Regulatory and Practical Issues and Opportunities for Water Reuse in the Power Generation Sector

ENMAX

we're on for you™

The ENMAX Experience

June 26, 2014

OUTLINE

- About ENMAX:
  - Shepard Energy Centre
  - Bonnybrook Energy Centre
- Options for Cooling Towers and Steam Makeup
  - Opportunities for using reclaimed water
- Obstacles and Solutions
  - Permitting
  - Mechanical
- Conclusion

About ENMAX

Retail Metered Customer Locations
871,000

Customer Satisfaction
81%

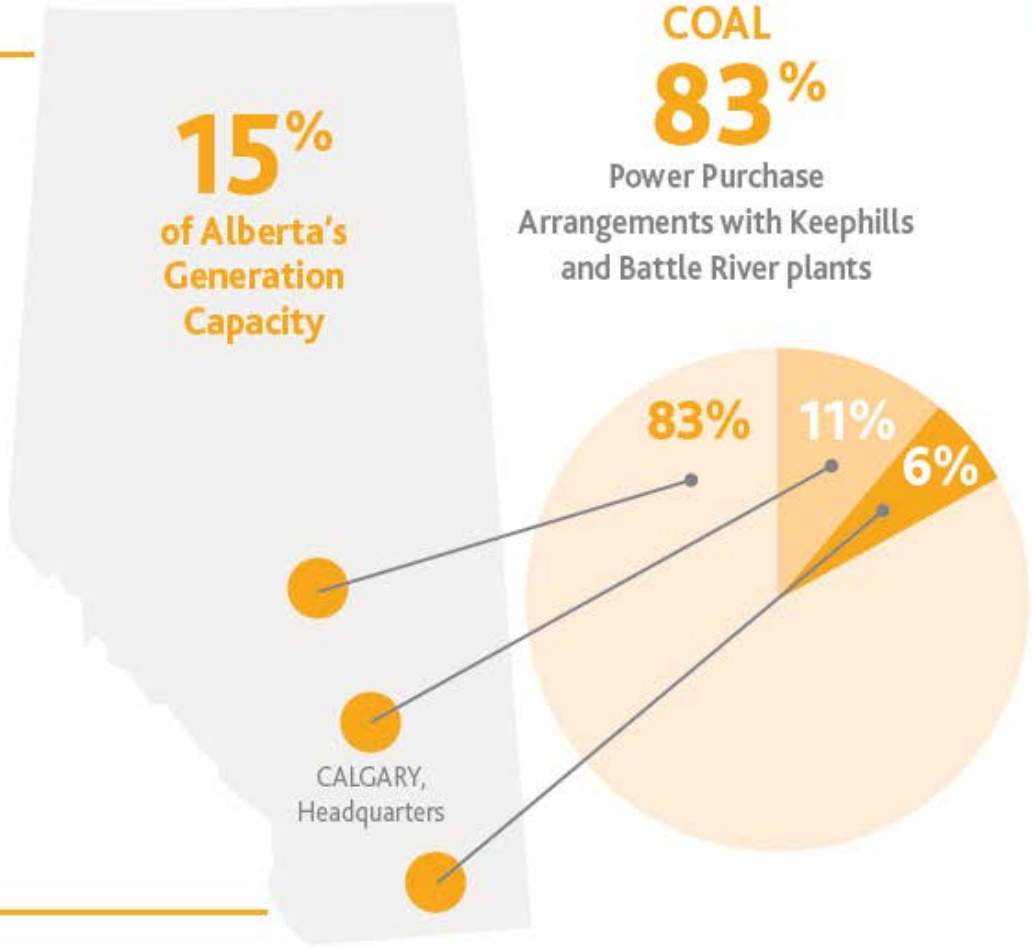
Electricity Sold
20,889 GWh

Kilometres of Wire
8,281

Alberta Employees
~1,800

Total Assets
$4.6 Billion

(as of 2013)

