

Integration of District Energy in Planned Mixed Use, High Density Development

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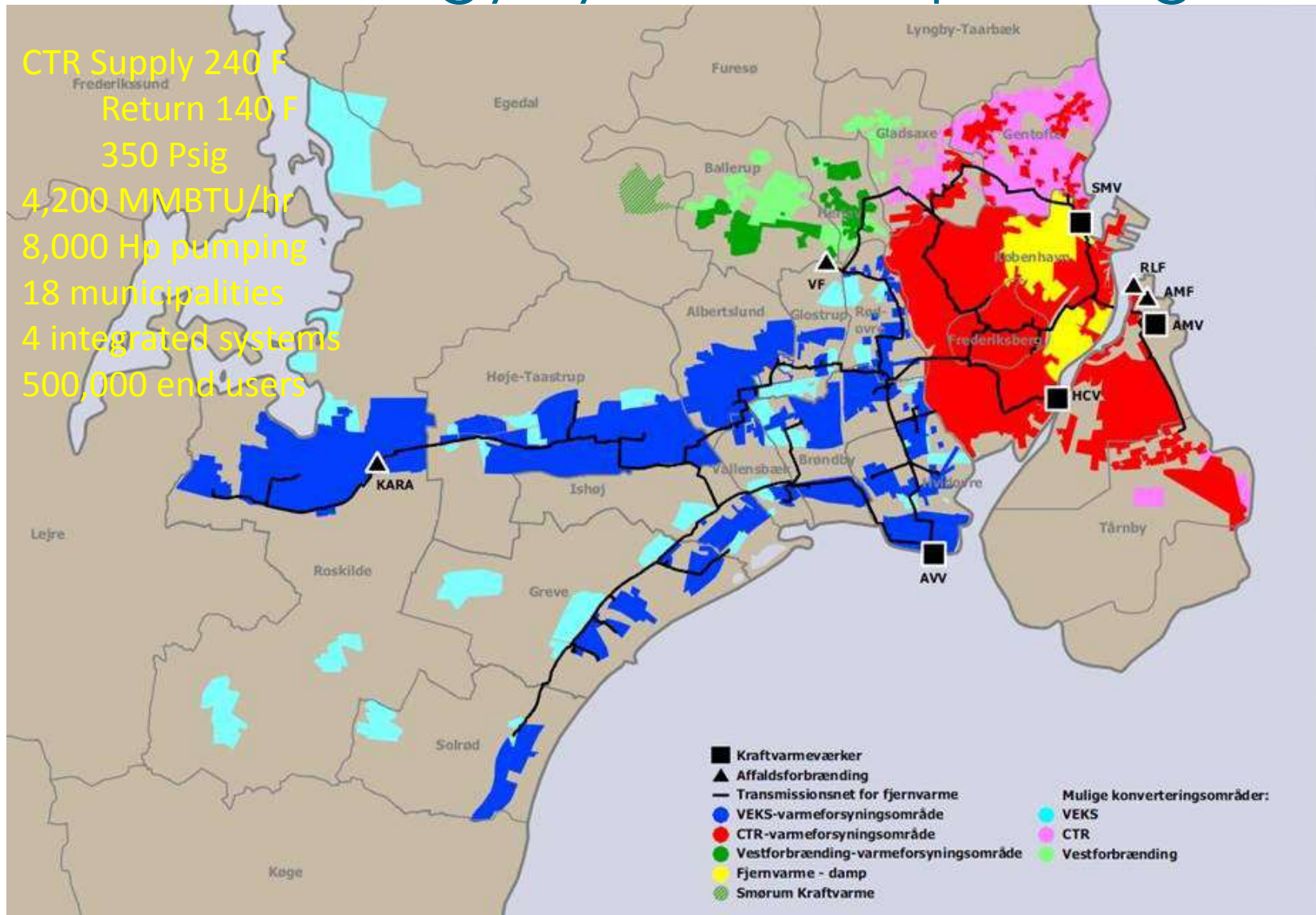
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Moving Community Energy Forward
105th Annual Conference & Trade Show
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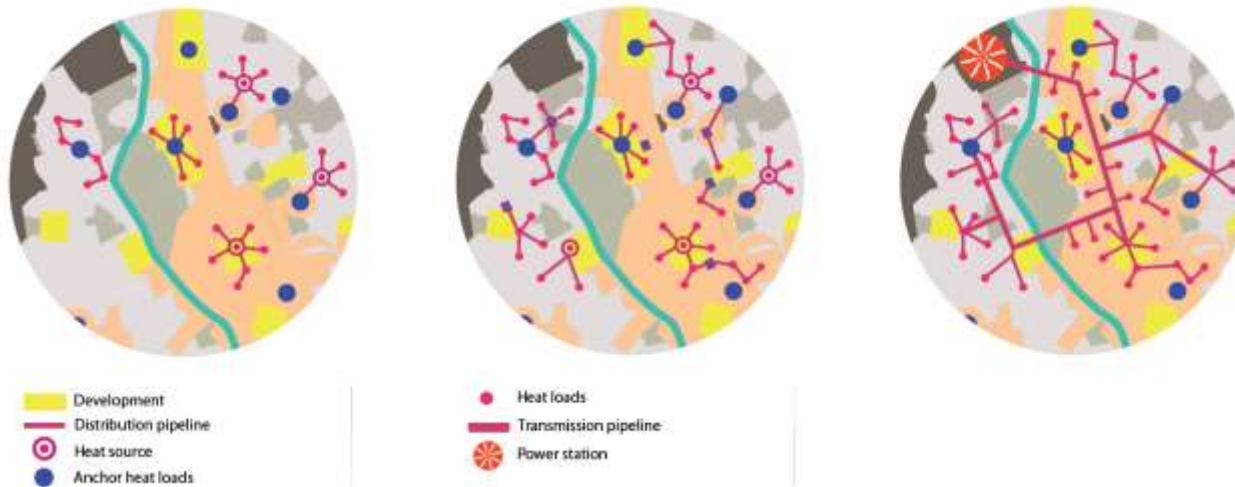
District Energy Systems: Copenhagen

