District Energy/Combined Heat & Power

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Discussion Areas

- The Importance of Thermal Energy Grids
- Markham District Energy
- Combined Heat & Power
- Thermal Storage
- Heat Recovery: The Other Renewable
- Questions & Discussion

The Importance of Thermal Energy Grids

- 0ver 60% of community energy use relates to heating & cooling our buildings.
- Standard practice in North America (on-building boilers and chillers) has low fuel flexibility or ability to adapt to new technology.
- In countries such as Denmark and Sweden, connecting communities “thermally” creates the necessary linkages to combined heat & power and the use of renewable fuels to heat & cool our communities.

Markham & Markham District Energy

Mission: *To continue as a leading developer of municipally owned district energy systems providing strategic foundations for Markham's Greenprint Sustainability Plan and economic development objectives.*

MDE'S Combined Heat & Power Fleet

Unit	Rating	Commercial Operation
G1	3.50 MW	April 2001
CHP1	5.00 MW	June 2008
CHPSOP 1	3.25 MW	Q2 2012
CHPSOP 2	2.60 MW	Q4 2012
Total	**14.35 MW**	

May 2007

Jan 2008

June 2008

Thermal Storage

During the combined summers of 2010 and 2011, the tank stored 3,600 MWHRS(th) of heat recovery from CHP operations; which was then discharged to the community heat load at night.

⟶ avoiding 432,000 m^3 of natural gas and 852 tonnes GHG emissions.

Heat Recovery Utilization: The Other Renewable

- Why do we invest in solar PV installation?
- Model a well sized natural gas fuelled CHP serving the heating needs of a community.
- Assume that the power generated (by the locally connected natural gas generator) is displacing a natural gas simple generator somewhere else in the province (lose the notion of a 100% renewable energy grid within our lifetime).
- Outcome: GHG emissions reductions (ERCs) is 5x greater per $ invested for the CHP district energy investment.

Heat Recovery Utilization: The Other Renewable

250 kW Solar PV		5.0 MW Natural Gas CHP
$1,600,000 ($6,400/kW)	**Capital**	$12,000,000 ($2,400/kW)
331 MWhe (based on 15.1% CF)	**Annual Energy**	20,000 MWhth (recovered to Useful Heat; assumes 4,000 hrs annually; which avoids 2.4 million m^3 natural gas for community heating)
133 tonnes (~.4 tonnes per MWhe based on IESO report for period May 2009 to April 2010)	**Annual GHG Emission Reductions**	4,735 tonnes (based on .001973 CO2 per m^3 per Environment Canada)
2,660 tonnes	**Emissions over 20 years**	94,704 tonnes
$600	**Capital $ per ton avoided**	**$127**

Questions & Discussion