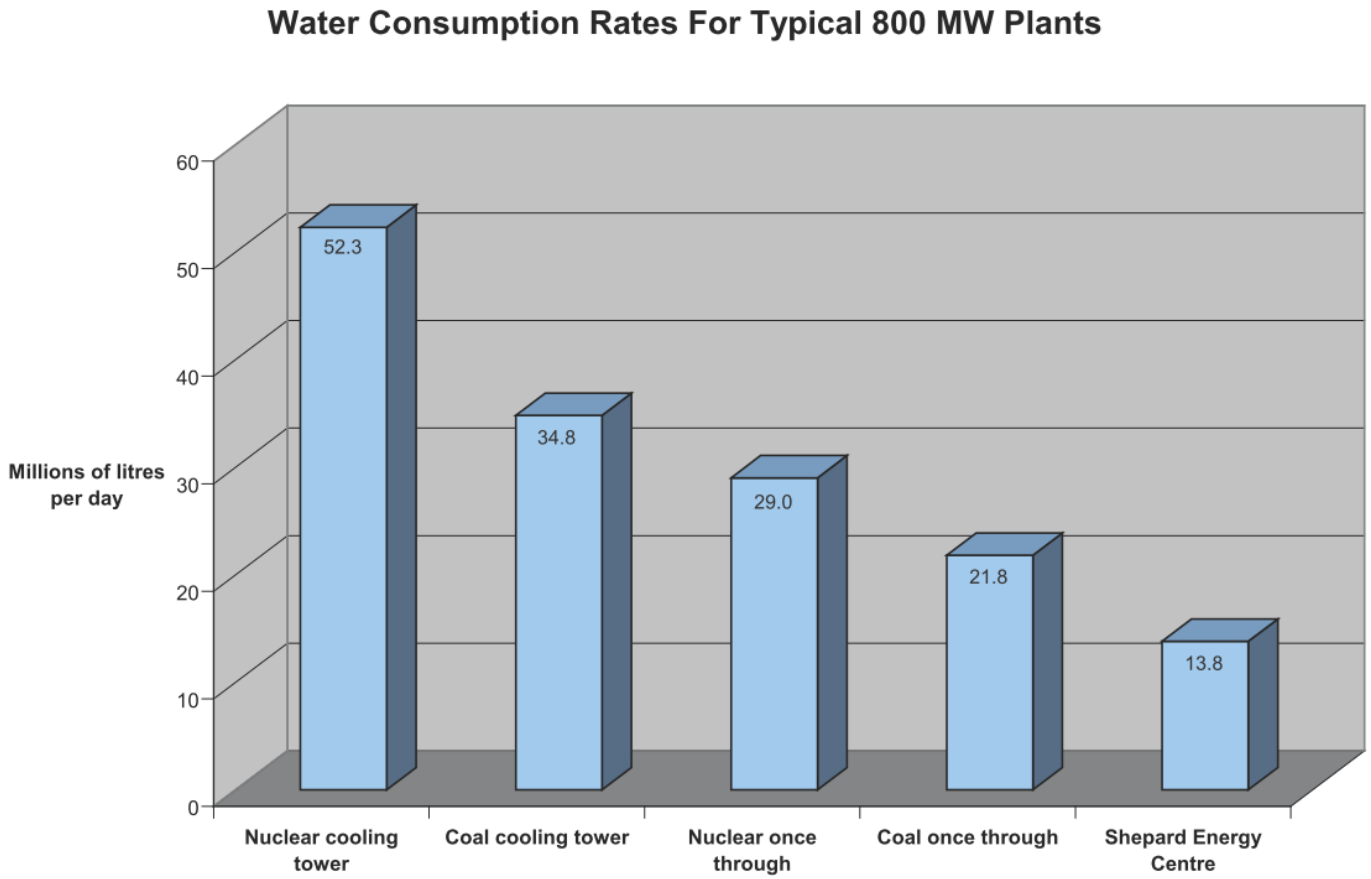


COAL
83%
Power Purchase Arrangements with Keephills and Battle River plants