CTR Supply 240 F
Return 140 F
350 Psig
4,200 MMBTU/hr
8,000 Hp pumping
18 municipalities
4 integrated systems
500,000 end users

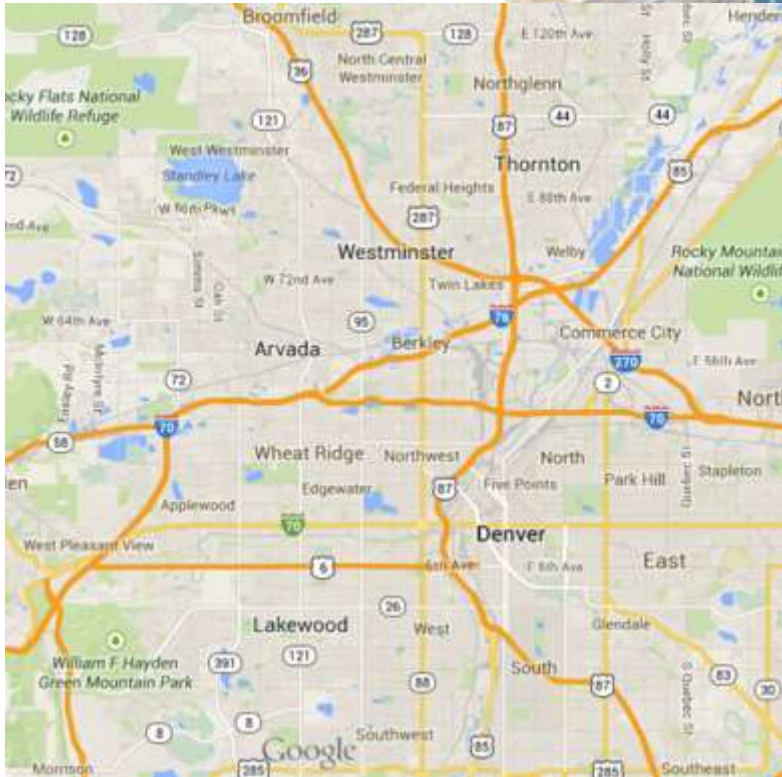


Evolution of Clusters

- District Energy as a modular concept
- District ready building systems
- Energy Clusters/Anchor Loads
- Integrate energy density into urban planning



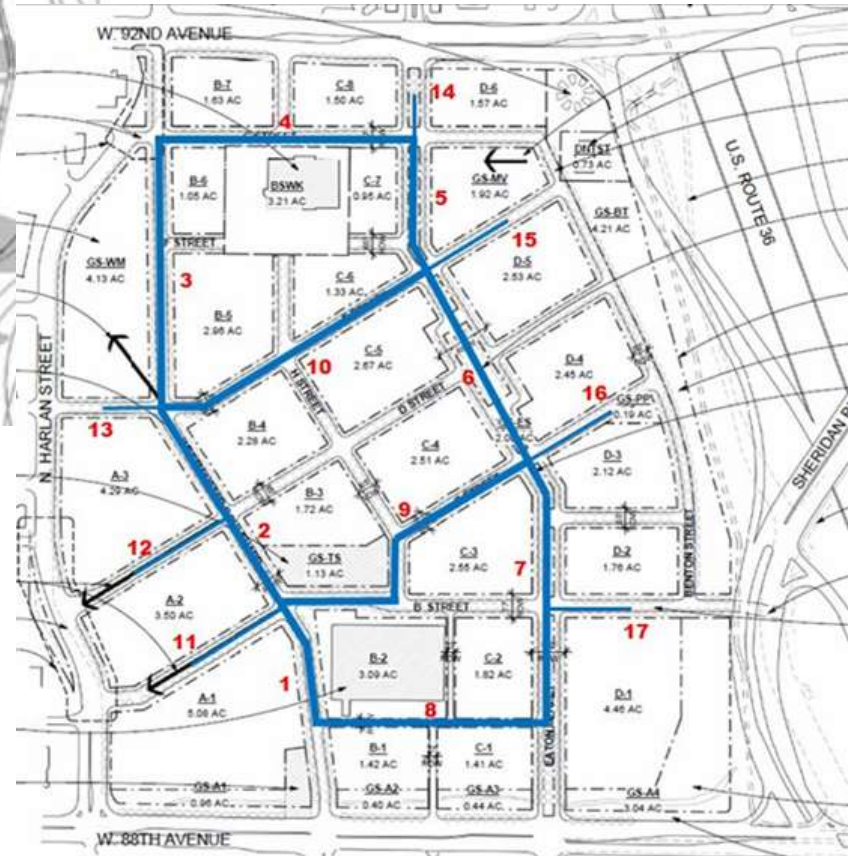
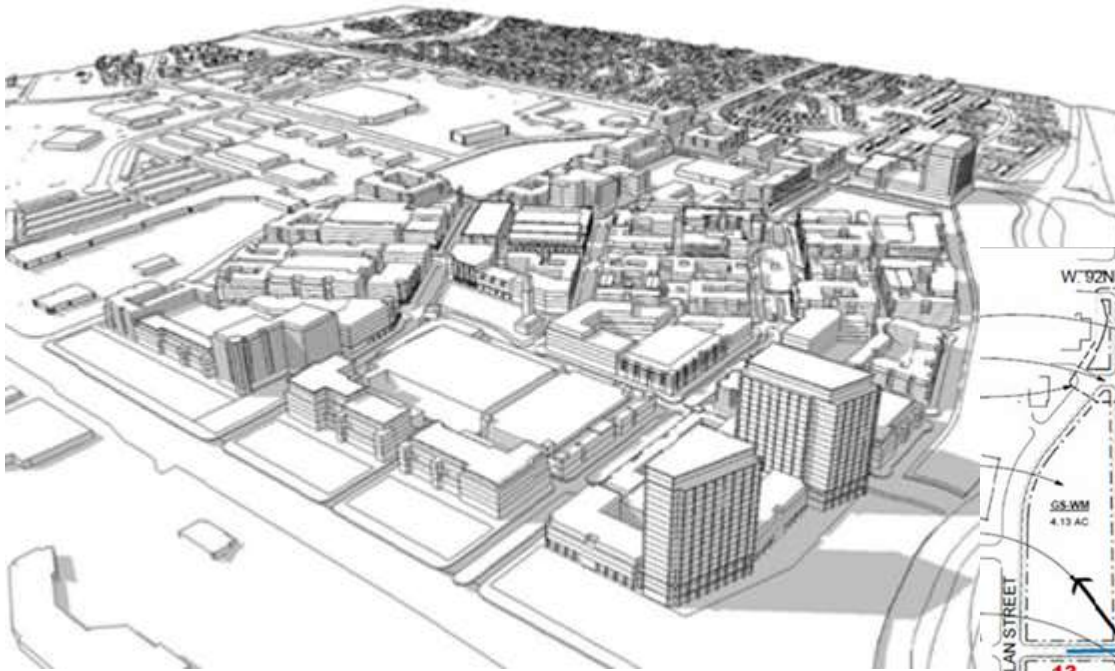
Example



