ECONOMICS OF DISTRICT ENERGY FOR HVAC IN MULTI-FAMILY HOUSING – AN ECONOMIC EXPOSE

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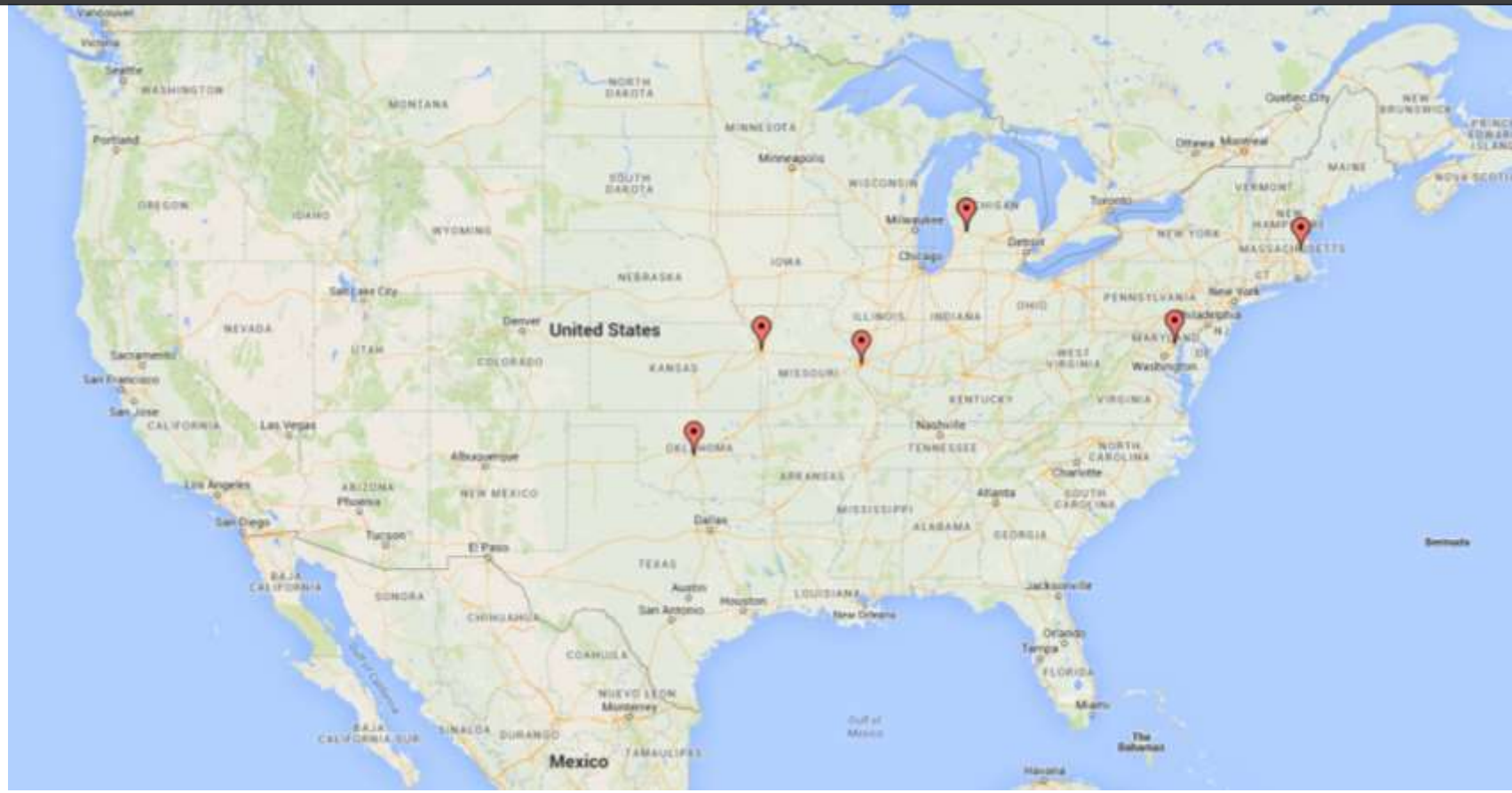
INTRODUCTION

An analysis was undertaken to evaluate the competitiveness of district energy compared to a variety of other competitive approaches.

