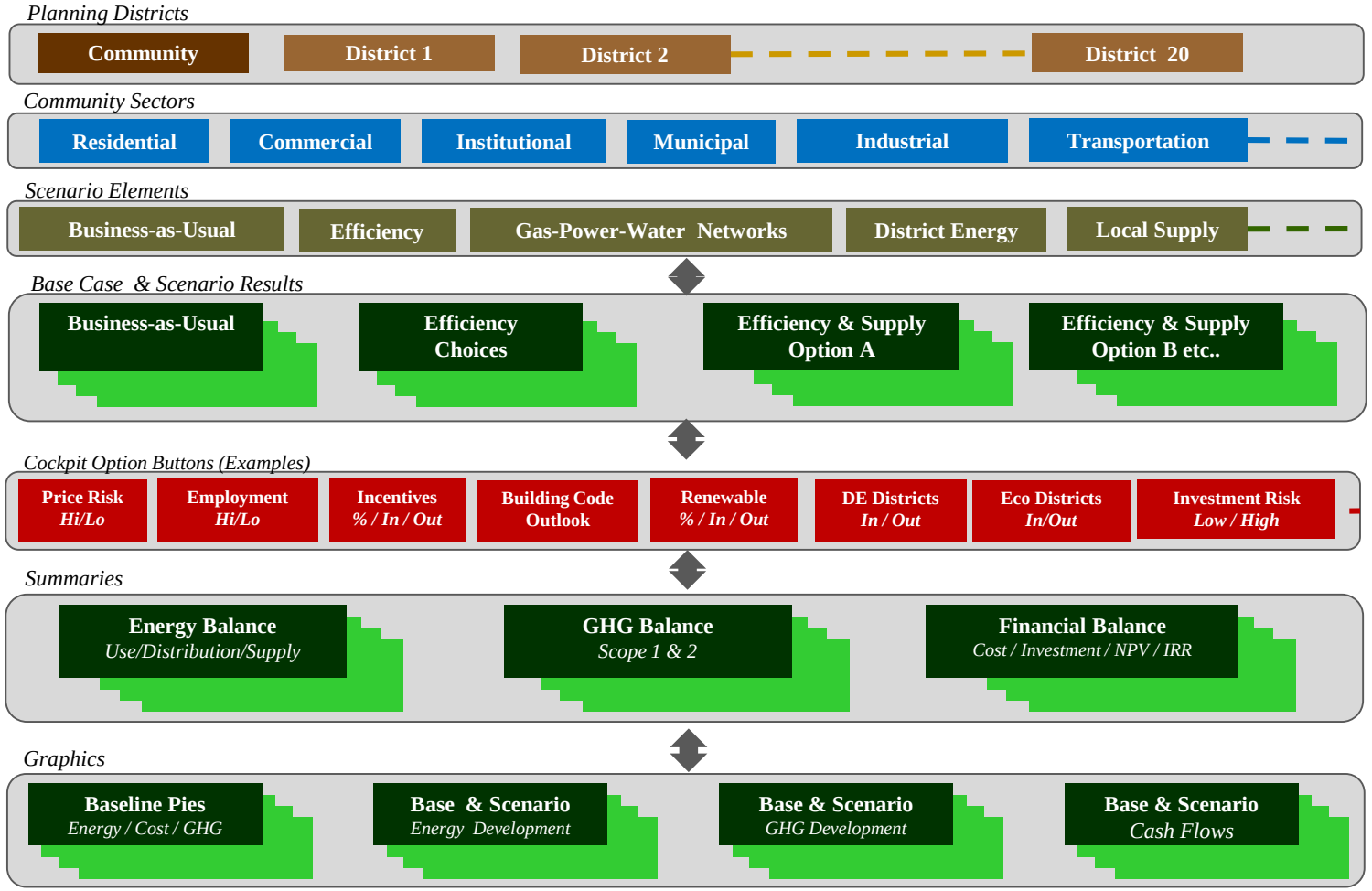
4. Supply security
5. Supply quality
6. Flexibility

Environment

7. Greenhouse Gas Reduction

Robust Planning Quantifies Benefits

Community Simulation
Integrated Data and Scenario Assessment Tools



Basis for Ongoing Detailed Design Plans

Community Simulation
Integrated Data and Scenario Assessment Tools

- ❑ Assemble data
- ❑ Integrate data
- ❑ Set targets
- ❑ Build scenarios
- ❑ Simulate scenarios & risks
- ❑ Select best-fit to targets
- ❑ Make recommendation
- ❑ Gain approval
- ❑ Implement consistently!

Basis for Ongoing Detailed Design Plans

Typical Community Energy Plan
Integrated Solution…not a Buffet!

