DISTRICT ENERGY AND COMBINED HEAT AND POWER

IDEA – Vancouver
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ENMAX we're on™

Building and Growing a District Energy Business in Alberta

DEC 9th, 2015

DISTRICT ENERGY IN CALGARY

- The ENMAX District Energy Centre was commission in 2010 and is a 26,000 square foot state-of-the-art district heating plant.
- Currently have 55 MW of installed thermal heating capacity with approximately 5500 meters of installed thermal pipeline. And growing.
- Sold-out of the original 35MW of capacity in 2013 and installed and commissioned an additional 20MW of thermal generation capacity 2015.
- Currently going through the process of integrating 3.3 MW of CHP, to the ENMAX District Energy Centre in 2016.
- When fully built-out with CHP, there will be heating capacity at the District Energy Centre for approximately 10 million square feet or commercial and residential space.
- Currently, there is approximately 7.5 million square feet of connected, or committed capacity, from the District Energy Centre. (32% commercial, 28% residential, 15% institutional)

DISTRICT ENERGY LANDSCAPE IN ALBERTA

- Most existing district energy systems in operation in the province are either universities, hospitals, or municipally owned.
- They are aligned with municipalities and identified in the City of Calgary Green House Gas Reduction Plan, City of Edmonton Energy Transition Strategy and The Way We Green and The Way We Grow municipal plans.
- Strong alignment with partner organizations such as Quality Urban Energy Systems of Tomorrow (QUEST), Canadian Green Building Council (CaGBC) and IDEA.
- City of Calgary has developed FAR credits for Green Building features which includes connecting to DE in downtown Calgary
- The City of Edmonton has approved adoption of District Energy for Downtown and will continue the development in 2016. The redevelopment of the City Centre Airport currently plans for a District Energy System
- The City of Red Deer is also exploring District Energy for a new intra-urban community

OUR VALUE PROPOSITION

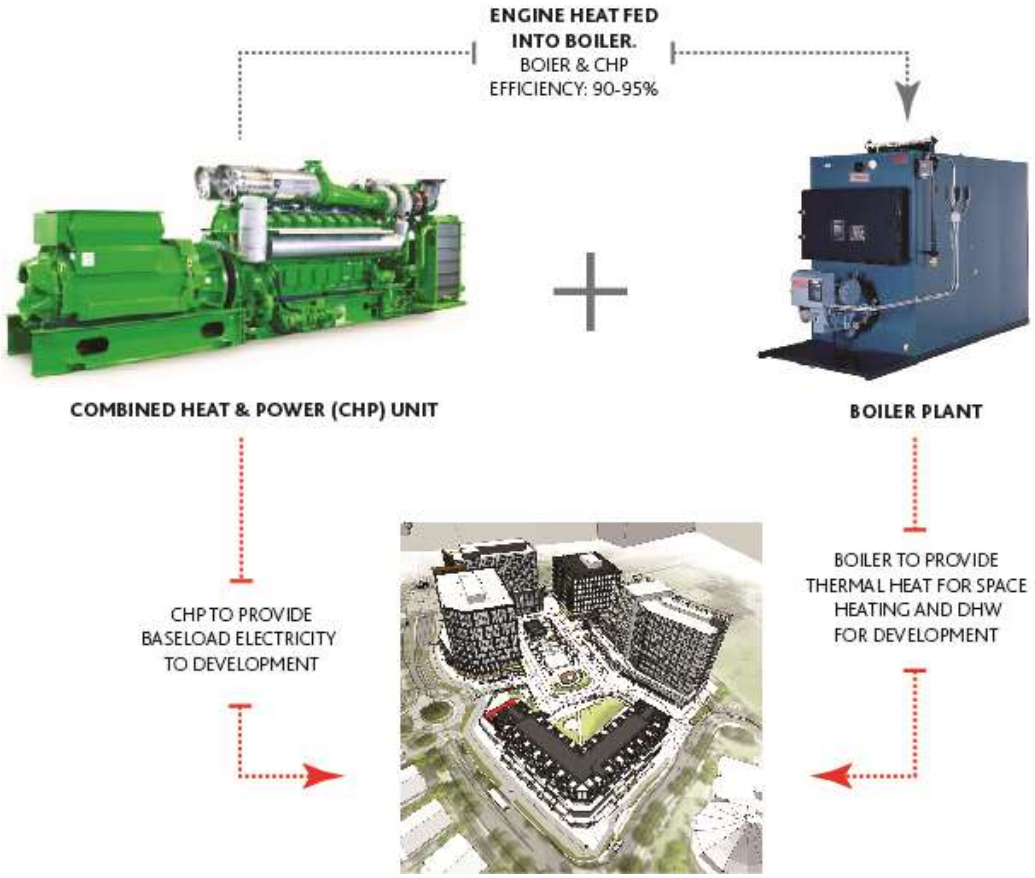
- The removal of old boiler plants from building penthouse frees up real estate that can generate revenue for property owner.
- Property owner avoids the capital costs associated with installing new or replacing aging boiler equipment.
- Significant reduction in the O&M cost associated with maintaining boiler plants. Building operators can focus on customer service.
- DE allows for building owners to optimize costs and create competitive rates in a slowing economy.
- The installation of CHP in the customer building allows for less volatility in electricity cost.
- Thermal energy generation and CHP operation is maintained by an experienced and reliable utility.