CITIES MODELED WHICH INCLUDE DISTRICT ENERGY SYSTEMS

- Baltimore, MD
- Boston/Cambridge, MA
- Grand Rapids, MI
- Kansas City, MO
- St. Louis, MO
- Oklahoma City, OK



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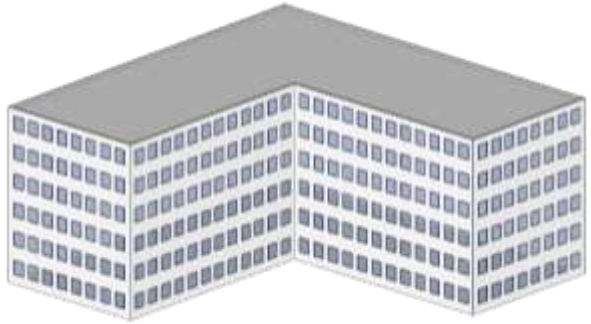
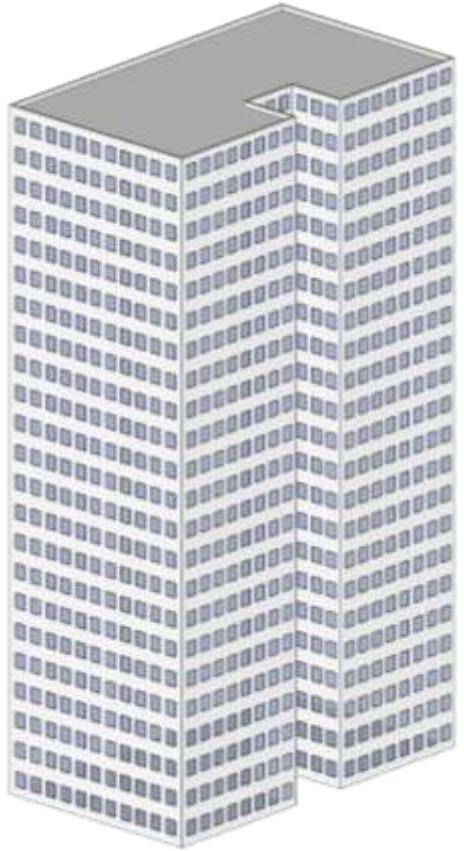
PROTOTYPICAL MODELED BUILDINGS

30 Unit



100 Unit



300 Unit

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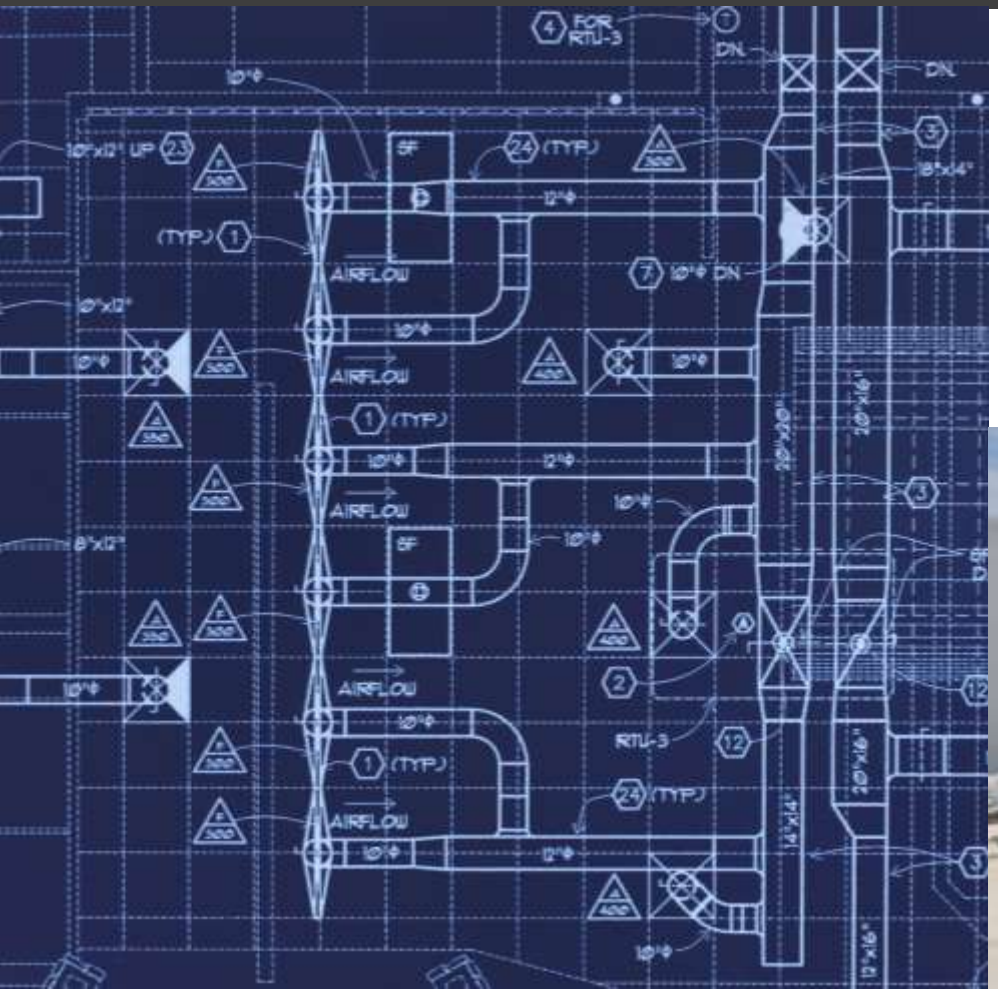
HVAC SYSTEMS MODELED