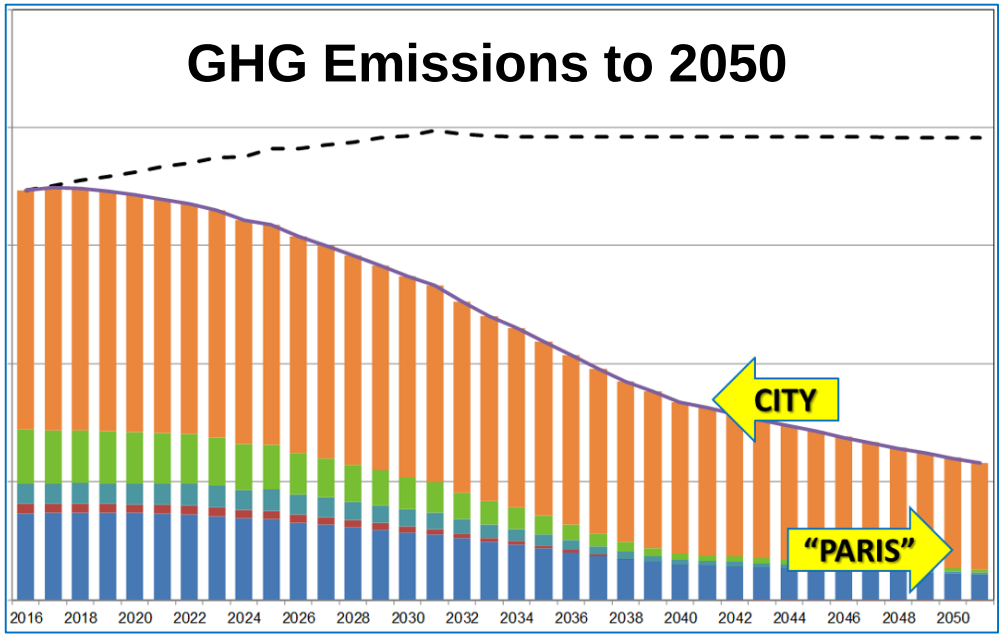
Retrofit Buildings

Retrofit Homes

Efficient Construction

Efficient Industry

Mixed Use Densification



Efficient Vehicles

Transport Mix

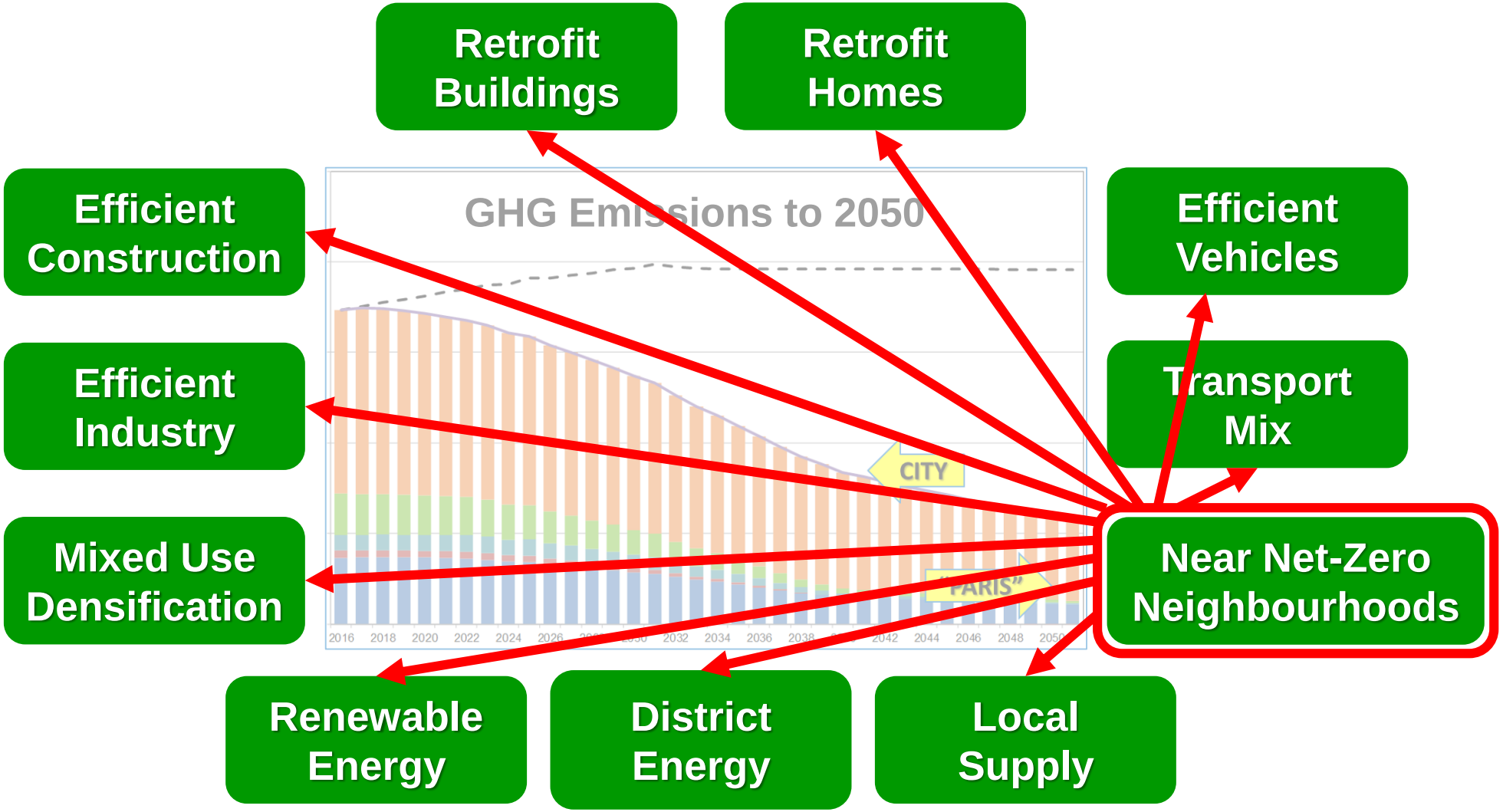
Near Net-Zero Neighbourhoods

Renewable Energy

District Energy

Local Supply

Neighbourhood is a Community As Well
Integrated Solution…not a Buffet!



Case Study: Net Zero Neighbourhood

“New Competitive Edges for Developers”

Host City Expectations (Example)
Principles to be Addressed by Energy Plan

- Protect What is Valuable
- Create Sustainable & Energy Efficient Infrastructure
- Establish a Multi-modal Pedestrian-focused Mobility System
- Create an Attractive & Memorable Place
- Promote Diversity of Land-Uses & Densities
- Grow Innovative Employment Opportunities
- “Work towards carbon-free”
- Be learning environment for other communities

Convert Guidance to Tangible Goals

Neighbourhood Energy Solution Goals
Performance Challenges

- Source Energy Efficiency: 50% higher than Code
- Potable Water Efficiency: 40% higher
- Greenhouse Gas Emissions: 80% lower than Code
- Internal Rate of Return: >10% on incremental investment
- Global best practice technology
- Configured for Community Engagement & Outreach
- Expandable to wider community
- Marketable benefits for Developer

Feasible to Meet All Goals

Neighbourhood Development
Overview

Confidential Site Plan

- Scale
  - *Residents ~ 4,000*
  - *Employment ~ 2,000*
- Completion Phasing
  - *5 Phases*
  - *7 years*
- Energy Archetypes Modeled
  - *Single Family Homes*
  - *Town Homes*
  - *Stacked Town Homes Block*
  - *Mid Rise*
  - *Mixed Use*
  - *High Rise*
  - *Office*
- Energy Models
  - *Code & Efficient Case*
  - *Heating, cooling, equipment, ventilation, pumps, lighting &c, hot water*
  - *Incremental investment above code*

Near Net Zero Neighbourhood
Overview of Integrated Energy Solution

Buildings

- Enhanced Control
- Envelope Efficiency – Insulation & Windows
- Radiant Heating
- High Efficiency Chillers
- Solar PV
- District Energy Transfer Stations

District Energy Distribution

- Medium Temperature District Heating – All Buildings
- District Cooling – Selected Buildings

Energy Centre

Natural Gas Boilers
Combined Heat Power Generators
Electric Chillers
Absorption Chillers
Thermal Storage (heating and cooling)

Indicative Recommendation
Energy Efficient Buildings

- Archetype Energy Models
  - *Reference Case : Fully Compliant Local Code*
  - *Efficient Case: ~ German A+ rated*
- Efficiency Measures
  - *Added wall insulation*
  - *Triple Glazing*
  - *Reduced air changes*
  - *LED lighting with addressability, occupancy and daylight controls*
  - *Residential smart thermostats and TRVs*
  - *Hydronic heating with radiator and underfloor distribution*
  - *Low-flow toilets & shower heads*
  - *Commercial: Dedicated Outside Air System*
  - *Commercial: demand control ventilation for all areas*
- Building Supply
  - *Network energy transfer stations for heating, hot water, and some cooling*
  - *Higher efficiency chillers*