CHALLENGES

- District Energy is relatively unknown or misunderstood which creates apprehension to connect.
- No provincial or municipal bylaw existing that mandates or incentivizes building owners or developers to assess DE.
- Civil costs to construct the thermal pipeline are very high and create economic challenges associated with growing the business.
- As the plant reaches service capacity, finding capital to expand to meet the demand is challenging in this economy.

COMBINED HEAT AND POWER & DISTRICT ENERGY

- The integration of CHP into our DE facility will displace 14,288 tonnes of CO2 Annually by 2020. Or the equivalent of 3,008 cars.
- The electricity generated from the CHP is sold in the electricity pool and offsets the demand for electricity coming from high emitting generation sources like coal.
- This combination supports many municipal, provincial and federal mandates to reduce emission and create energy efficient means of generation.



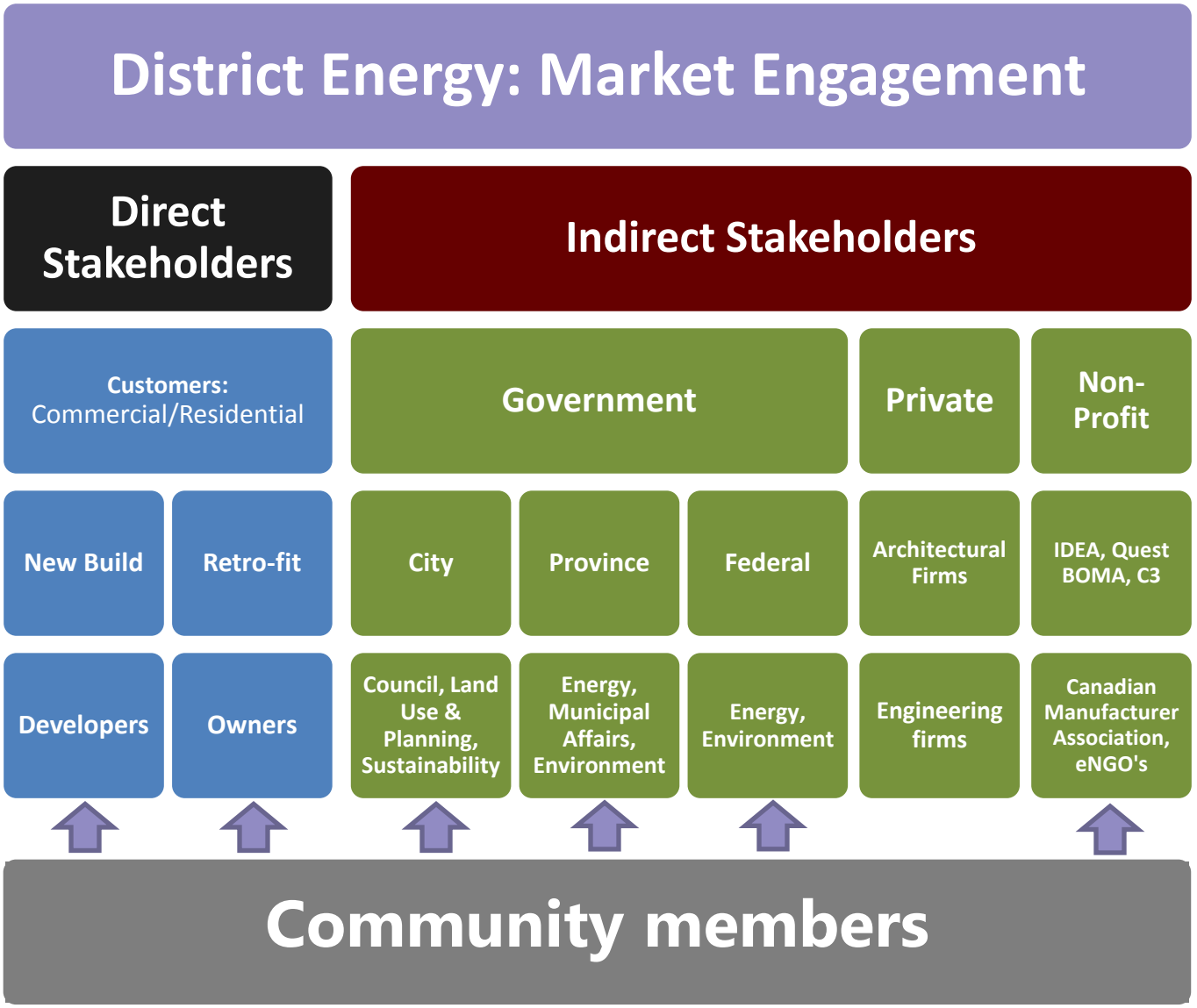
HOW CAN DE AND CHP HELP COMMUNITES REDUCE GHG EMMISSIONS?