- Base Case
  - Split System DX / gas furnace (30)
  - Through-wall packaged electric (100 & 300)
- 4-Pipe Fan Coil with Local Boiler & Chiller (Building Self-Performed)
- Boiler-Tower heat pump
- Variable Refrigerant Flow
- District Energy with 4-Pipe Fan Coils

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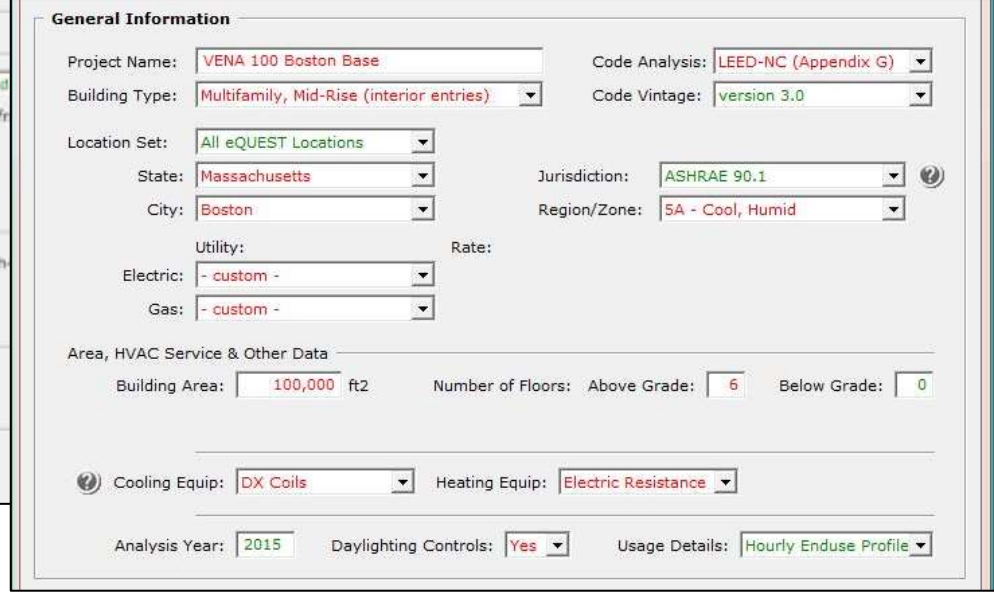