Enhance High Standard Local Code

IEMP Recommendation
Heating & Hot Water Distribution

- Site-wide modern district heating network
- Global (EN) standards
  - *Pre-insulated pipes & accessories*
  - *Design & Installation methods*
  - *Warranties*
- Expandable to neighbouring areas
- Low temperature with low losses
- Expandable to neighbouring areas
- Simple installation – Predictable costs
- Multiple global suppliers
- Limited North American Experience

Proven Long-Term Performance

IEMP Recommendation
Heating & Hot Water Connection

- Prefabricated energy transfer stations
- Global (EN) standards
- All functions
  - *Heating & DHW transfer*
  - *Pumps, valves and meters*
  - *Cooling for selected buildings*
- Multiple global suppliers
- Simple installation
- Predictable costs
- Local fabrication opportunity
- Limited North American Experience

Small Space – Minimal Maintenance

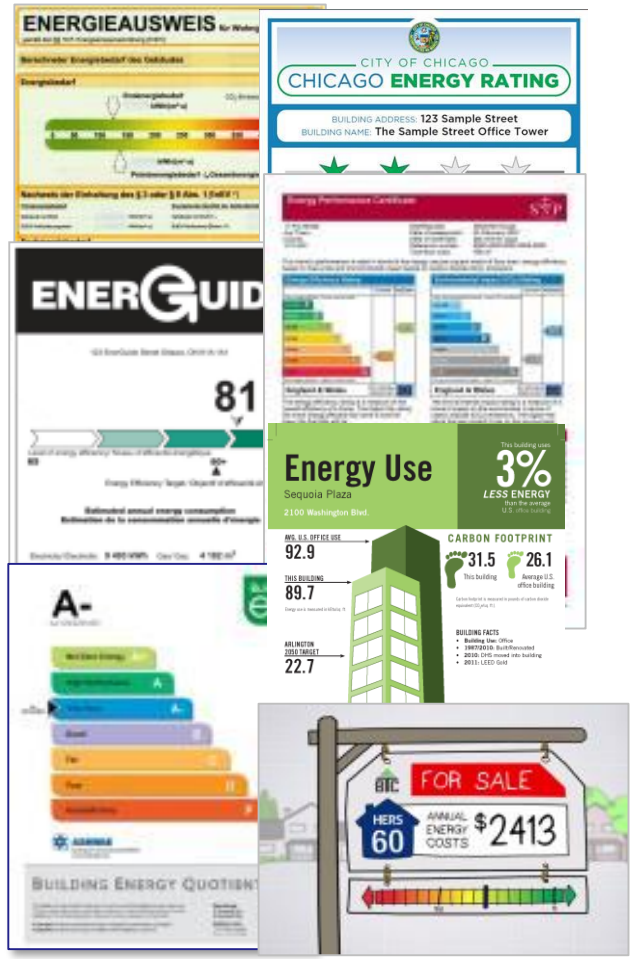
Indicative Recommendation
Thermal Distribution

IEMP Recommendation
Shared Energy Supply Elements

- Heat Supply
  - *2 x 5.5 MW gas boilers sized for base, shoulder and peak heat demands*
  - *Combined Heat & Power : 2 x 1.5 MW_{el} sized for base load heat*
  - *Future options: Biomass; solar thermal; electric boilers….*
- Cooling
  - *2.5 MW Electric Chiller*
  - *1.5 MW Absorption Chiller*
- Thermal Storage
  - *Heat 150 m3 / Cold 100 m3*
- Cooling (All other Blocks)
  - *Chillers sized for buildings*
- Solar Photovoltaic
  - *2.3 MW rooftop*

Flexible Supply Portfolio

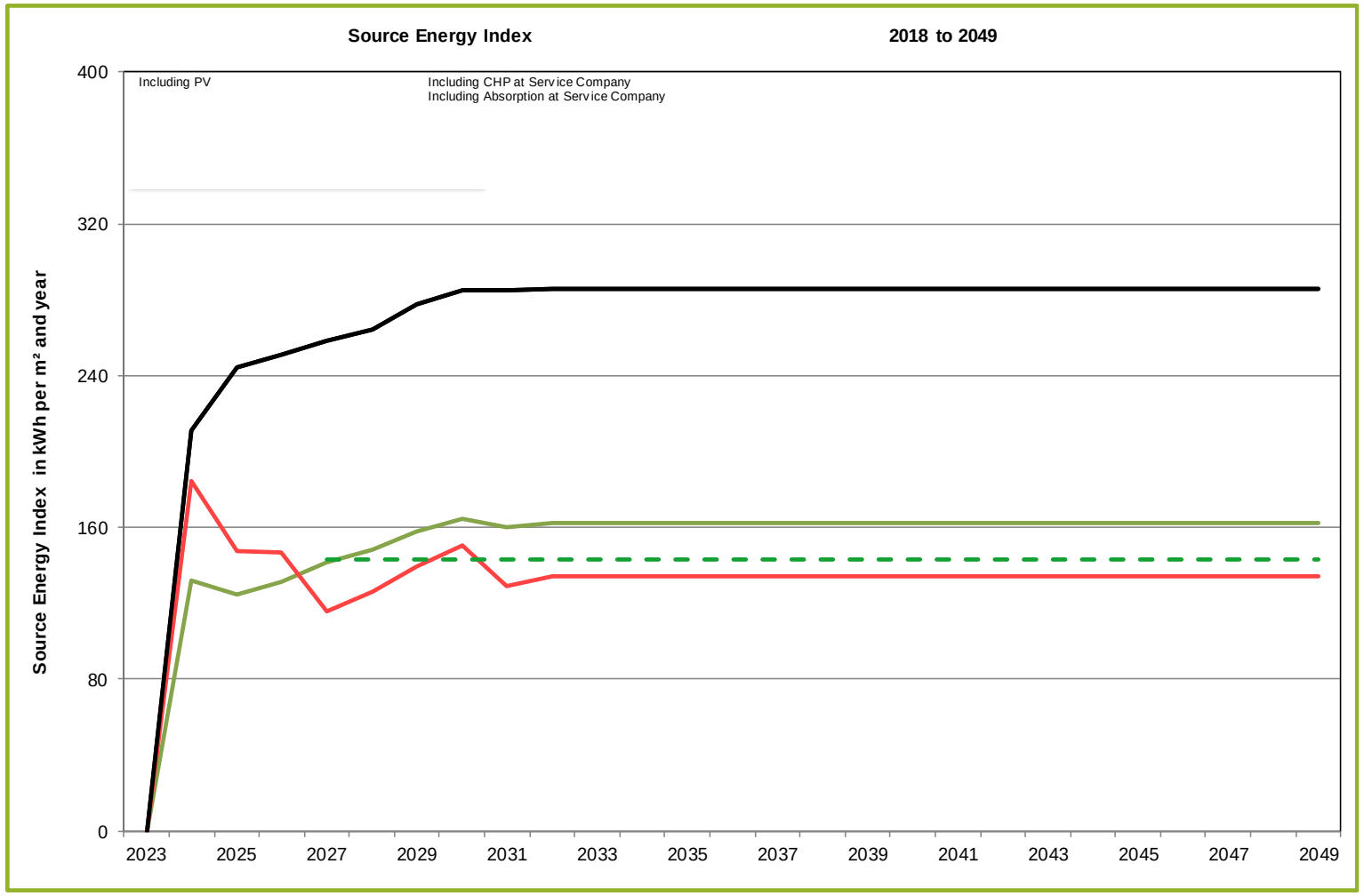
IEMP Recommendation
Energy Performance Labels