The mixed use occupancy, as currently contemplated, includes:

Large Office	1.0	MSF
Medium Office	1.0	MSF
Retail	1.0	MSF
Restaurant	0.1	MSF
Hotel/Conference	0.3	MSF
Residential	0.6	MSF
Total	4.0	MSF

Example



Composite design at peak
Cooling 6,600 Tons
Heating 80 MMBTU/hr
Power (inc Cooling) 12 MW

The Screening Tool

Inputs

- Location
- Building Types, Size, Age
- Utility Costs
- Finance Costs
- District Energy Alternative
- Conversion Efficiency
- Construction Costs
- Labor Costs
- Project Phasing

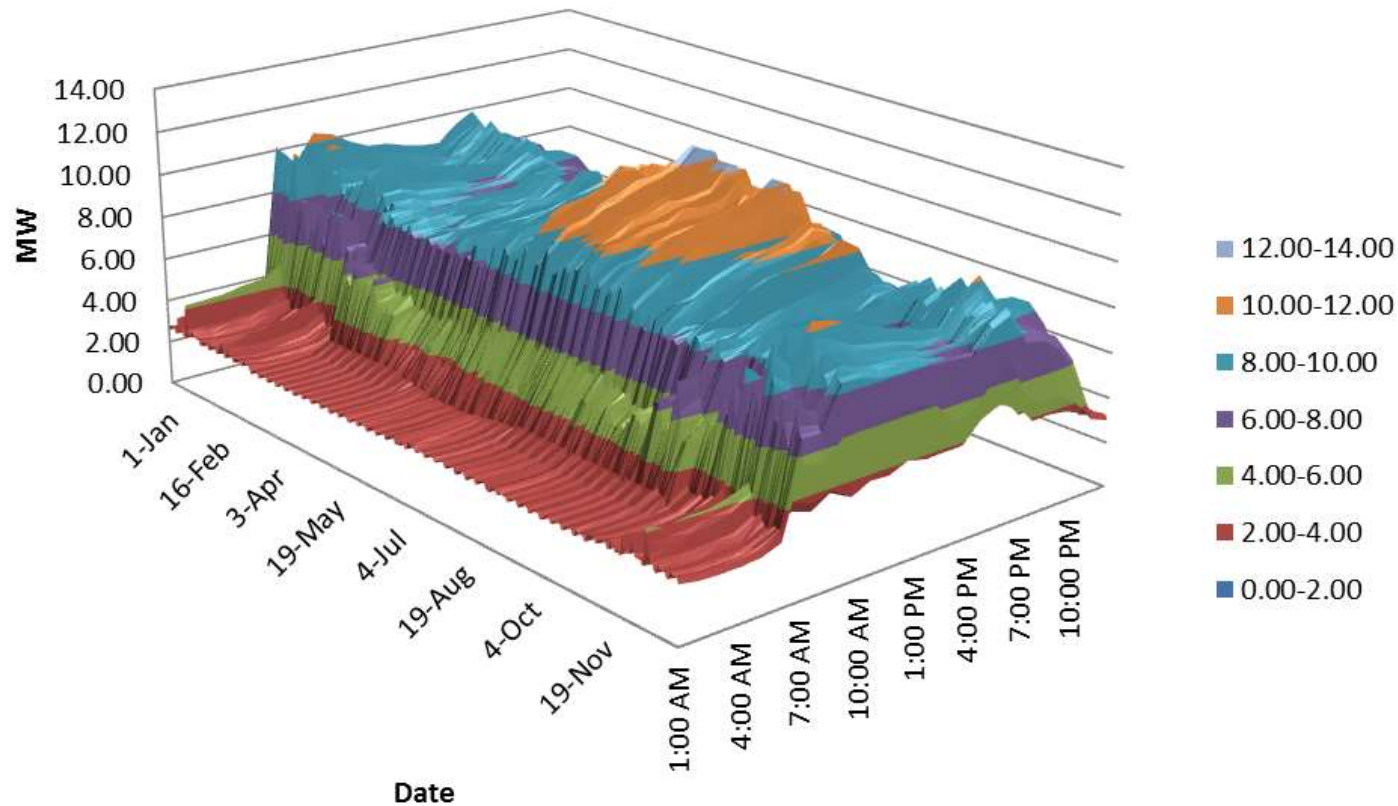
Outputs

- Energy Load Profile
- 20 year Cash Flow Projection
 - Capital Expense
 - Operating Expense
- Simple Payback of Alternatives
- Return on Investment of Alternatives

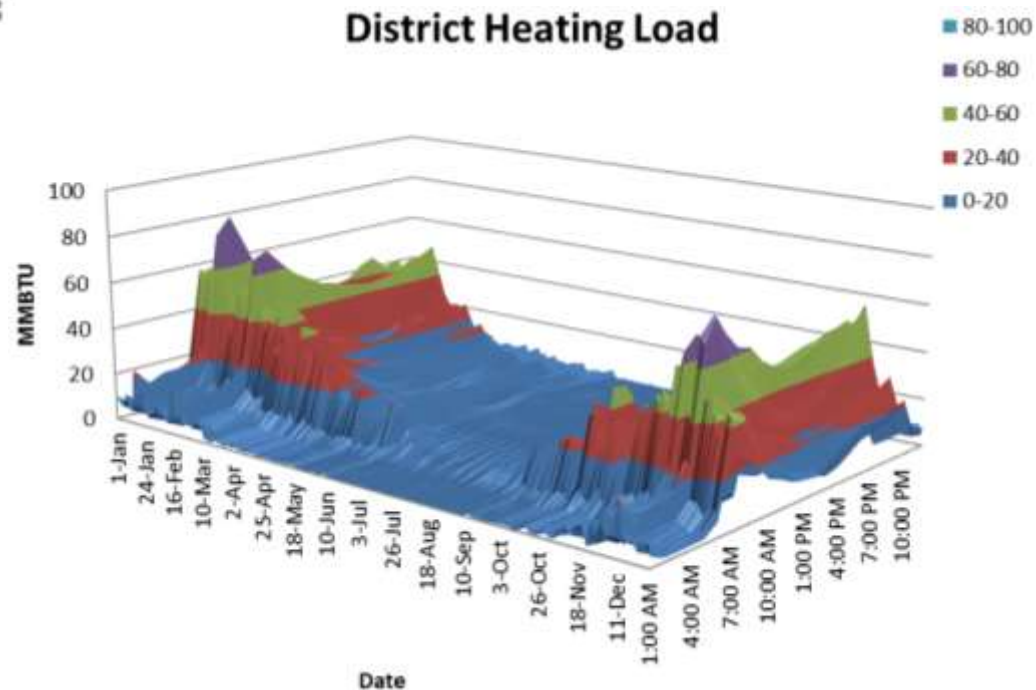
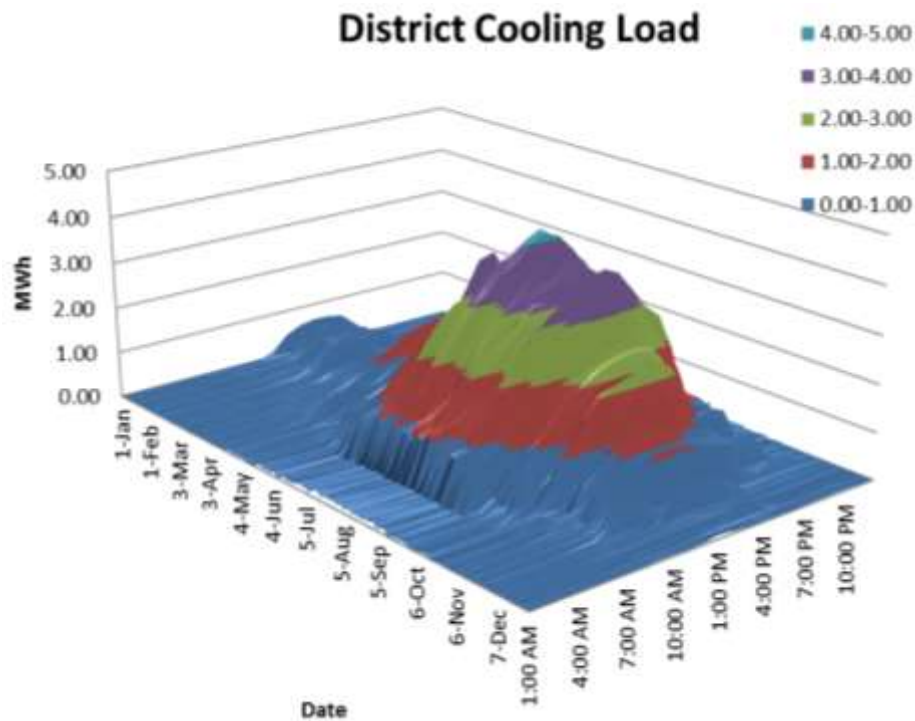