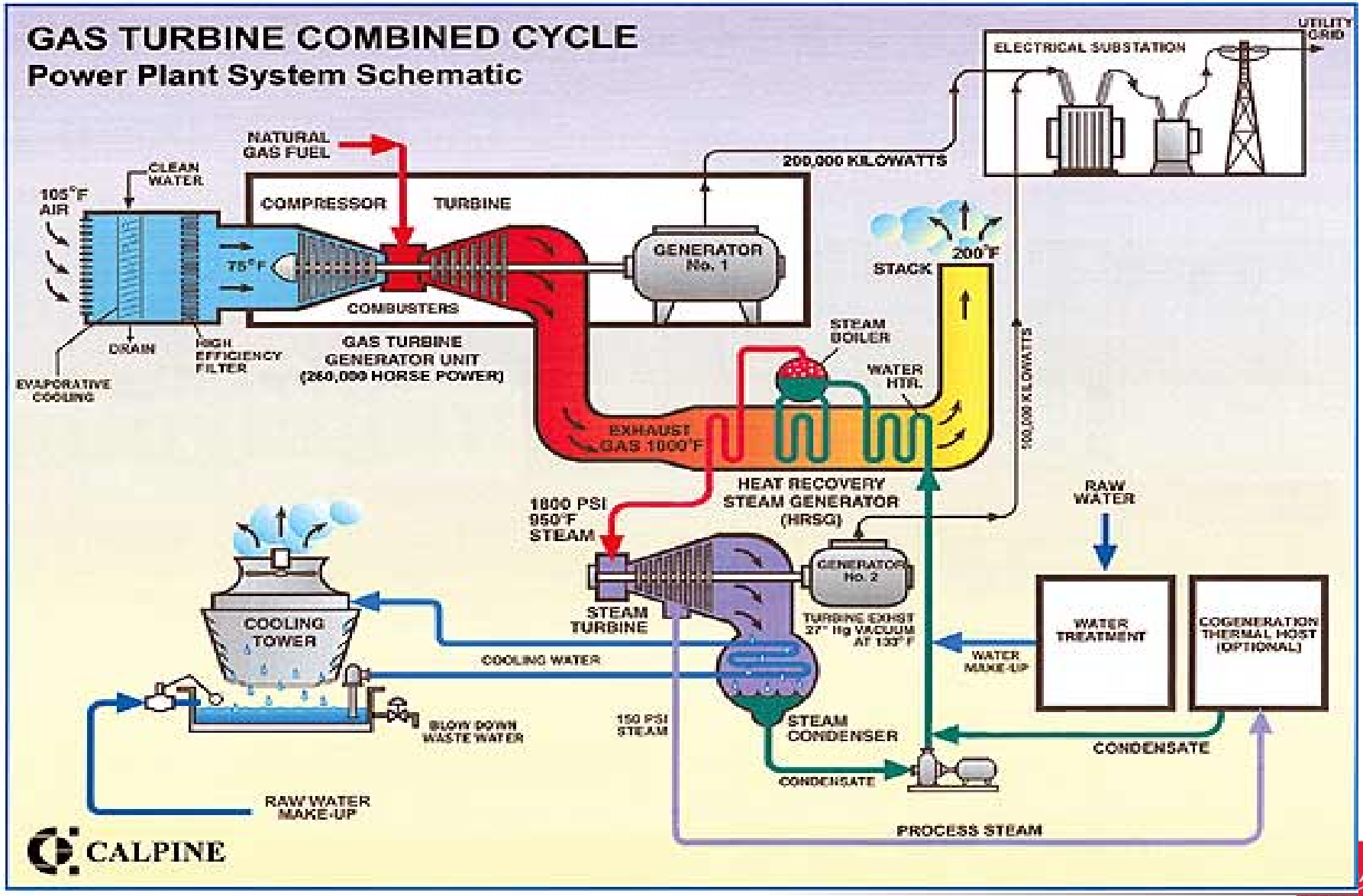
NATURAL GAS
11%
Calgary Energy Centre and Crossfield Energy Centre plants
(100% ENMAX owned)