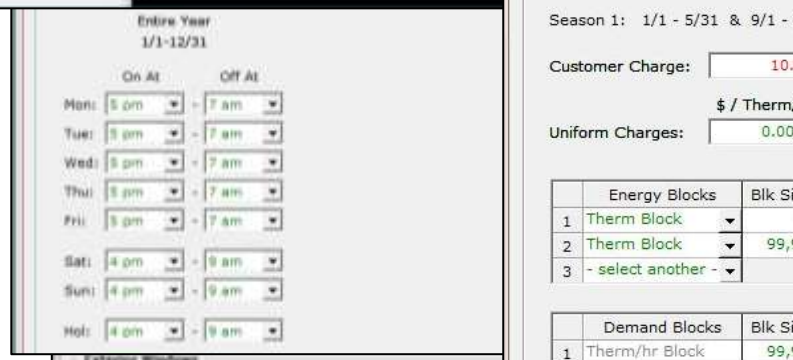

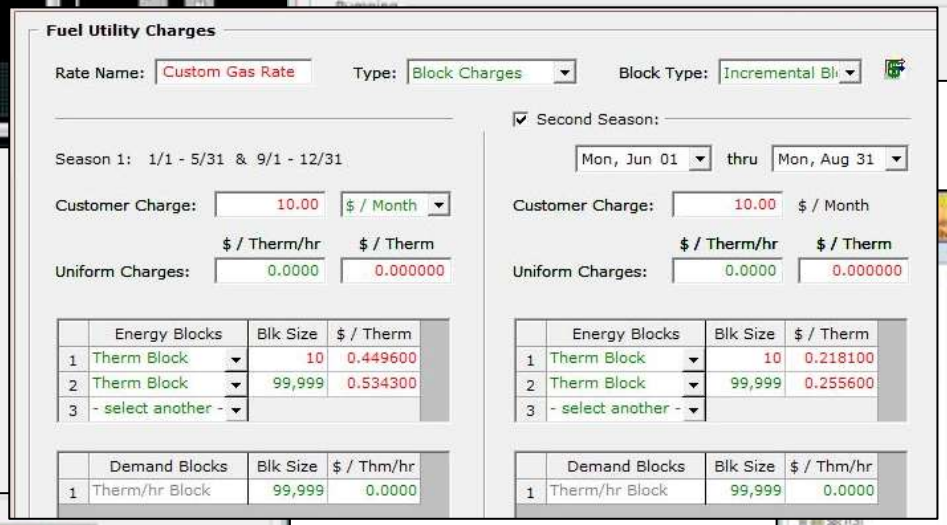

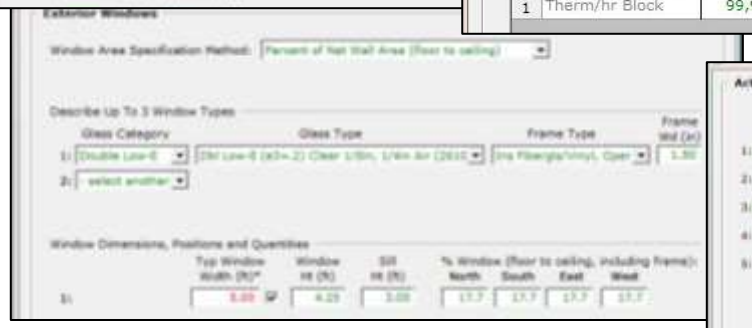

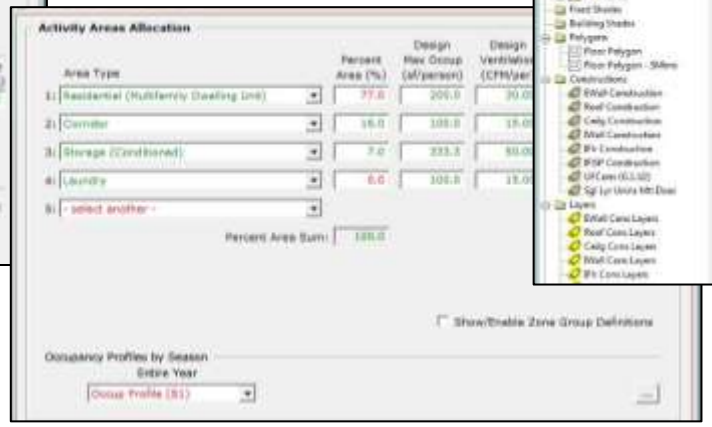

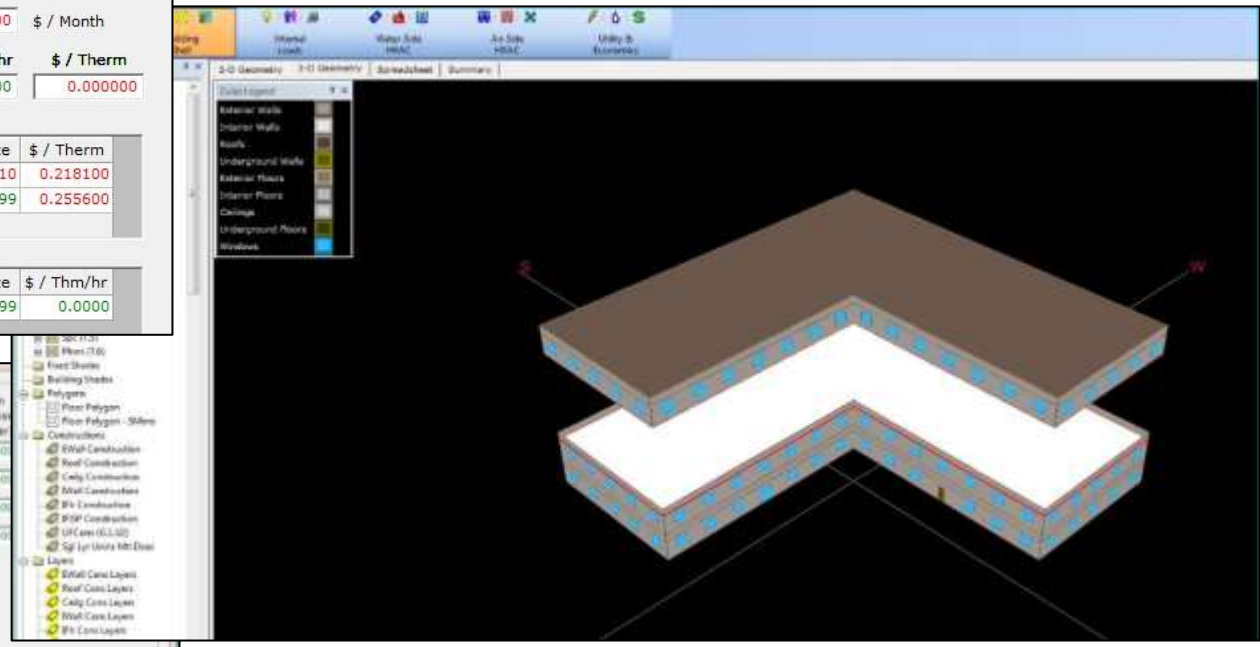

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ANNUAL UTILITY COSTS

		Base Case					
City	**No. of Residential Units**	**Split System, DX clg, gas heat**	**Self-contained (packaged)**	**4-pipe fan coil (4P FC) local**	**Heat Pump (WSHP) local**	**Variable Refrigerant Flow (ASHP)**	**4-pipe fan coil (4P FC) district**
Boston, MA	30	$29,646		$32,175	$39,317	$39,125	$40,952
	100		$180,402	$132,363	$133,013	$135,253	$141,179
	300		$525,619	$359,051	$407,748	$408,776	$429,973
Grand Rapids, MI	30	$26,823		$28,681	$33,611	$36,416	$36,573
	100		$159,200	$114,703	$114,485	$125,956	$125,692
	300		$467,598	$316,990	$353,078	$380,440	$376,694
Baltimore, MD	30	$29,702		$31,261	$34,816	$30,856	$39,631
	100		$130,965	$122,887	$118,158	$106,649	$125,333
	300		$389,906	$335,317	$358,709	$325,809	$360,153

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CONTRIBUTING FACTORS

- Factors considered beyond utility cost
  - System first cost
  - Regional cost adjustments
  - Equipment replacement schedule
    - Based on published estimates of equipment life
  - Maintenance costs