- Developer offers EPLs when sold/rented
- Performance guarantee in normal operation with rectification conditions
- Format: Probably some adaptation of recognized global norm
- Real estate marketing tool
- Potential team with mortgage lender
- EPL the norm of future rentals or sales

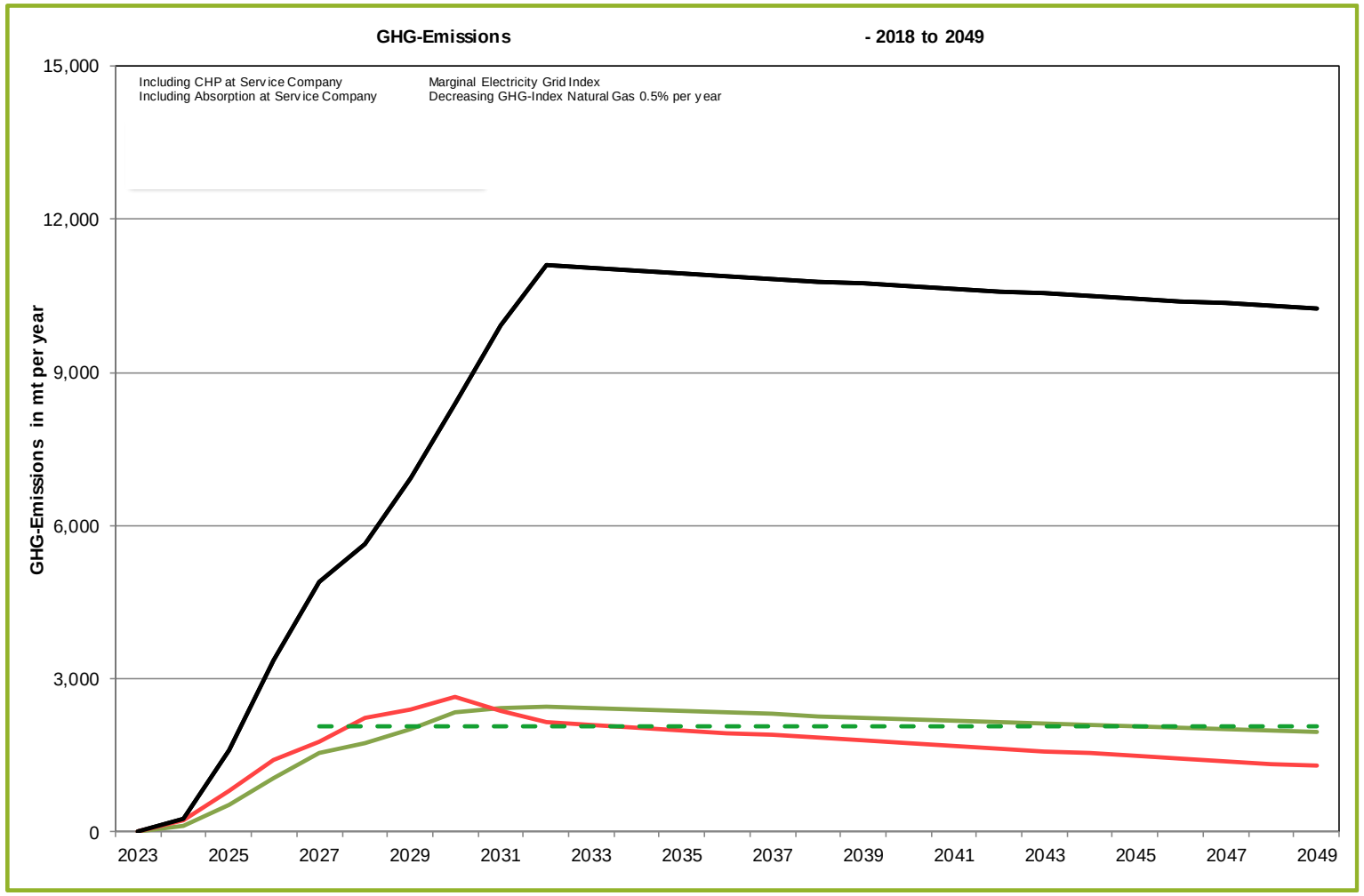
Embed Energy Performance in Property Value