EXAMPLES

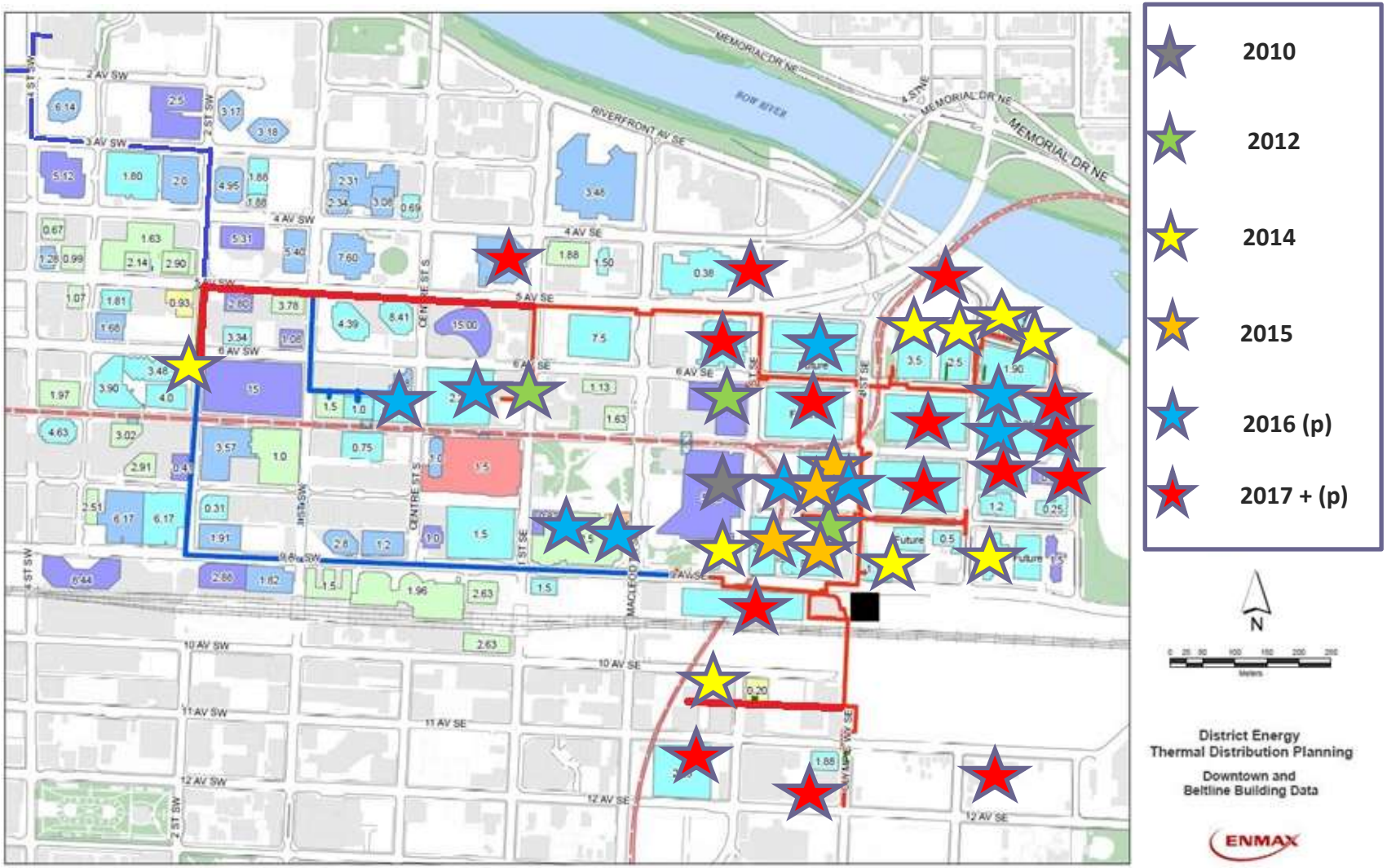
Source: United Nations Environmental Programme: District Energy In Cities, Unlocking the Potential of Energy Efficiency and Renewable Energy, 2015

