

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

- Over 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.

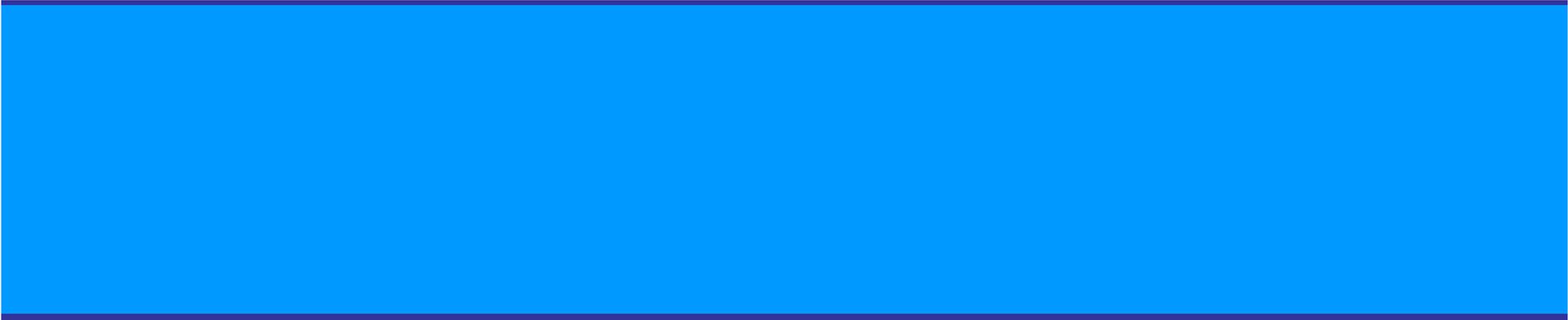
→ avoiding 432,000 m³ of natural gas and 852 tonnes GHG emissions.

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 MWh _e (based on 15.1% CF)	Annual Energy	20,000 MWh _{th} (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 MWh _e based on IESO report for period May 2009 to April 2010)	Annual GHG Emission Reductions	4,735 tonnes (based on .001973 CO ₂ per m ³ per Environment Canada)
2,660 tonnes	Emissions over 20 years	94,704 tonnes
\$600	Capital \$ per ton avoided	\$127



Questions & Discussion