IEMP Recommendation Results
Source Energy Efficiency



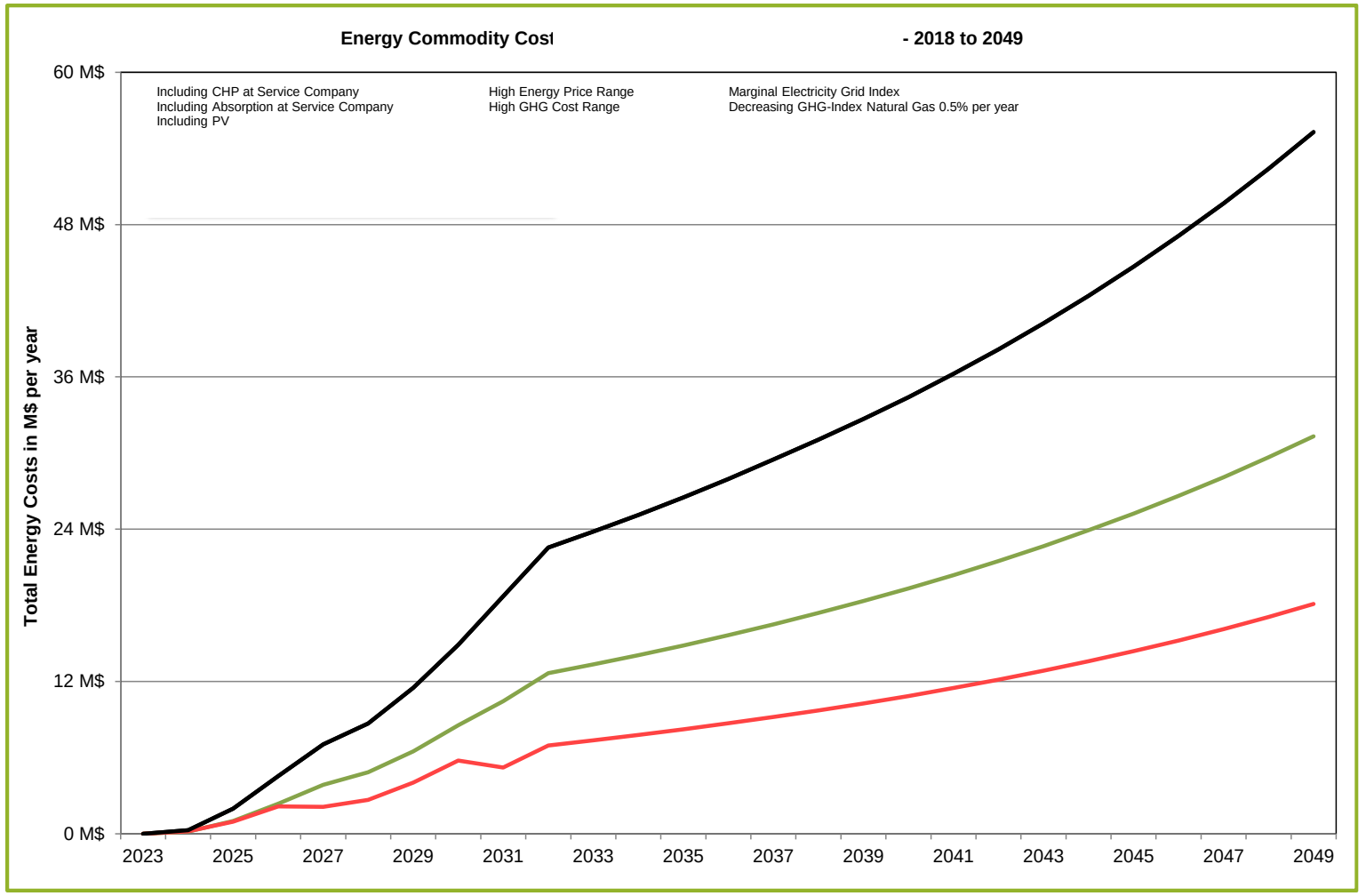
Exceeds Host City Targets

IEMP Recommendation Results
Greenhouse Gas Emissions



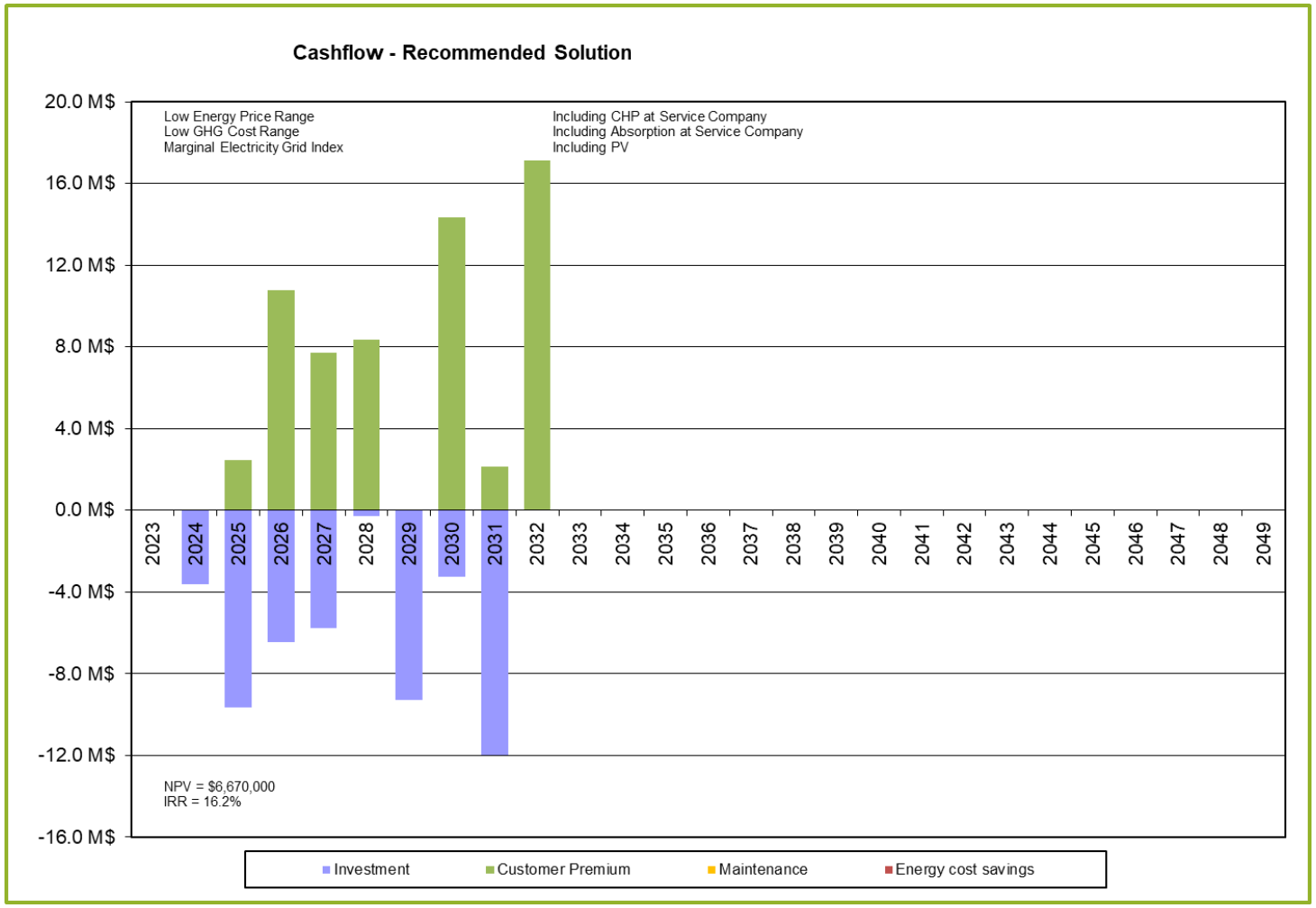
Exceeds Host City and "Paris" Targets

IEMP Recommendation Results
Consumer Costs – Price Outlook II



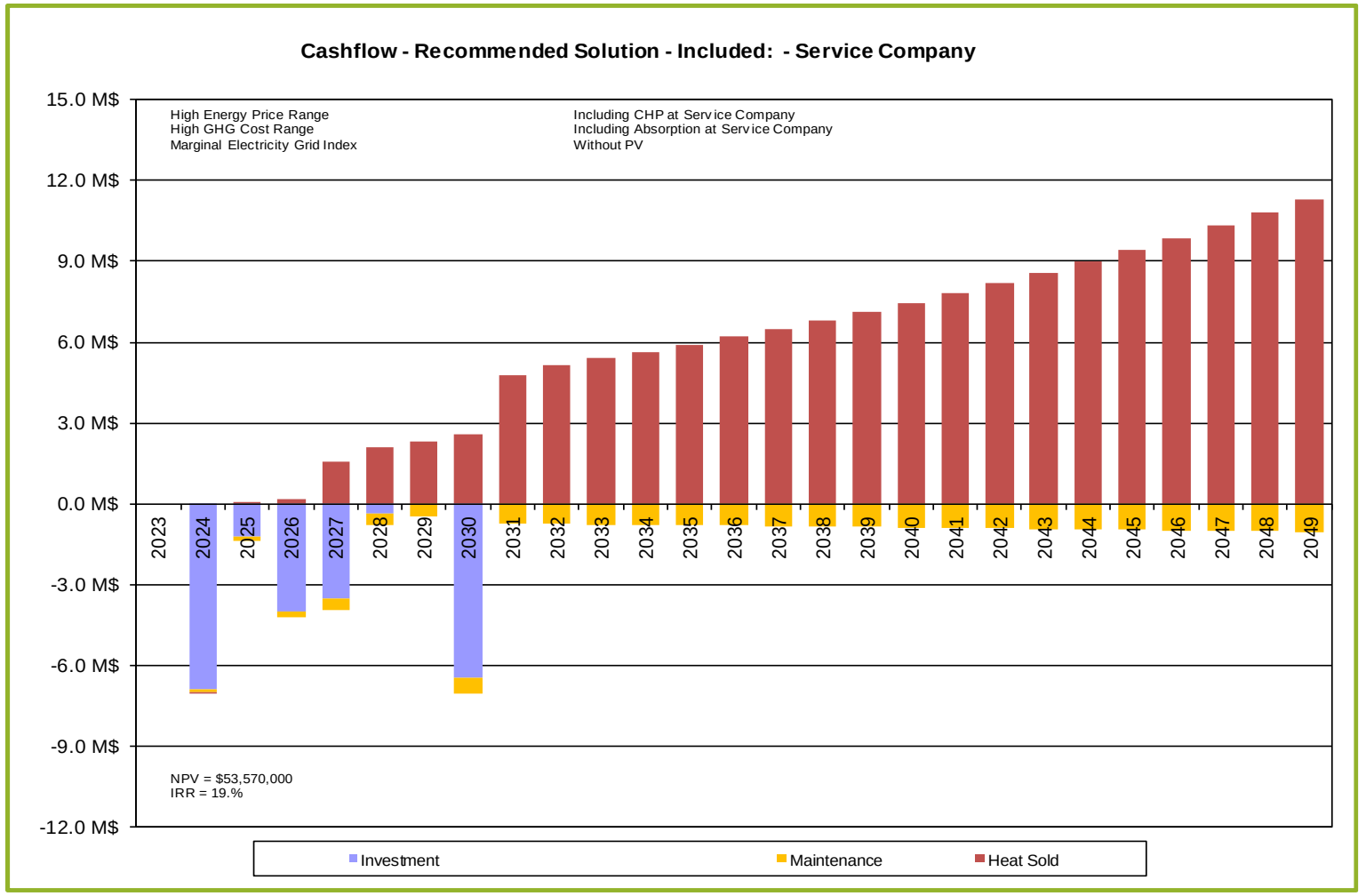
Cumulative Saving of $ 341M

IEMP Recommendation Results
Developer Incremental Cash Flow



IRR 16.2% / NPV $6.7M

IEMP Recommendation Results