    - Based on published estimates for each system

20 YEAR LIFE CYCLE COSTS

		Base Case					
City	**No. of Residential Units**	**Split System, DX clg, gas heat**	**Self-contained (packaged)**	**4-pipe fan coil (4P FC) local**	**Heat Pump (WSHP) local**	**Variable Refrigerant Flow (ASHP)**	**4-pipe fan coil (4P FC) district**
Boston, MA	30	$2,054,301		$2,064,773	$2,065,533	$2,109,496	$2,160,518
	100		$7,281,495	$5,158,073	$4,569,074	$4,978,822	$5,144,704
	300		$19,580,856	$12,508,625	$11,935,766	$13,148,069	$13,733,052
Grand Rapids, MI	30	$1,772,263		$1,908,534	$1,892,029	$2,001,995	$2,009,417
	100		$6,363,982	$4,524,624	$4,044,255	$4,613,664	$4,618,292
	300		$16,970,985	$10,914,447	$10,412,401	$12,041,229	$11,979,653
Baltimore, MD	30	$1,846,811		$1,976,021	$1,923,466	$1,860,872	$2,088,460
	100		$5,651,609	$4,737,989	$4,139,298	$4,123,489	$4,612,211
	300		$15,013,010	$11,395,370	$10,559,240	$10,654,746	$11,566,388

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INITIAL AND LIFE CYCLE COSTS

Cost discussion

District Energy shows economic advantage:

- In northern climates
- Where utility rates are high
- In larger buildings
- Broad conclusions are difficult when considering total life-cycle costs

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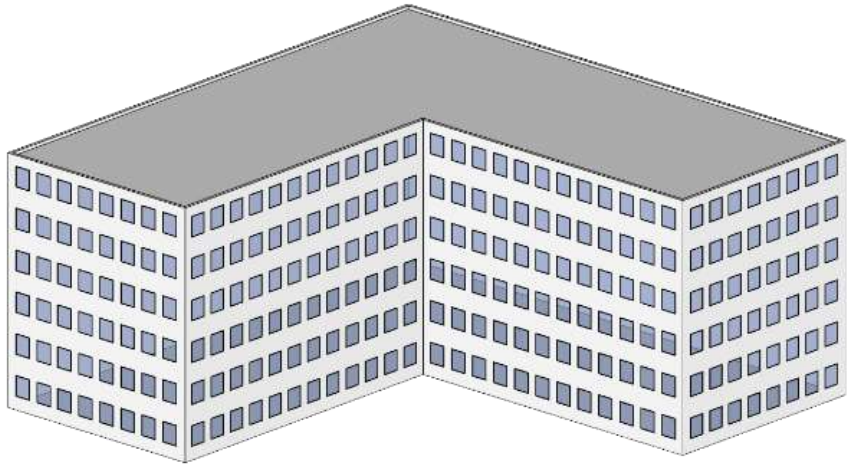
BASIS OF DISCUSSION

