QUEST Alberta
Webinar Series – Southwoods Sustainable Community Energy System

Moderator: Magdalena Muir, Arctic Institute of North America

Presenters:
- Simon Knight, President and CEO, C3.
- Bruce McFarlane, Christenson Developments Ltd.
- Michael Roppelt & Stuart Vaughan, GSS Integrated Energy
- Doug Wood, Clearflow Enviro Systems Group.

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Quality Urban Energy Systems of Tomorrow (QUEST)

• National non-profit founded in 2007 by all levels of government, industry, academia and ENGOs.

• Mobilize governments, utilities, real-estate sector, energy industry, regulators and professional services to create and apply Integrated Community Energy Solutions (ICES).

• ICES are about creating smart energy communities by linking energy across land-use, buildings, transportation, water, waste and related infrastructure.

www.QUESTcanada.org/
QUEST Alberta Caucus

• QUEST Alberta Caucus provides information for and supports the implementation of Integrated Community Energy Solutions (ICES).

• Participant base of roughly 100; 15-20 attend quarterly meetings;
  – Chair Simon Knight, President & CEO of C3.

• Host webinars to provide an active forum to share information, experiences, and best practices.
SOUTHWOODS SUSTAINABLE COMMUNITY
ENERGY SYSTEM: BUILDING ALBERTA'S
HEAT STORAGE INDUSTRY

Bruce McFarlane, Christenson Developments,
Michael Roppelt, GSS Geothermal,
and Doug Wood, Clearflow Enviro Group
SOUTHWOODS COMMUNITY

Sustainable and Resilient Development
Christenson Developments is redeveloping Southwoods’ 19-acre townhome rental community increasing densification by building seniors’ apartment complexes, and relocating townhomes requiring upgrades to the services infrastructure and energy efficiency retrofits to the existing townhomes.

installing a cogeneration-BTES integrated system to meet electrical, domestic heating, cooling and hot water supply suitable for over 400 residential units.

Southwoods Sustainable Community Energy System
CHP + BTES Integrated Energy

- Natural Gas Cogeneration will be used to meet power and heat needs of 424 residential units
- Multiple CHP units and borefields
- Install and operate in phases: test the operational profile of the first CHP unit and the delivery of heat in the first BTES.

Power Ecosystems will be supplying reciprocating Cummins powered Ener-g CHP prepackaged units.
BTES Design and System Details

BTES optimizes the value of the CHP by storing the heat generated when there is less or no demand and retrieving it when required.

- Analogous to a rechargeable battery as it can absorb, store or supply thermal energy on demand.
- Sequence of vertical boreholes at various depths in a strategic array designed to reduce thermal losses.
- Advanced controls manipulate the transfer of energy to multiple thermal zones to reduce or eliminate short term storage tanks.
- Thermal distribution network to heat pumps operates at low temperatures, reducing thermal losses.
- The heat distribution system will total 1,100m and deliver heat through treated recycled grey water.

GSS Integrated Energy
Phase 1: Preliminary Site Evaluation

TCT began in April 2012 involving:

- Direct measurement of the continuous cores to 67m (225’) borehole
- Core recorded by using the log sheets to record the core size, geology, locations, and any features, which have engineering significance.
- Additional production and monitoring wells were also completed to validate modeling.
Thermal Conductivity Testing & Enhanced Ground Response Testing

GSS will contribute in the development of protocols for the industry standards of thermal conductivity methods specific to BTES.

GSS is building consistent numerical models.

3D Finite Element Modeling of BTES aimed at evaluation of heat capacity and losses of BTES.
Thermal Conductivity Testing
Build Out Next Steps

- **Phase 2**: move townhouses, build first 2 apartment buildings, install first CHP unit and borefield in 2013

- **Phase 3**: build central apartment building, install additional CHP and borefield

- **Phase 4**: Build last 2 senior’s complexes, install additional CHP and borefield
Other Sustainability Components & Benefits

Distributed electrical smart micro-grid technology.
Integrated solar thermal and PV peak load energy delivery
Treated storm water and grey water reuse
Working with local technology providers, service companies, academia, and 3 levels of government

- 60% GHG emissions reduction
- 90% NOx and SOx reduction (compared to Alberta coal fired grid-connected power)
- ~ 60% potable water use reduction
NEXT STEPS FOR THERMAL STORAGE IN ALBERTA

- Christenson looking to replicate this model in other communities throughout Alberta
- C3 wants to encourage the further development of the heat storage industry
- Southwoods moves the yard stick in striving towards QUEST’s vision of realizing integrated energy systems in communities across Canada
Clearflow Enviro Systems Group