Thermal Services Cash Flow – Price Outlook II



IRR 19% / NPV $53.5 M

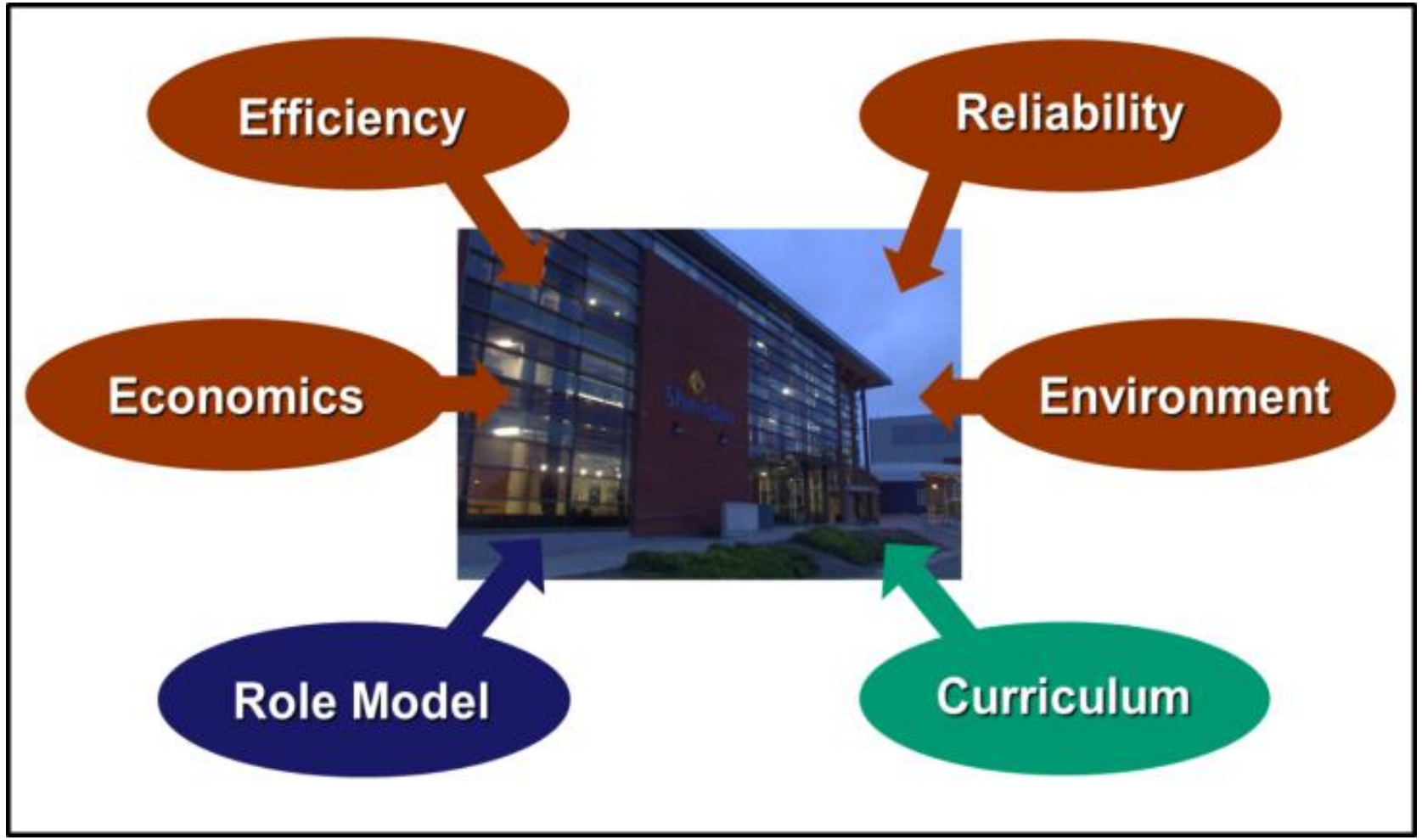
Recommended Solution
Conclusions

- Delivers a more attractive housing product
- Meets reasonable financial goals
- Meet Host City and “Paris” Climate Goals
- Proven global best practice with minimal technical risks
- Effective neighbourhood prototype
- Platform for local economic development
- Platform for wider community engagement and outreach

Case Study: Local College Catalyzing Community Action

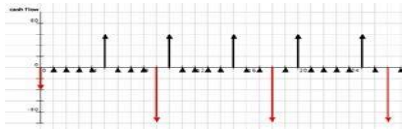