Closer look:

- Boston, MA
  - Representative of:
    - Steam heating distribution
    - Chilled water distribution
  - 100 unit building



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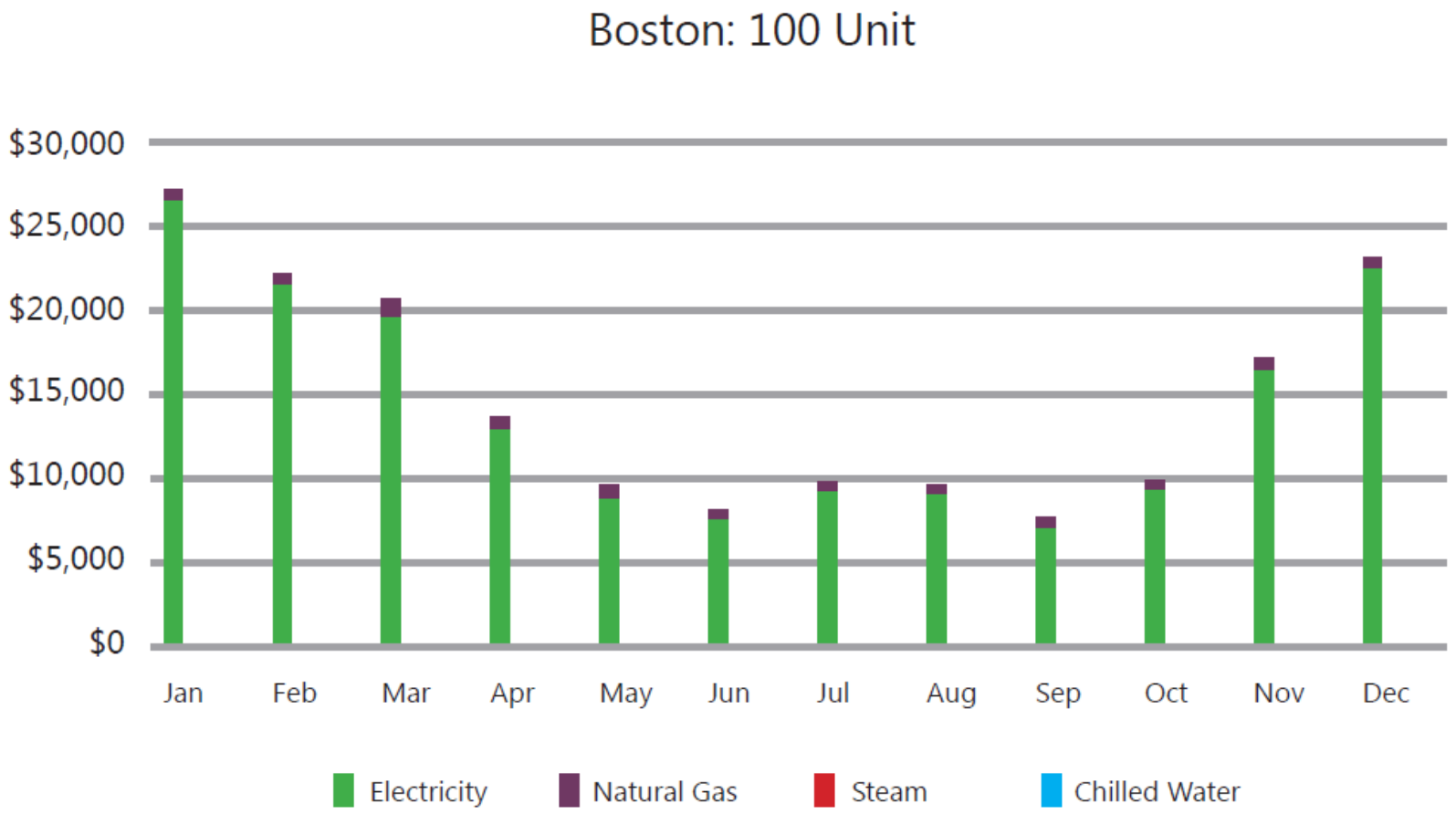
ANNUAL UTILITY COSTS