Energy Load Shape

District Electric Demand

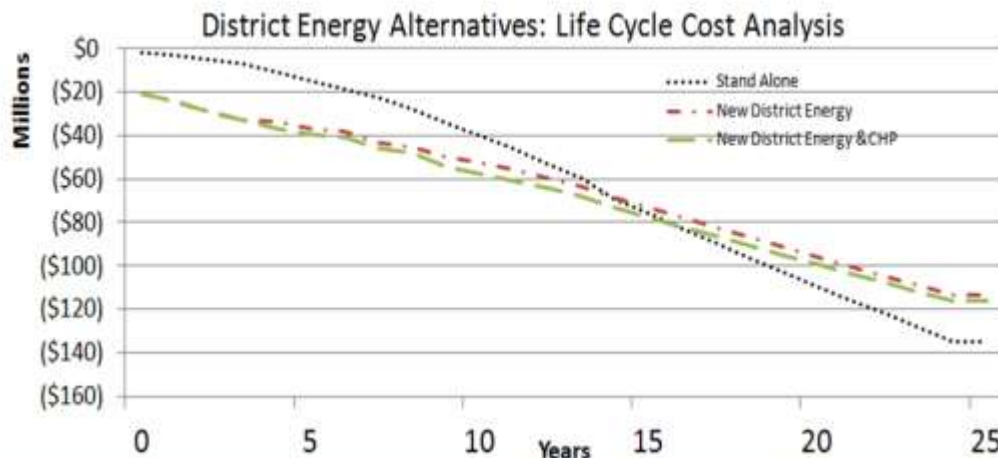


Energy Load Shape



Life Cycle Economic Evaluation

	Stand Alone	District Energy	District Energy + CHP
--Project Capital Distribution	\$0	-\$14,086,917	-\$14,086,917
--Project Capital Heating & Cooling Equipment	-\$33,338,964	-\$25,677,946	-\$25,677,946
--Project Capital CHP	\$0	\$0	-\$6,438,686
--Total Project Capital	-\$33,338,964	-\$39,764,863	-\$46,203,549
--Operation Cost	-\$180,425,015	-\$126,648,767	-\$122,039,431
--Project Capital + Operation Cost	-\$213,763,979	-\$166,413,629	-\$168,242,981
Total Life Cycle Cost Net Present Value	-\$131,785,834	-\$109,615,316	-\$110,762,193
(Lower Number = More Attractive)			
** Includes Debt Service			



Challenges

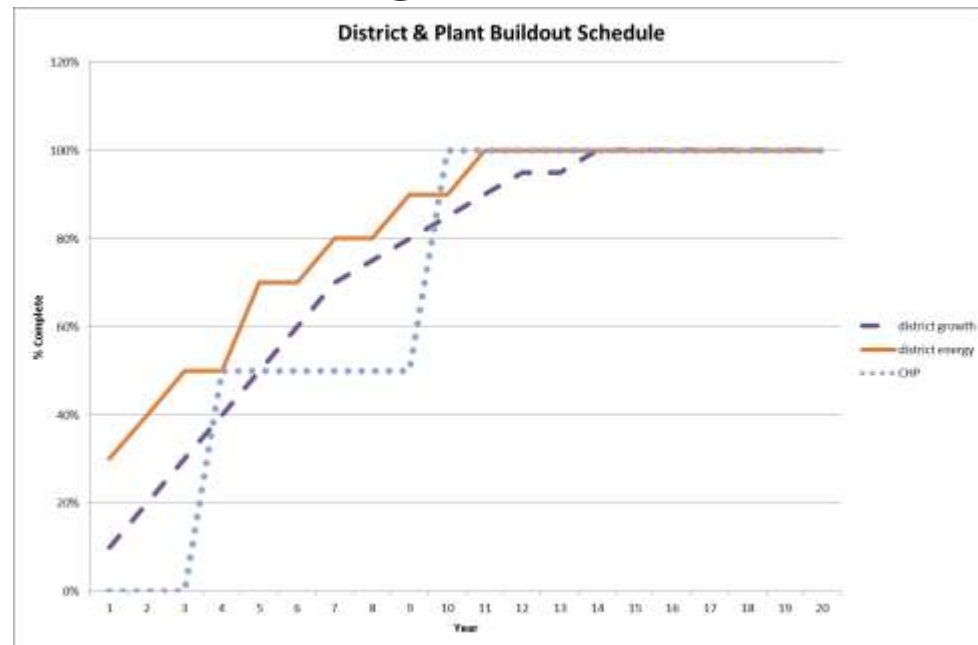
- Return on investment and developer Interest
- Energy load density and duration
- Utility roadblocks

