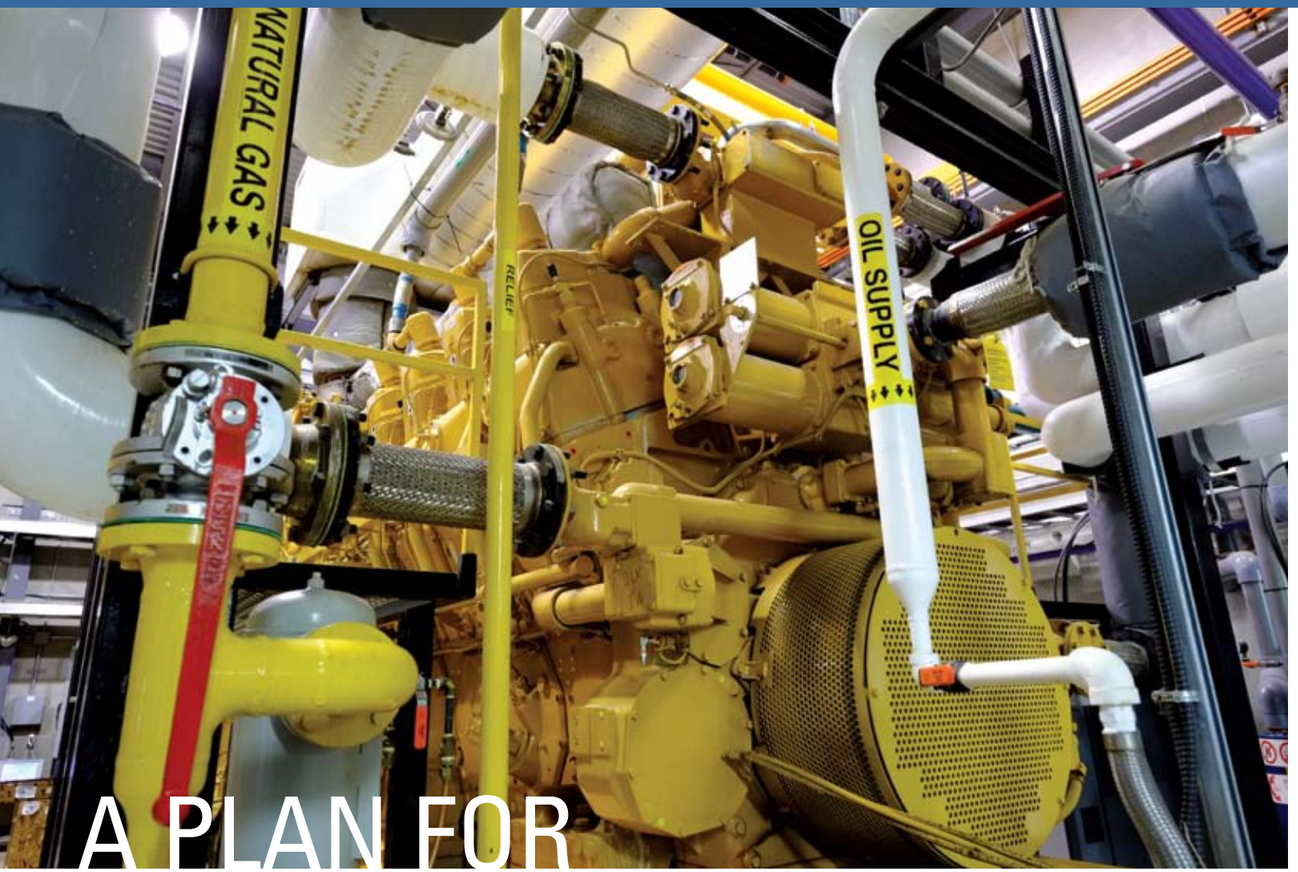

A PLAN FOR TOMORROW

Cat® power and Toromont are key elements in district energy plan

With close to 900 high-technology and life sciences companies located within its borders, Markham, Ontario is arguably the fastest growing city in Canada based on its current population of 310,000 that is expected to grow to 450,000 within 15 years.