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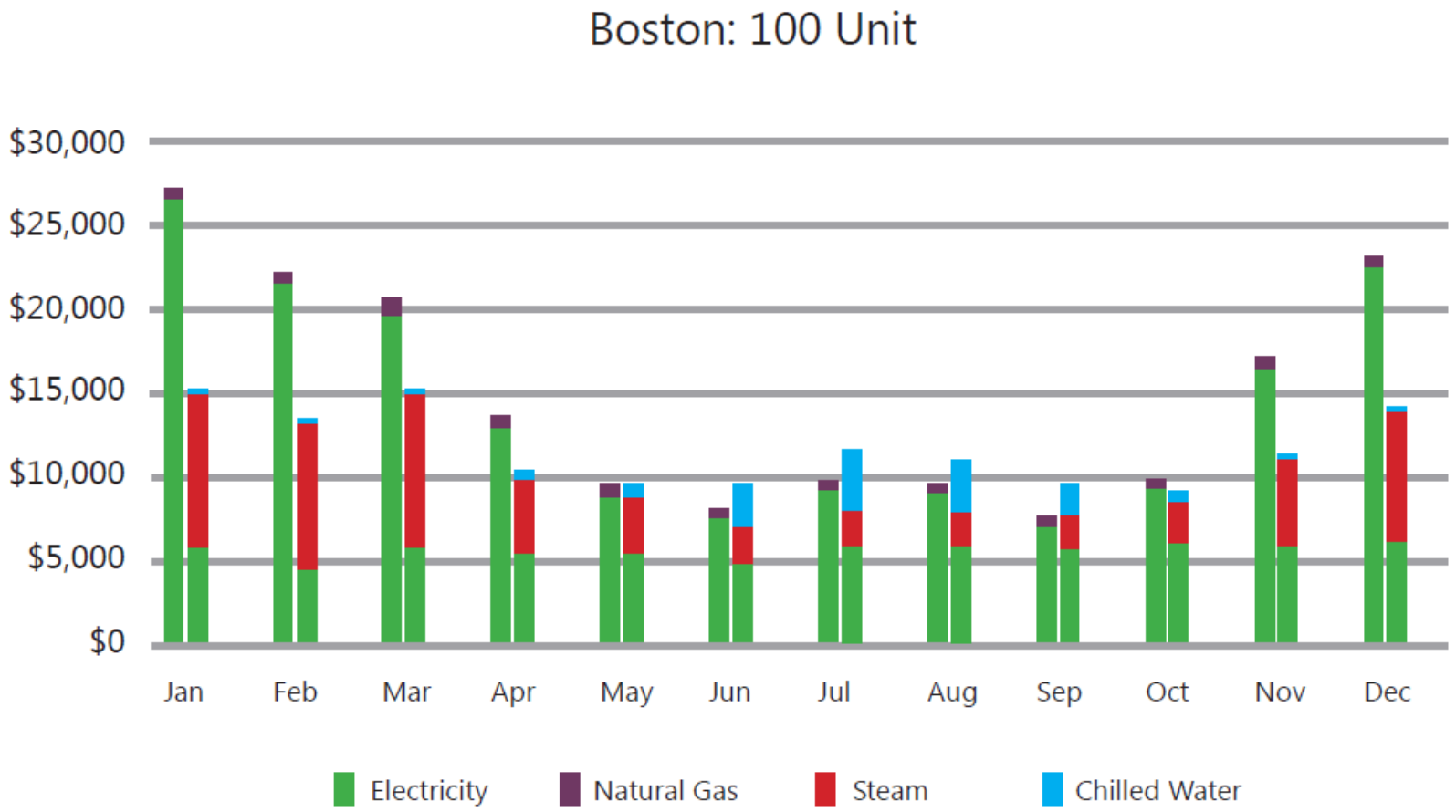
ANNUAL UTILITY COSTS



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DEVELOPER'S PERSPECTIVE

- The developer's time frame can dictate greater concern toward 1st cost than life cycle costs
- Can be insulated from D-E benefits by engineer/contractors
- The Building O&M labor cost for self-perform cases tend to be minimized by developers
- Long term financing options can include some capital costs

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DISTRICT ENERGY STRATEGIES

- Win, win situations can be achieved by extending distribution to other potential customers or to increase system reliability
- Leverage sustainability opportunities that include DHW preheat, snowmelt, rooftop greenhouses
- Municipal WW boiler makeup in Grand Rapids
- Condensing economizers improve plant efficiency