ROI and Developer Challenges

Slow projected build out

Marginal incentive to building developer

Questions of Risk



ROI and Developer Opportunities

Slow projected build out

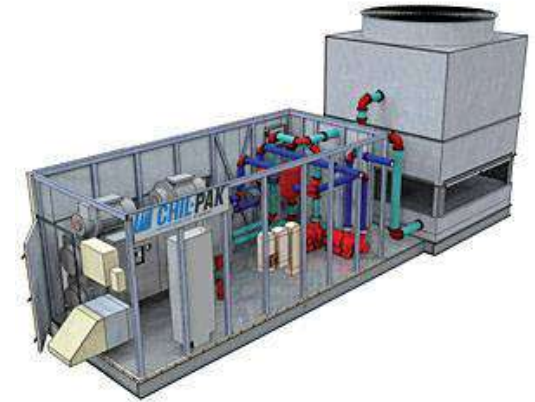
Begin with “district ready”
modular heating, cooling

Marginal initial incentive to building
developer

Remove energy plant from building costs

Questions of Risk

Solve Ownership, Operation and
Governance



Density and Duration Challenges

- Low Rise Residential
- ASHRAE 90.1, LEED, Net Zero, Deep Green
- Separated Sensible and Latent Cooling



Density and Duration Opportunities

- Low Rise Residential
- Encourage high density occupants and diversity to improve load shapes.
- Masterplan utility corridors for most cost effective piping methods, materials, alignments
- ASHRAE 90.1, LEED, Net Zero, Deep Green
- Diversity, diurnal and seasonal thermal energy storage
- Separated sensible and latent in building design
- Design chilled water loop to encourage cascading energy use

Utility Interconnect Challenges

- Franchise agreements and electrical interconnection
- Net metering requirements
- Time of Use, Demand Response
- Influence of increasing renewable generation

Diurnal Thermal Energy Storage

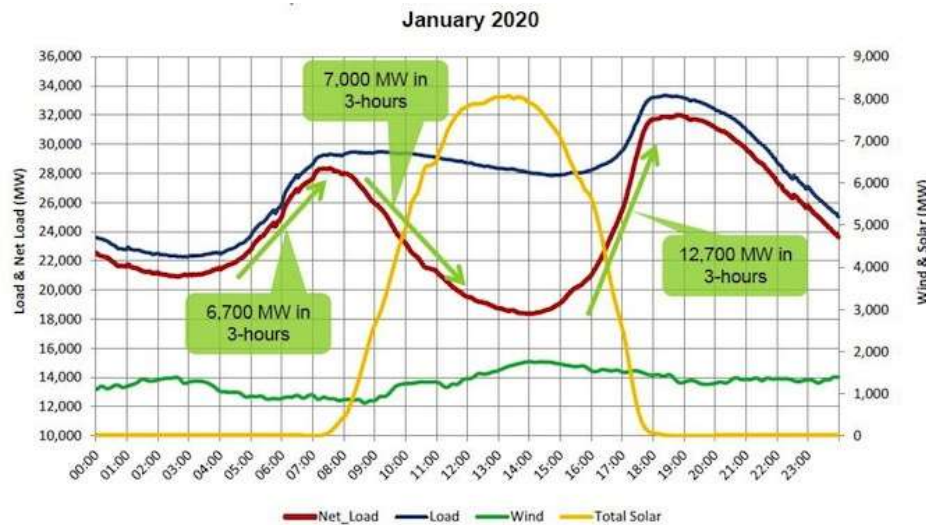
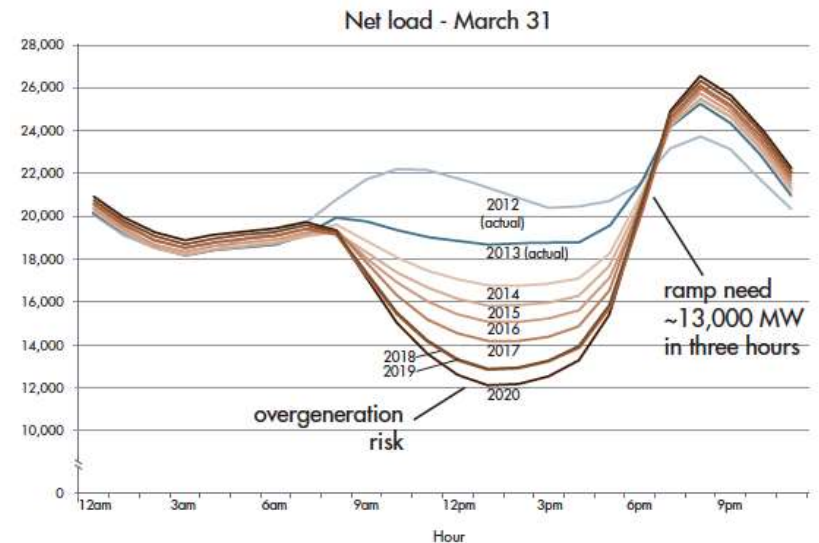
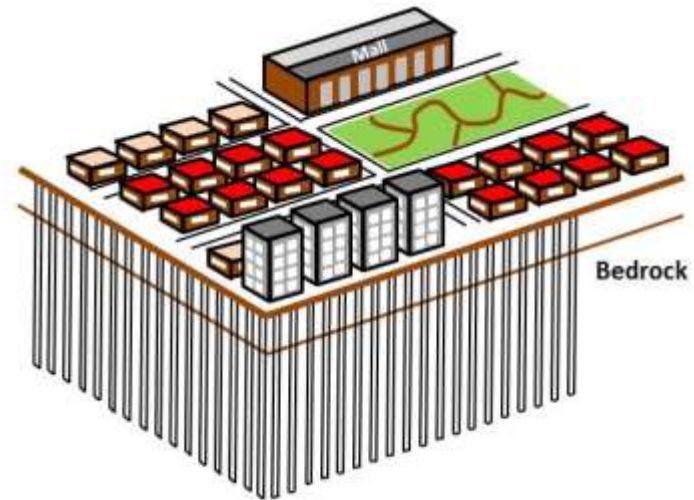
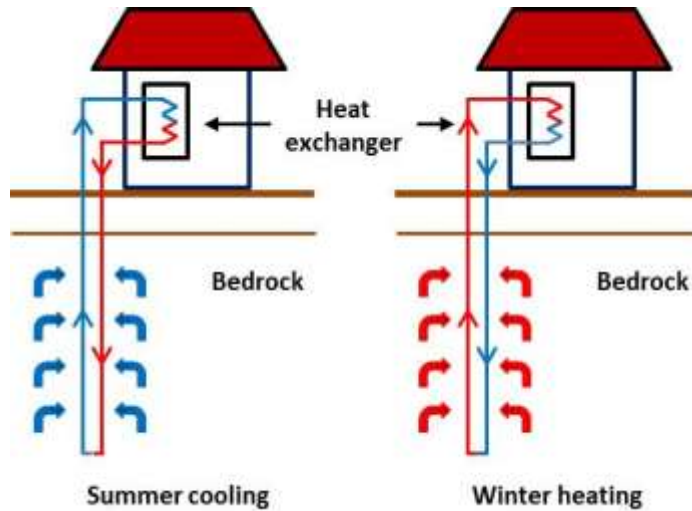