"Tail Wags the Dog ….Dog Wags the Tail"

Sheridan College
Integrated Energy and Climate Master Plan



Institutional & Operational Goals

Sheridan IECMP
Breakthrough Planning Goals



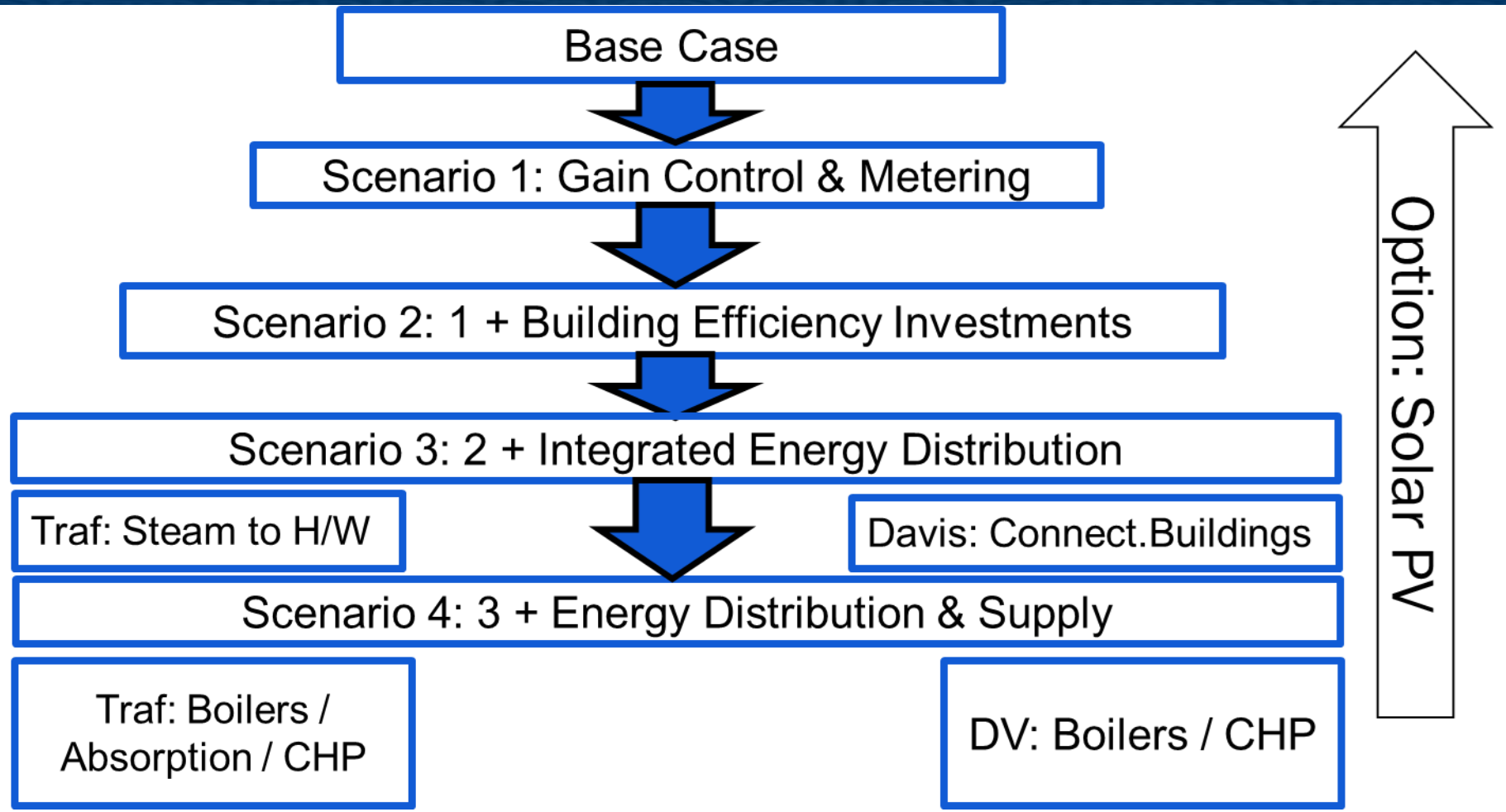
7% Internal Rate of Return

40% Reduction in
Carbon Emissions

50% Reduction in Source
Energy Consumption

2030 Goals set in 2013

Sheridan - One College – Three Campuses
One Integrated Energy Portfolio



Global Best-Practice Standards for New Buildings
At Least German A-Rated Efficiency