RENEWABLES
6%
Taber and Kettles Hill Wind Farms
(100% ENMAX owned)
McBride Wind Farm
(50% ENMAX owned)

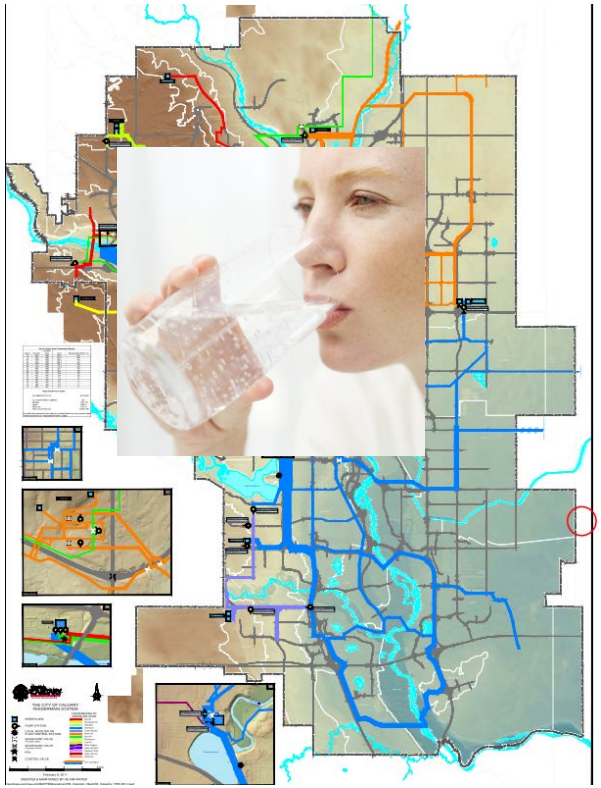
Water Consumption – Comparison to other Thermoelectric Plants



Combined Cycle Power Plant Operations



Cooling Water Source – ‘New’ Water



Potable – City of Calgary Distribution

River Intake

ENMAX Water Reuse Projects

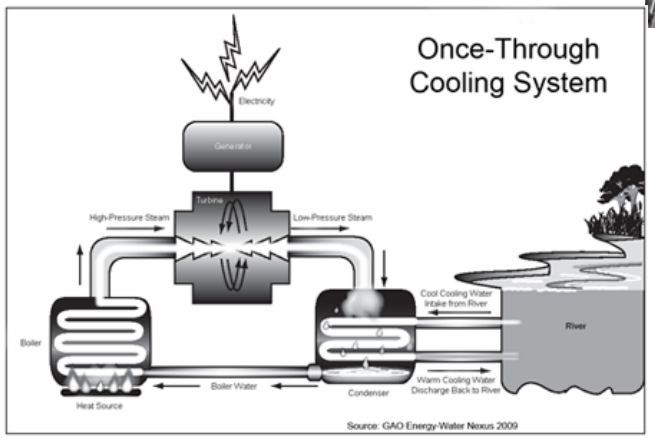
SHEPARD ENERGY CENTRE - INSERT PICTURE

- Located on a 60 acre site on the east side of Calgary in the Shepard Industrial Park, construction began in 2011.
- 1.4 Billion Capital Project
- 800 MW Combined Cycle (2 gas and 1 steam turbine) will meet half of Calgary's current needs.
- To be completed in 2015
- Will be Alberta's Largest natural gas-fired power facility
- Capital Power purchased 50% interest in 2012

Shepard will use reclaimed water piped from The City's Bonnybrook Wastewater Treatment Plant. This water will pass through an on-site water treatment facility before it's used at Shepard.