- Privately owned Canadian company in Sherwood Park began 2005
- Manufactures proprietary products for water treatment, sediment, dust and soil erosion control
- Manufactures Patented and Patent-pending mechanical water treatment processes for industrial and/or high contamination situations
- Core Focus - Help industry clean dirty water allowing it to be released or re-used
- ASRT - Accelerated Solid Removal Technology – quickly/safely remove solids and contaminants from water to save money and footprint
- Completed projects in Canada, USA, Mexico, Middle East and India
- Highly trained team of Engineers, Chemists, Implementation Specialists.
- **Key advisory board** – Dr Greg Goss PhD Executive Director U of A Water Initiative, Dr Edyta Jasinska PhD Dept Biological Sciences U of A, Dr Anne Naeth PAg, PBiol Director Land Reclamation and Restoration Ecology U of A
Population Growth 2008-2043, Edmonton and Area

Source: CRB and Alberta F&E projections
The diagram illustrates the water infiltration and runoff for different types of land cover:

- **Natural Ground Cover**:
  - 40% evapotranspiration
  - 10% runoff
  - 25% shallow infiltration
  - 25% deep infiltration

- **10%-20% Impervious Surface**:
  - 38% evapotranspiration
  - 20% runoff
  - 21% shallow infiltration
  - 21% deep infiltration

- **35%-50% Impervious Surface**:
  - 35% evapotranspiration
  - 30% runoff
  - 20% shallow infiltration
  - 15% deep infiltration

- **75%-100% Impervious Surface**:
  - 30% evapotranspiration
  - 55% runoff
  - 10% shallow infiltration
  - 5% deep infiltration

Changes in land use, such as changes in geomorphology and hydrology, changes in stream hydraulics, changes in function such as habitat, sediment transport, and storage, and changes in population, composition, and distribution, can affect the water cycle and urban water quality.

Source: FISRWG 2001

Clearflow Enviro Systems Group
Clearflow Improves Water Quality for Reuse, Release

**Suspended Solids Reduction**

**Nutrient Reduction**

**Chlorophyll A Reduction**

**Metal Reduction**
- Aluminum & Barium
- Nickel, Zinc & Copper
- Lead, Chromium, Selenium & Arsenic

Enviro Systems Group Inc.
MUNICIPAL – Unique Water Reclamation
Creating Sustainable Communities

Clearflow’s Sewer Treatment systems provide Water Reclamation, Storage and Reuse for Toilets in New Apartment Buildings.

Joint Canadian government and private initiative. Builder is increasing density from 340 people to 1200 without increasing water infrastructure.

Savings on infrastructure: $5,000,000

Cost of Clearflow System: $700,000

Yearly Consumables: $50,000

Environmental Savings: TBD

Recycling 100M³ (26400 US gals/day)
35% potable water savings from local water grid, and builder gets own utility.
MUNICIPAL – Water Treatment (India)

In the 1960s the Buddha Nala waterway was a seasonal freshwater stream and source of drinking water teeming with 56 species of fish and supplied water to locals. Today it is a thick sludge-like black water, made up of industrial discharge, sewage and runoff water from the city of Ludhiana, aquatic life is destroyed, locals becoming sick or dying from its use.*

Spent to Clean without success over 10 years:
$94.25M

$50M Contract Currently Failing!
Only 40% reduction of BOD (Bio oxygen demand)

Clearflow Testing November 2012:
Reduced BOD by 96% and all other requirements

* The Punjab Agricultural University found in 2008.
INDUSTRIAL SYSTEMS up to 100M$^3$ Daily

**Hydro-Carbon Contaminated Water**
Oilfield pipe cutting plant facing **shutdown orders** due to compliance scrutiny after failure of treatment systems. Clearflow provided permanent installation solution.

**Alternative:** Haul contaminated water: (100m$^3$ x $85/m^3$ x 312 days)
Yearly Cost  $2,652,000

**Compliance Failure:**
Shutdown + fines  $250,000

**Clearflow System:**  $350,000

**Yearly Running Cost:**  $50,000

**Savings Year One:**  $2,250,000

**Yearly Savings:**  $2,600,000
Clearflow Water Treatment Micro System, Potash Plant

Clearflow Inline Water Treatment Systems

Delivery of an in-line water treatment system designed for a Potash Plant in Saskatchewan. Designed to treat as well as remove solids and algae within the plant process water to reduce scaling in the boiler units.

Clearflow’s Patent-pending Inline Canister PR5 System
Questions
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