- Denmark has seen a **20 per cent reduction** in national CO2 emissions since 1990 due to district heating, and many cities are turning to district energy as key components of climate action plans.
- District energy is a core strategy in putting Paris on the pathway to a **75 per cent reduction in CO2 emissions** by 2050.
- In Copenhagen, recycling waste heat results in 655,000 tons of CO2 emission reductions while also **displacing 1.4 million barrels of oil annually**.
- And Tokyo, Japan's, district heating and cooling systems use **44 per cent less primary energy** and emit **50 per cent less CO2** compared to individual heating and cooling systems.

Go to Market Strategy



GROWTH 2010-2017



DISTRICT ENERGY IN EDMONTON

PROJECT OVERVIEW

- ENAMX has been working with the City of Edmonton since 2012 to implement a DE system in downtown Edmonton.
- Primary objective is to reduce GHG emissions.
- Project team consists of City Administration from Real Estate, Housing & Economic Sustainability, and Sustainable development, EPCOR (Edmonton local utility), FVB Energy Inc, The Holmes Group, and ENMAX.
- The initial phase would consist of a 22 MW DE plant.
- The City of Edmonton would commit to connecting 6 municipal buildings with aging boiler infrastructure.
- In addition, 4 provincial buildings would also be connected in phase 2 of the project.
- City of Edmonton would make a capital contribution of $9M to offset cost associated with the implementation of a DE system.

DISTRICT ENERGY IN EDMONTON

- The implementation of DE system in Edmonton directly aligns with City objectives on Sustainability, Livability, Affordability, Innovation and Integration.
- Directly aligns with Municipal Development plan – The Way We Grow, and The Way We Green.
- The DE system also aligns with Edmonton's Community Energy Transition Plan and 2030 GHG emission reduction goals.
- When all four phases are completed, the DE system will reduce GHGs by 36% over normal consumption with 18,100 tonnes of avoided GHG annually (~3800 cars).
- At full build-out, the DE system will include 6 MW of cogeneration and 44 MW and thermal heating capacity.
- Total avoided GHGs will amount to 94,000 tonnes annually with nearly 2.8M tonnes avoided over 30 years.

DISTRICT ENERGY & CHP OPPORTUNITIES AND BARRIERS

OPPORTUNITIES

- Municipal Systems
- Stand alone Community Systems
- Health Care
- Campus
- Cooling
- Market Momentum
- International Momentum

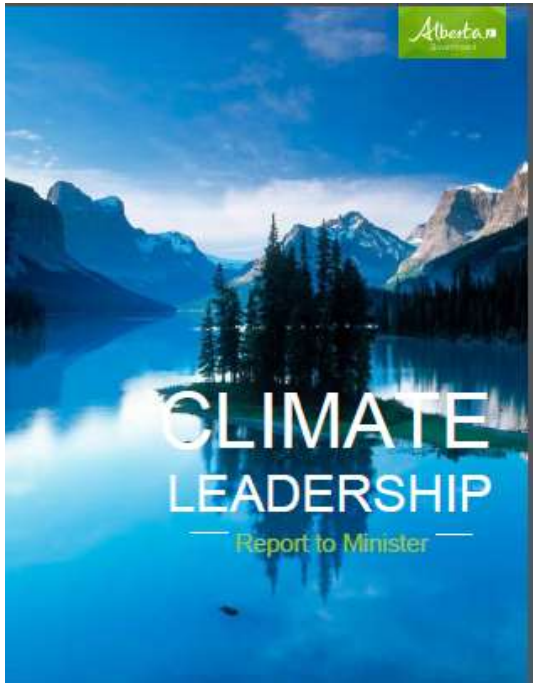
BARRIERS AND DELAYS

- Still a significant knowledge gap with developers
- Paralysis by analysis
- Pending funding/support gap from the Province and Federal Government

OPPORTUNITY

- Leverage the success and learnings from Europe
- Leverage the UNEP supporting structure
- Contribute to the Provincial and National dialogue
- Secure strong support Provincially and Federally
- The conversation is resonating, now is the time to coalesce an ask and develop a strategic approach to funders