Shepard - Power Plant Cooling Options

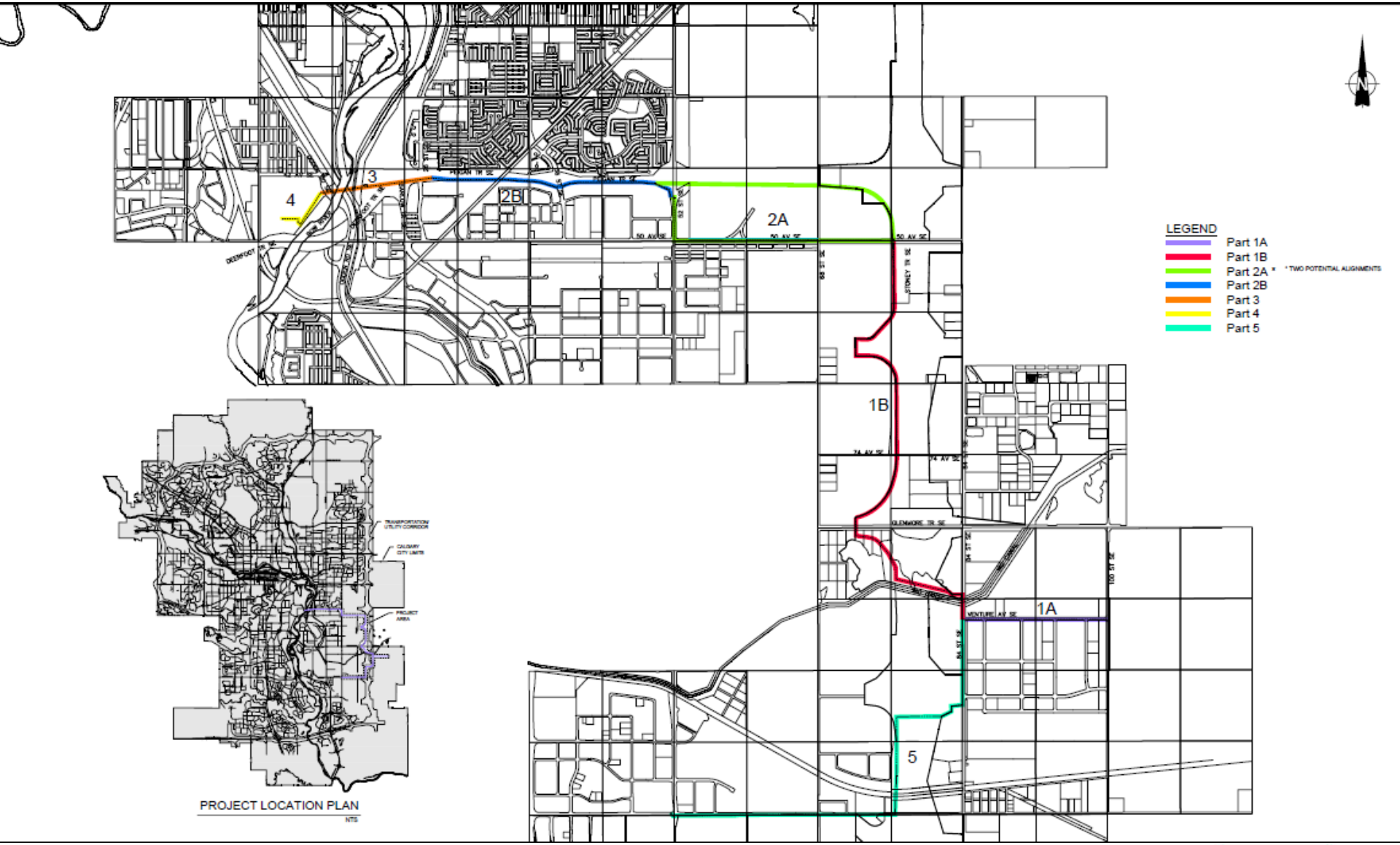
Evaporative Water Cooling



Once Through Water Cooling

Air Cooling


Shepard Energy Centre June 1, 2014


LEGEND
Part 1A
Part 1B
Part 2A *
Part 2B
Part 3
Part 4
Part 5
* TWO POTENTIAL ALIGNMENTS
1A
1B
2A
2B
3
4
5
PROJECT LOCATION PLAN
NTS