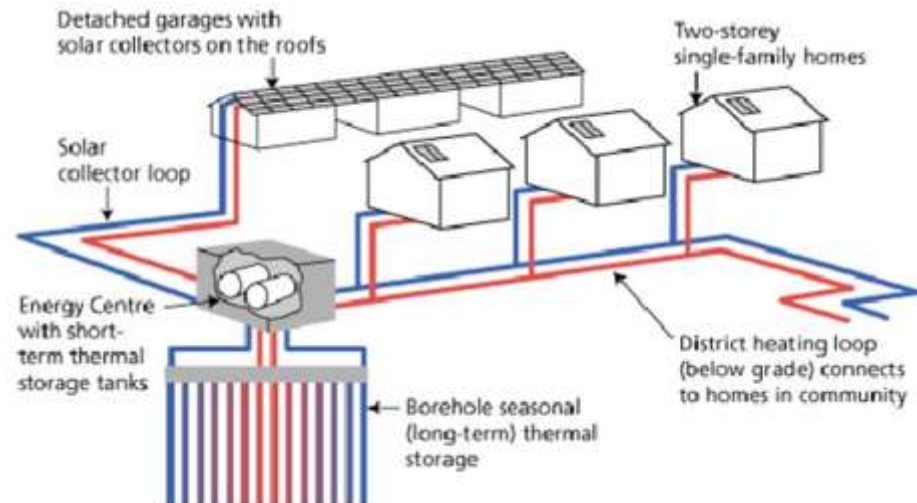
Figure 2: The duck curve shows steep ramping needs and overgeneration risk



Seasonal Energy Storage



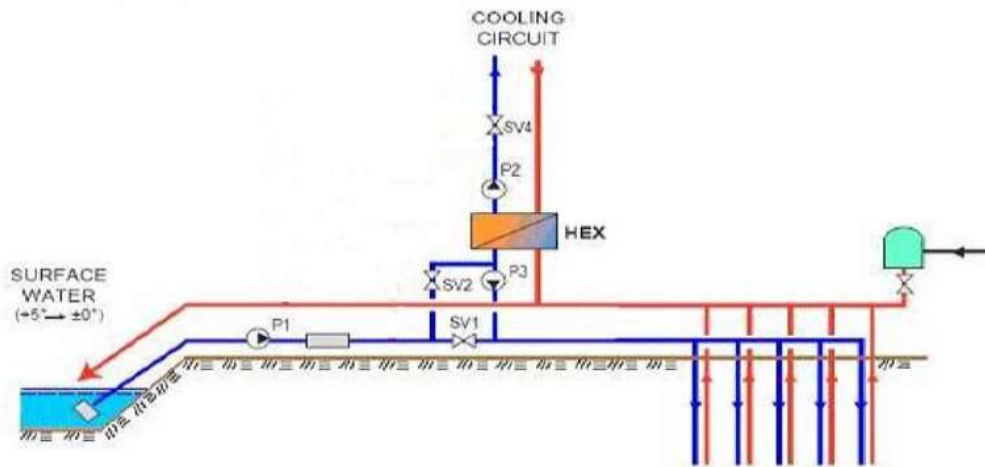
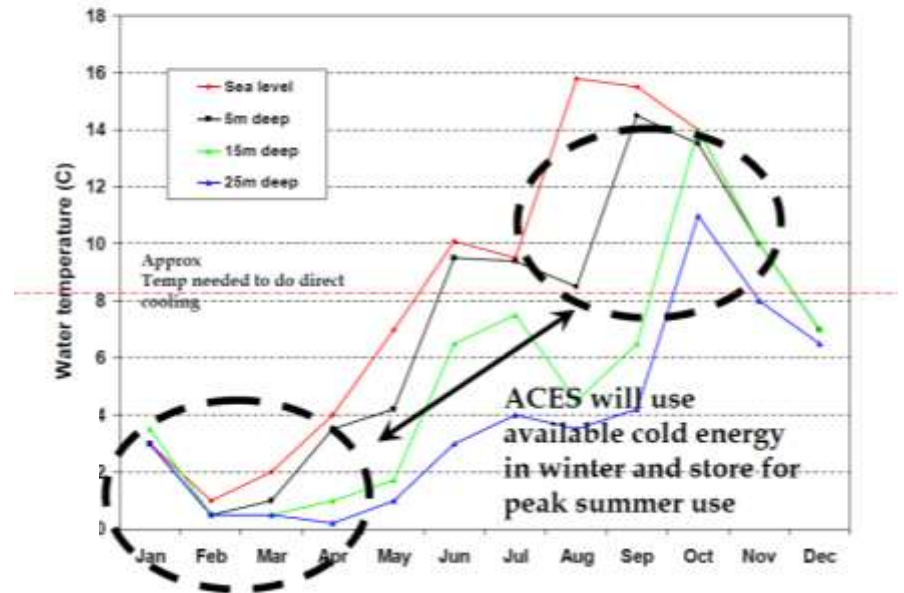
Drake Landing