Energy Efficiency and Energy Resilient Communities

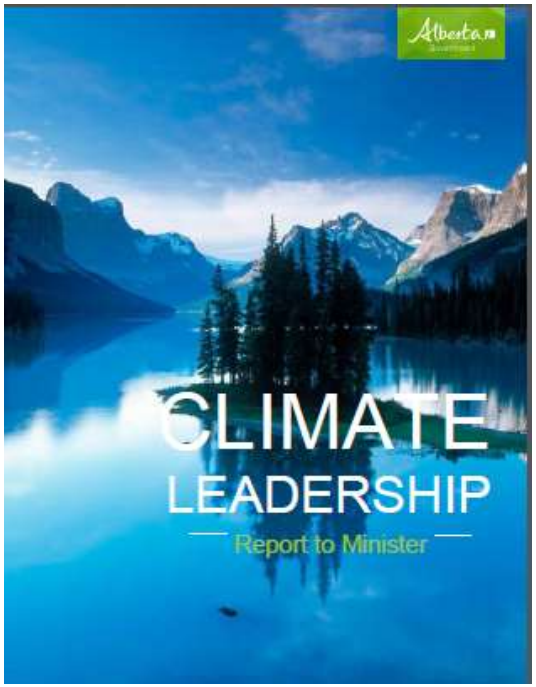


Policy Recommendations

1. **Implement a new integrated energy efficiency and community-scale energy program. This program should:**
   - ensure incremental spending on energy efficiency and small-scale community generation meets standard tests for return on public investment;
   - investigate the feasibility of a small-scale community generation regulation, to be funded within the same Community Energy Strategy envelope;
   - ensure low-income households are not "left behind" in the transition to a lower carbon economy, and have opportunities to adopt the same new energy technologies as higher income households; and
   - ensure collaboration with existing municipal programs already in place or in the planning stages.
2. **Implement a complementary regulatory agenda which would include:**
   - building energy performance reporting and disclosure requirements;
   - updated building codes and standards; and
   - a renewed regulatory standard for distributed and small-scale community generation.
3. **Foster municipal partnerships by:**
   - integrating guidance to municipal governments on climate change in the current review of the Municipal Government Act;
   - making high quality data available for community energy and emissions inventories, and work with municipalities to develop and transfer best practices; and
   - expanding green infrastructure investments and/or increasing provincial infrastructure grant flexibility to support transit oriented development, active transportation options and public transit.

$125M estimated for Annual Community Energy Strategy Funding

Energy Efficiency and Energy Resilient Communities



Renew and update Micro-generation Regulation and investigate the feasibility of a new regulation for small-scale community generation

Alberta's current Micro-Generation Regulation expires at the end of 2015. The Panel heard broad interest in micro-scale generation from individuals, cooperatives and municipalities. We also heard strong support for a new class for slightly larger scale community generation, as a way to encourage alternative energy technologies well-suited to community energy systems.

Examples offered included:

- home energy storage systems
- combined heat and power,
- district energy,
- solar,
- wind,
- geothermal,
- water source cooling,
- sewer heat capture,
- biomass for heating, and
- capturing biogases for transportation, heating and electricity generation.

Unlike the Micro-Generation Regulation, these alternative technologies are not limited to renewable energy, but they are low-emissions.

These technologies would allow all Albertans to take more control of their carbon footprint, with major positive implications for energy resilience at the local scale. Distributed energy and community combined heat and power systems, for instance, allow for a transition away from fossil fuel use and can result in a 30-50 per cent reduction in primary energy consumption.[35] These smaller-scale systems produce less power, and will be more expensive per kW than utility scale systems. However, they avoid investments in transmission and distribution, and provide other electricity grid benefits such as reduced network congestion. They also

Context – Micro-generation

- As of June 1, 2015, there were 1208 micro-generation sites in Alberta, with a total capacity of over 9.2 megawatts. 1130 of the sites are solar photovoltaic installations.
- Alberta's current Micro-generation Regulation expires on December 31, 2015.

Context – District Energy

- A Combined Heat and Power (CHP) system produces both electricity and heat. The electricity can be used to service a building or sold into the power pool. The heat can be used to heat water for boilers for a District Energy System. This supplies space heating to multiple building locations from a central energy centre through a network of insulated underground pipes.
- A CHP/District Energy system uses fuel inputs with 80% efficiency, compared to 34% efficiency for a standard power plant.

"Aggressive deployment of distributed generation would likely require more extensive funding"

Climate Leadership Report to Minister Nov 22, 2015

ENMAX