Best-Practice District Energy
Full integration – Global Norms

District Energy to World Standards
Technology – Cost - Installation

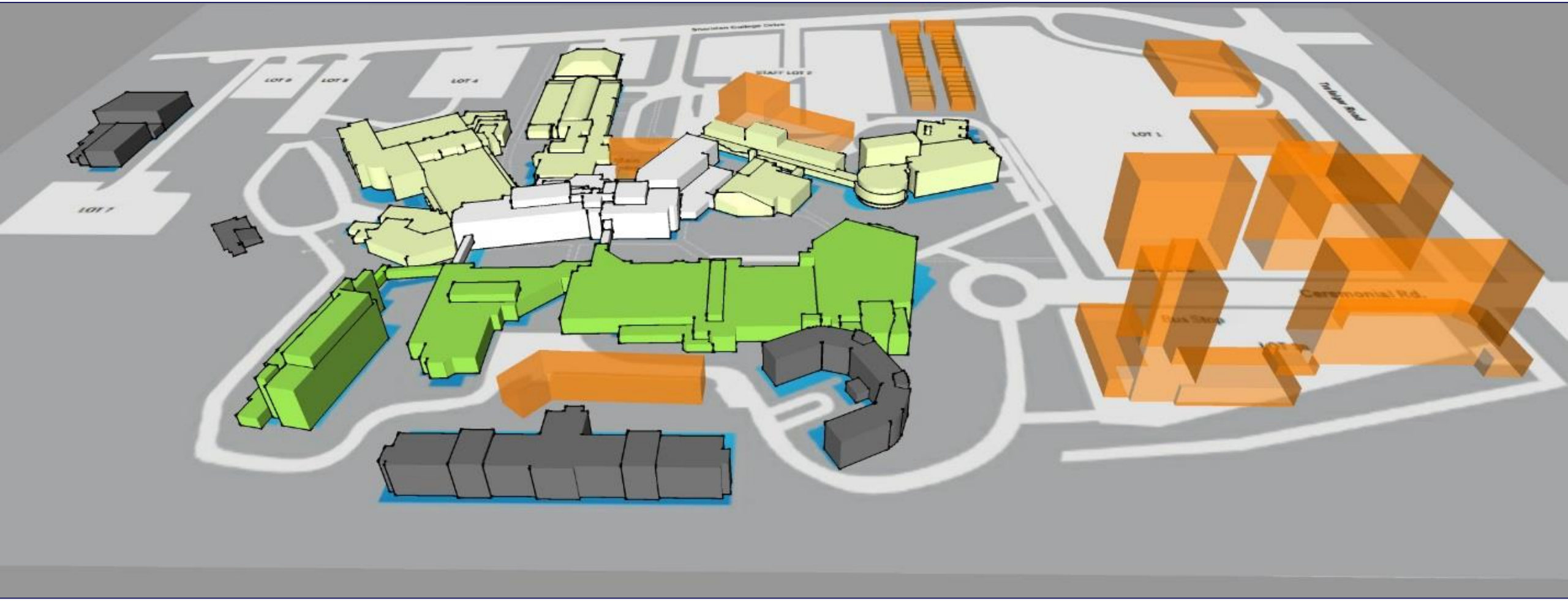
District Energy to World Standards
Technology – Cost - Installation

District Energy to World Standards
Technology – Cost - Installation

Energy Centre
Classroom and Campus Landmark

Community Exemplar

Neighbourhood Growth

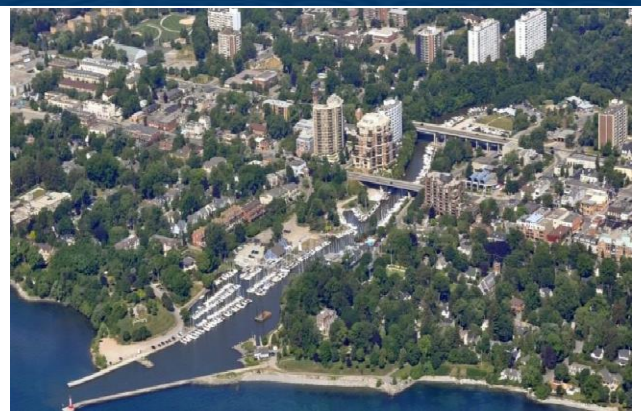


Design Energy Solution for Expansion

Can the tail wag the dog?

How do we start the conversation in our communities?

Starting the Community Energy Conversation



- Initial Limited Scope
  - *Can this be viable without Community context?*
  - *Can College be a planning example for host communities?*
- Community Energy Plan ✓

Community Energy Plan
Goals

- Support “Brampton 2040 Vision”
- Environment – Support Federal Climate Goals
  - *Cut GHG emissions by 50% by 2041*
  - *Be on track to cut GHG by 80% from 1990 levels*
- Economic – Positive Economic Development
  - *Energy investments meet acceptable risk-adjusted returns*
  - *Energy costs will be competitive compared to comparable Canadian and US communities*
  - *Generate incremental high-quality employment*
- Energy Efficiency – Global Best Practice
  - *50% below 2016 level by 2041*
- Energy Reliability / Resilience / Flexibility
  - *Energy systems will meet the challenges of changing user expectations, climate uncertainty and new technologies*

Competitive Community

Brampton Simulation – Aggressive Case
GHG Emissions by Scenario

But now the dog begins to wag the tail …

Sheridan needs to take its strategic energy and carbon planning to the next level

Thank You

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Peter Garforth
Introduction

Peter Garforth, runs a specialist consultancy company, Garforth International llc, based in Toledo, Ohio, and Brussels, Belgium. The company, advises major companies; cities, communities, property developers and policy makers on developing competitive approaches that reduce the economic and environmental impact of energy use.

Mr. Peter Garforth, has a long and diverse background in business development and general management around the world. His extensive knowledge of the global energy environment; past, present, and future, will ensure that any recommended investment approach has a sound business basis and reflects the larger movements in the energy market.

In his career he has been responsible for developing major businesses in major global corporations including Honeywell, Landis & Gyr (Siemens) and Owens Corning. He is well connected in the energy productivity business and regulatory community around the world. He has extensive knowledge of global best practice in energy efficient performance, construction, and greenhouse gas mitigation.

Peter Garforth

Herb Sinnock
Introduction

Herbert has over 20 years' experience in the energy sector in commercial/industrial energy assessment, project management, teaching, and product development. Herb is a Certified Energy Manager, Certified Measurement & Verification Professional and LEED Green Associate. He holds US Patent 6,925,361 for the Distributed Energy Neural Network Integration System.

As Director – Sustainability for Sheridan College in Oakville, Ontario, Herb is responsible for all aspects of corporate sustainability vision, strategy and culture, including implementation of Mission Zero, the institution's ambitious plan to reduce energy consumption, waste to landfill and greenhouse gas emissions. Prior to joining Sheridan College, he was Manager of the Centennial Energy Institute at Centennial College in Scarborough, Ontario.

Prior to joining Sheridan, he was Manager of the Centennial Energy Institute at Centennial College in Scarborough, Ontario, co-founder of Orion Engineering Inc., and Energy Project Engineer for Aspen Systems, Inc. (Marlborough, MA).

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