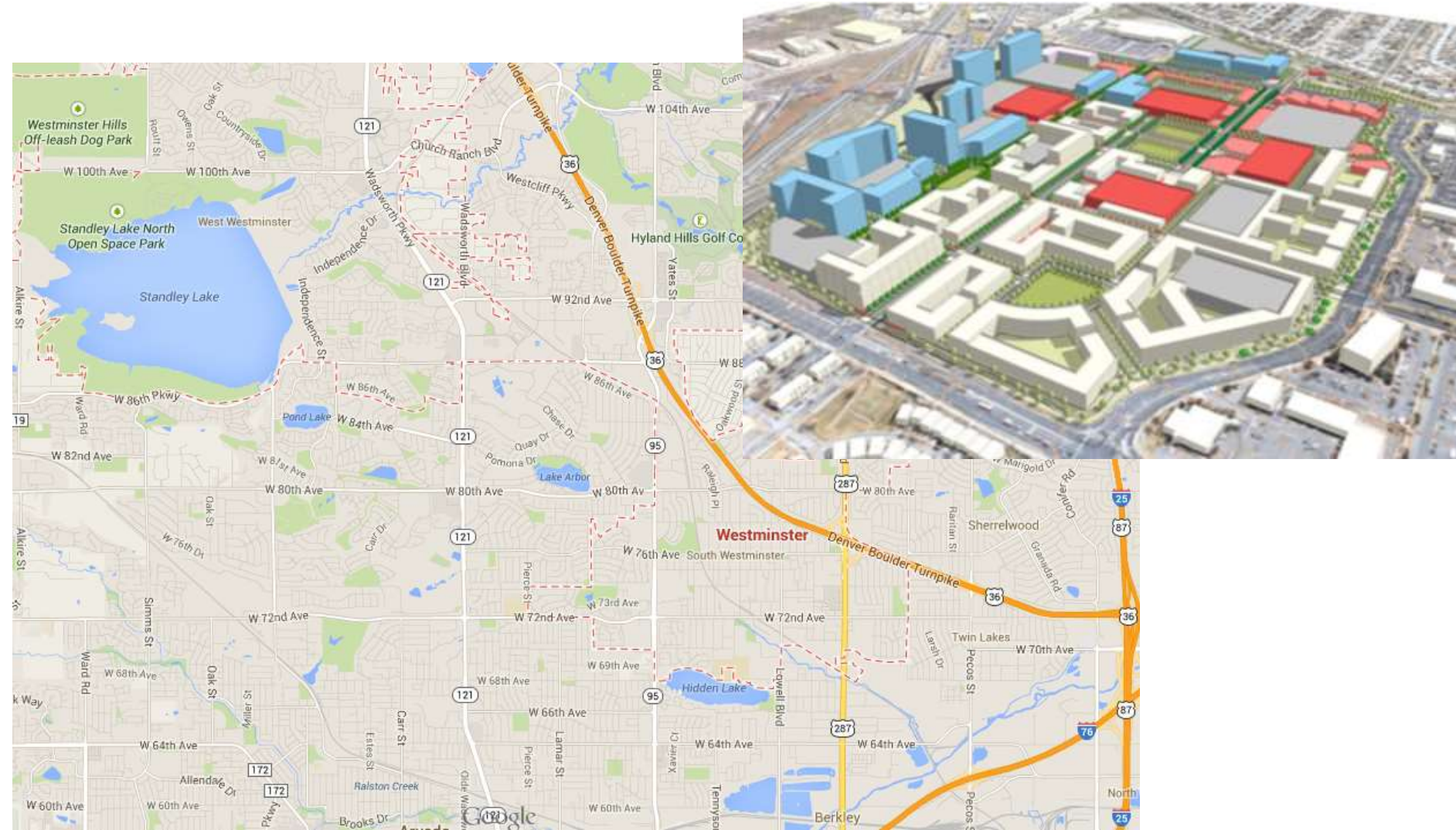
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HALIFAX HARBOUR TEMPERATURES



Unexplored Opportunities



Summary

Many challenges to integrating District Energy into planned mixed use communities.

Aggregated load density and shape planning a necessary early element of concept.

Near term Return on Investment using current energy, water, carbon costs may marginalize value of district energy

Resource economics and integrated cascading infrastructure