The urban satellite community located just north of Toronto has embarked on a plan for growth that emphasizes density over sprawl, and utilizes district energy heating and cooling—a practice more commonly found in European cities.

District energy systems—neighborhood-scale utilities that deliver heating and cooling—are emerging as a key strategy for cities that are pursuing aggressive environmental goals. As a leader in urban planning, Markham is a prime example of a community and its district energy system that are planned in concert.

The Markham Centre Plan establishes a framework for creating Markham's new downtown, accommodating future growth and focusing on environmental sustainability.

Timed with the urban planning for downtown development, Markham District Energy (MDE) began operations in 2000 with IBM as its first customer.

When complete, Markham Centre will be a development of 30 million square feet including residential, commercial and institutional buildings, and be home to over 41,000 residents and 39,000 employees.

Creating a local energy system

An infamous ice storm that hit Eastern Canada in 1998 along with the deregulation of the power industry were critical factors in Markham's decision to create a local energy system and become more self-reliant.

"It was an opportunity to think differently about how we build our buildings and deliver energy," says Bruce Ander, president and CEO of Markham District Energy.

District energy is forecast to reduce greenhouse gas emissions by as much as 50 percent. Produced at central plants, heated and chilled water is distributed throughout the community via underground thermal distribution systems. The energy that is delivered to the buildings is used to provide space heating or cooling, heating processes such as laundries, or cooling processes such as data centers.

"It was an opportunity to think differently about how we build our buildings and deliver energy."

Bruce Ander,
president and CEO

Once a community builds its thermal energy network, the next common step is to connect locally sited, small power generation plants that recover waste heat used in the community system and deliver electricity to the local power grid. This is known as cogeneration, or combined heat and power (CHP), which is widely recognized as a highly efficient and socially responsible way of meeting a community's energy needs.

MDE's primary fuel source is natural gas, with large, efficient boiler plants that produce hot water distributed through underground networks, and chilled water that comes from electric centrifugal chillers. The entire system represents economy of scale.

"Electricity is a byproduct of what we do," Ander says. "Thermal is first. We produce power as a means of producing useful heat for the community thermal grid."

CG260 gensets debut

To dramatically increase efficiency and reduce emissions, MDE has deployed an aggressive cogeneration strategy using state-of-the art reciprocating generator sets and heat recovery technology.

Toromont, the local Cat® Dealer, is supplying a CG260-12 generator set for the MDE Birchmount Energy Centre, a CG260-16 generator set for the Bur Oak Energy Centre, and ancillary electrical and mechanical equipment for both sites. The CG260 generator sets will provide a combined 7 MW of electricity and 7 MW of thermal energy to the Markham District Energy systems. These projects represent the first in North America that employ Caterpillar's recently introduced CG260 Series of high-efficiency gas generator sets.

Continued on page 6

Customer Profile

Markham District Energy

LOCATION: *City of Markham, Ontario, Canada*

APPLICATION: *District energy heating and cooling*

CAT® EQUIPMENT: *G3616, G3612 (2), 3516 (2), G150LG, G100LG, CG260-16, CG260-12*

MARKHAM DISTRICT ENERGY INC.

CUSTOMERFEATURE

The CG260 utilizes particle-free combustion with chamber plugs for extended maintenance intervals and improved heat utilization.

Once the new CHP projects are complete, MDE will operate over 21 MW of Cat-powered generating capacity at three locations that provide reliable and efficient power and heating to its customers.

"We have successfully operated Cat power generation equipment for over a decade now, and Toromont has been an excellent partner since our project was first commissioned," Ander says.

Altogether, MDE utilizes nine Cat gensets, including two 3516 diesel units that provide emergency power to the hospital as well some of Markham's major business customers.

"This is part of our emergency preparedness plan, having onsite power with both diesel and gas, Ander says. "Having those generators reliable and ready to run is important."

Toromont expertise

In 2007, MDE hired Toromont as a turn-key provider to deliver not just gensets, but to design and commission a CHP plant at Markham Centre as part of a bid process with the government for new generating capacity. This 5.0 MW CHP plant sited at the Warden Energy Centre was commissioned in 2008.