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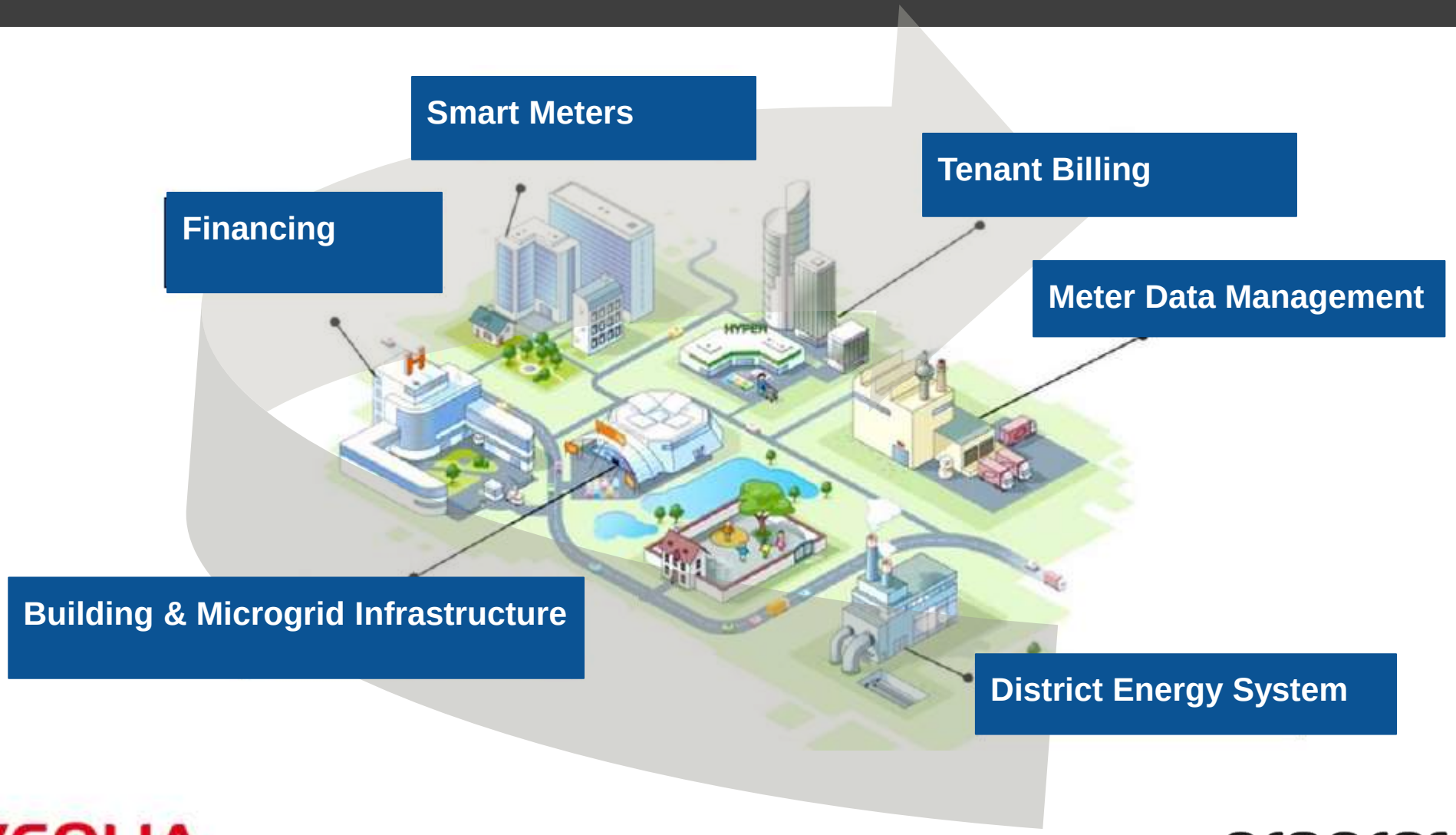
DISTRICT ENERGY SOLUTION



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ENERGY SUB-METERING

Developers prefer the simplicity of Energy Sub-metering and Direct Billing to tenants.

- Enables marketing actual energy use to tenants as portrays them as being energy conscious
- Compete with electric utilities that commonly bill direct
- They can avoid the billing process

Three approaches to allocating energy exist:

- Space allocation – proportionally allocate energy use by the ratio of square footage
- Hybrid – digital or temperature input to an algorithm
- Energy meters – direct via flow rate and delta T measurement

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DATA MANAGEMENT

One method of data managing is the EMSYS system, by Source One. It gathers, reports and can generate billing.

Third party billing services are also available.

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CONCLUSIONS

District energy does offer economic advantages for multi-family housing. It is important to understand the developers perspective and the specifics of each opportunity.

These findings are for specific locations in the USA. Results may differ in other locations.

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QUESTIONS

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