Water Re-Use - Benefits

- Environmental
  - Reduced withdrawals
  - Less energy use to create potable water
- Efficiency
  - Better plant efficiency, more power output, less fuel consumption
- Economical
  - Reclaimed water cost less than potable, less energy and infrastructure refiltration effort, defer potable expansions
- Societal
  - System in place for other RW customers

Matching Water Quality To Its Use

- To our knowledge this was the first re-use of Municipal Wastewater for evaporative cooling
  - Traditionally, water has been plentiful so there has been no need to conserve in Canada
  - Common in California since last 1960's
- Large volumes of 'swimming pool quality' water
  - Wasted effort purifying water to potable levels
  - Many river-fed cooling towers have poor water quality
  - MBR-quality water is too expensive
- Reduced diversion from the Bow River
- In line with Alberta Government Water for Life and City of Calgary's 30 by 30 plan

Water Re-use – Plant Consumption

- Typical 13-15 MLD with peak flows > 29 MLD
  - 96% of incoming water used for evaporative cooling
  - 80% evaporated/20% returned
- 4% for other uses
  - Boiler feed water, backup landscape irrigations
  - Fire tank
  - no fixture flushing, drinking, showers
- Plant uses ‘river discharge quality’ water

Water Re-use – Permitting Obstacles

- Alberta permits re-use under Stormwater Drainage regulation
  - Can use municipal wastewater to irrigate crops only
  - All other applications require approval from the Director
- No government staff assigned to this specific application process
- Easier to get approval for filtered/potable water
- Other Regulations and Codes do not contemplate re-use
  - Plumbing and Building codes - No city Standards in place for reclaimed water systems i.e.- led to custom manhole covers must use cistern for fixture flushings reclaimed water not allowed.

Water Re-use – Permitting Obstacles

- AUC looks to ESRD to Approve environmental components of projects , however ESRD wants to issue approval after AUC Ruling
- ESRD regulated cooling towers: to report real time disinfection levels
  - Its cumbersome and extra work compared with raw water… which might be worse water quality
- Water licences are not clear on the use of water after treatment
- No known environmental policies on the topic – leads to more time and more studies and more explaining

Other Challenges

- No storage in system
  - 0 to 29 MLD
  - Temperature dependent flow
  - 3 duty/1 SB VFD pumps
- Custom-ordered pipe and accessories

ENMAX Water Reuse Projects

BONNYBROOK ENERGY CENTRE

- ENMAX Energy Corporation is proposing to build and operate a 165 megawatt (MW) natural gas-fired cogeneration facility located on the Canada Malting site at 3316 Bonnybrook Road SE in Calgary.

- The Bonnybrook Energy Centre would be a cogeneration or combined heat and power (CHP) facility which generates electricity and captures and uses otherwise wasted heat energy by-products.

Future Bonnybrook Energy Centre – Water Reuse

- Combined (co)generation with malting operation
- Host uses large amounts of heat and water
- Host has water licences, but high costs of water treatment
- An MBR is constructed at the Malting site – improving water quality for reuse.
- Cogen Plant will provide heat to DE System and power to grid.

To Stimulate Water Reuse in Industry…

- Government of Alberta will need to decide whether it will make the use of reclaimed water a policy-making priority
- ESRD will need standard specifications for reclaimed water (coliform counts, level of treatment)
  - Look to other jurisdictions (e.g. California and Australia)
  - Look at temperature variations and how that impacts nutrient levels
- Will need standard terms for Approvals
  - treatment levels needed when receiving the water

- ESRD and Licence holders should determine how to address the use of reclaimed water in water licences.

Conclusion

- Use of reclaimed water or reuse of water in an industrial setting makes senses as it matches quality with use
- Practical and regulatory barriers do exist and these barriers make it difficult to justify using reclaimed water
- ENMAX was successful with two projects in using reclaimed water – however, it took considerably more effort than just using potable water
- With some policy and or regulatory changes, water reuse or use of reclaimed water can be encouraged, at the same time knowing the environmental impacts of its use.