"MDE needed a partner that could bid and guarantee capital and operating costs for a new CHP facility—not just provide generator set and component pricing," Ander said. "Toromont offered that turn-key capability, which formed the basis of a bidding partnership."

"It's a very important benefit, that they can make significant contributions to the design/engineering," Ander adds. "While there are many world-class engines, the key to us is the service support that goes through Toromont all the way up to the factory. The reliability of parts and service support, combined with the expertise and technical knowledge were the keys in differentiating Toromont and Caterpillar.

MDE commissioned its second district energy system in 2012 to service Cornell Centre, a rapidly growing urban centre with the expanding Markham Stouffville Hospital as an anchor energy customer. When complete, the Cornell Centre development will consist of over 10 million square feet of residential, commercial, and institutional buildings.

Two of the main reasons Toromont won the contract for the CG260 generators are their service group and the proximity to MDE's operations, Ander says.

The new gensets incorporate heat recovery equipment and exhaust emissions control in accordance with tightening regulations. It's an extensive scope, and as before, Toromont is providing more than just gensets, he says.

"Here at MDE, many of us have come from the supplier side," Ander says. "We understand the role of the distributor and the service group, because projects succeed and fail on the operations side. We really have a firm understanding of where Toromont plays and what they bring to the table."

What's old is new again

District energy is an internationally accepted method of heating, cooling and powering communities. In many European countries such as Denmark, Sweden and Finland, district energy is either mandated by law or a fundamental part of the community energy strategy. In Canada, a number of cities and towns have operated district energy systems for many decades. The oldest system in London, Ontario dates back to 1880. In Ontario, district energy systems are located in many communities including Toronto, Ottawa, London, Hamilton, Sudbury, Cornwall and Windsor.

Ander says CHP systems in Europe use other fuels such as biogas to replace or supplement natural gas. While Markham isn't doing it yet, one plan is to transition to biomass using clean wood waste as a fuel source.

"We have some very good examples, like St. Paul [Minnesota], which converted to wood (from natural gas and coal) to heat their downtown," Ander says. "Within 10 years, we may have the Cat natural gas generators work in conjunction with biomass or biogas boilers. We will not be dependent on just natural gas.

"First and foremost, our core business is to create thermal energy," Ander reiterates, "and reliability is our first priority. Whether the Cat fleet is providing emergency power to our customers, or grid power, or thermal energy for our heating system, high reliability is the goal for MDE and our suppliers."

QUICK STATS

- ***Energy Plants*** *(4)*
- ***District Energy Thermal Grids*** *(2)*
- ***Cooling Capacity*** *- 14,100 tons*
- ***Heating Capacity*** *- 48 MW*
- ***Thermal Storage*** *- 40 MWH*
- ***CHP Capacity*** *- 14 MW*
- ***Emergency Power Capacity*** *- 5 MW*
- ***Primary Fuel*** *- Natural Gas*
- ***Distribution System*** *- 25 kilometers*
- ***Buildings Served*** *(38) - 7 million ft²*

MARKHAM DISTRICT ENERGY

Markham District Energy Inc. (MDE), an energy company owned by the City of Markham, was established in 1999. Its mission is to develop a world-class community-based district energy system that responsibly invests capital to encourage local economic development and demonstrates environmental leadership.

MDE's History December 2000 to Present:

2000 Commences energy supply on December 1, 2000 from the Warden Energy Centre to IBM Canada.

2003 MDE commences service to Tridel Circa (the first of many residential condominiums in Markham Centre).

2005 MDE becomes EcoLogo Certified (Environment Canada's green energy branding).

2008 MDE commissions a 5 MW Combined Heat & Power facility resulting from winning a RFP from the Province's Ontario Power Authority.

2009 MDE's second energy plant is commissioned – The Clegg Energy Centre.

2010 MDE's third energy plant is commissioned – the Birchmount Energy Centre.

2011 MDE is awarded two contracts from the Ontario Power Authority to build, own and operate new Combined Heat and Power facilities with a total capacity of 7.0 MW.

2012 MDE commissions its second thermal energy grid in Cornell Centre and its fourth energy plant; the Bur Oak Energy Centre.