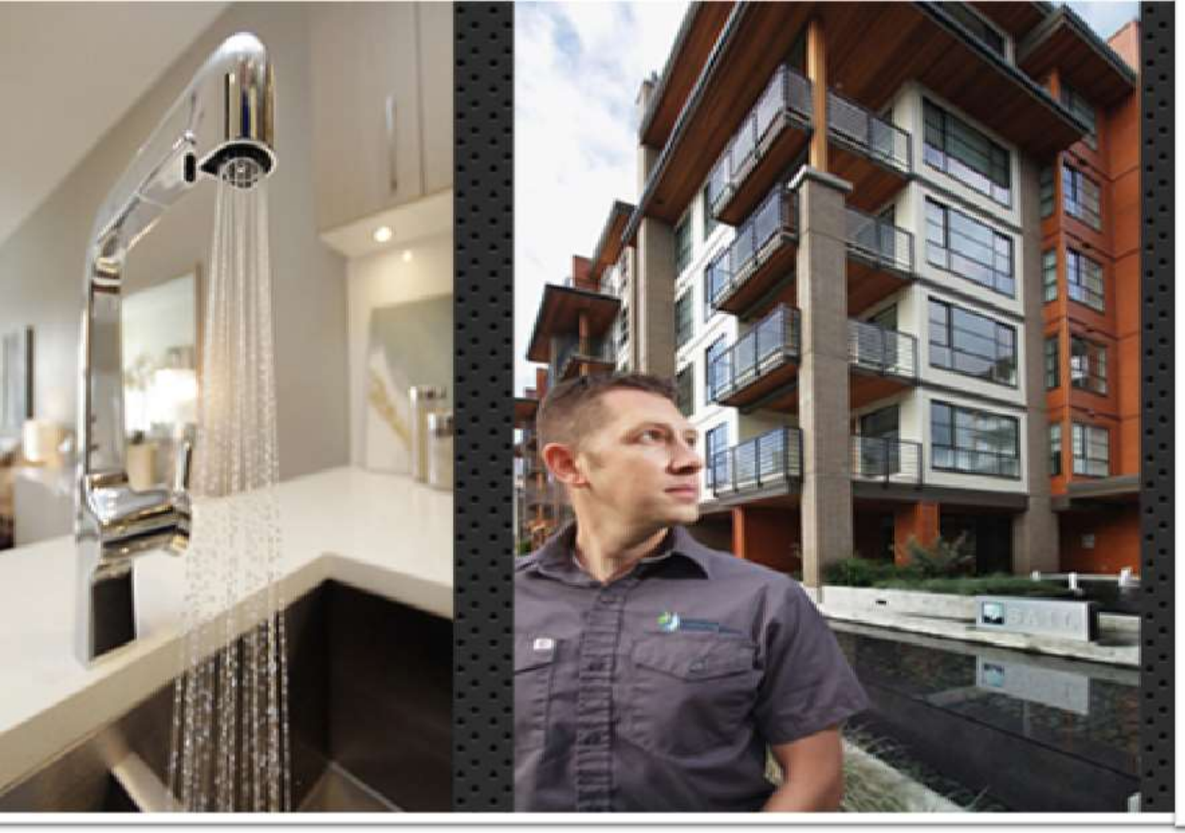
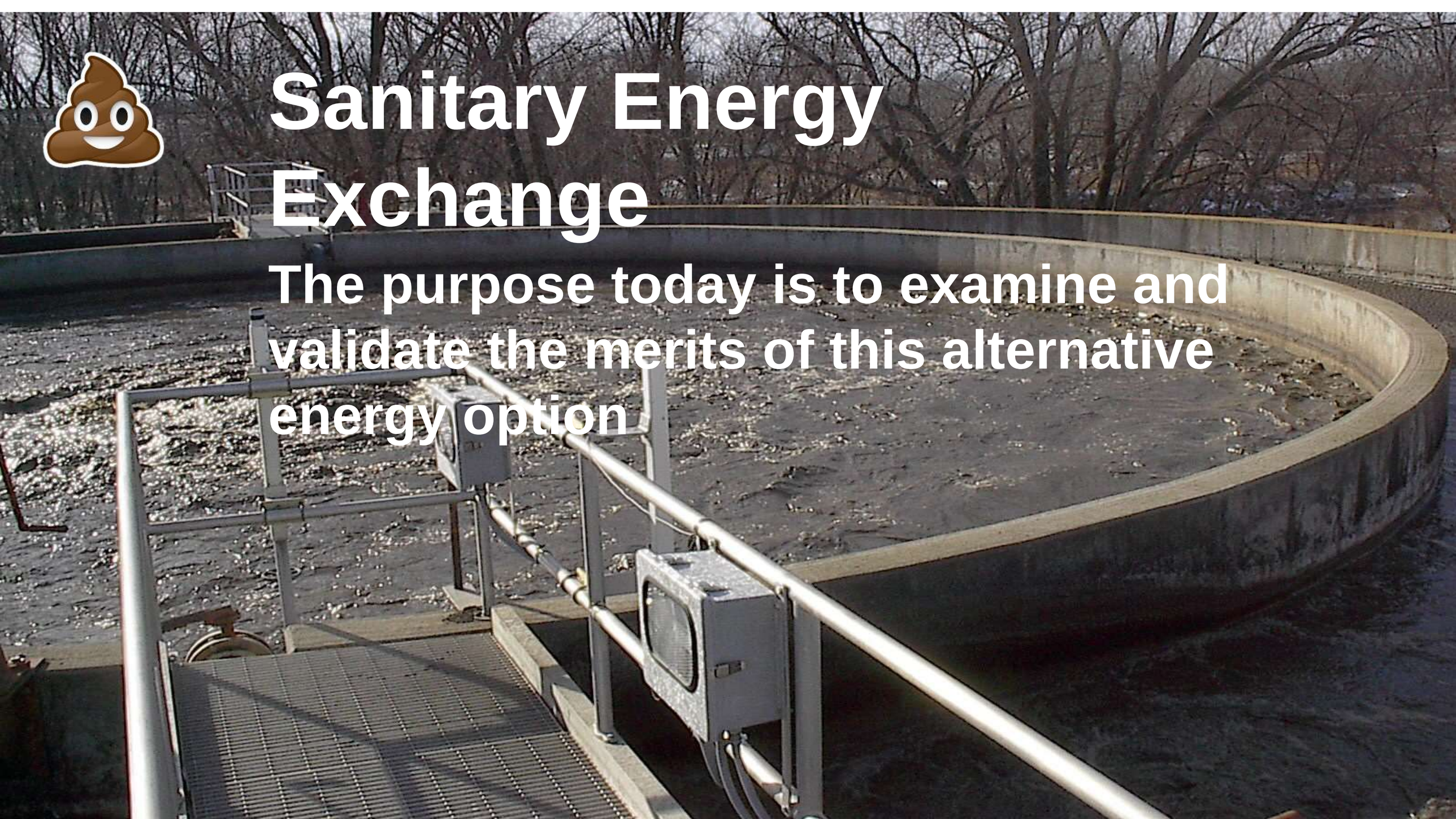


Energy Exchange Opportunities Leveraging Building & Municipal ~~Wastewater~~

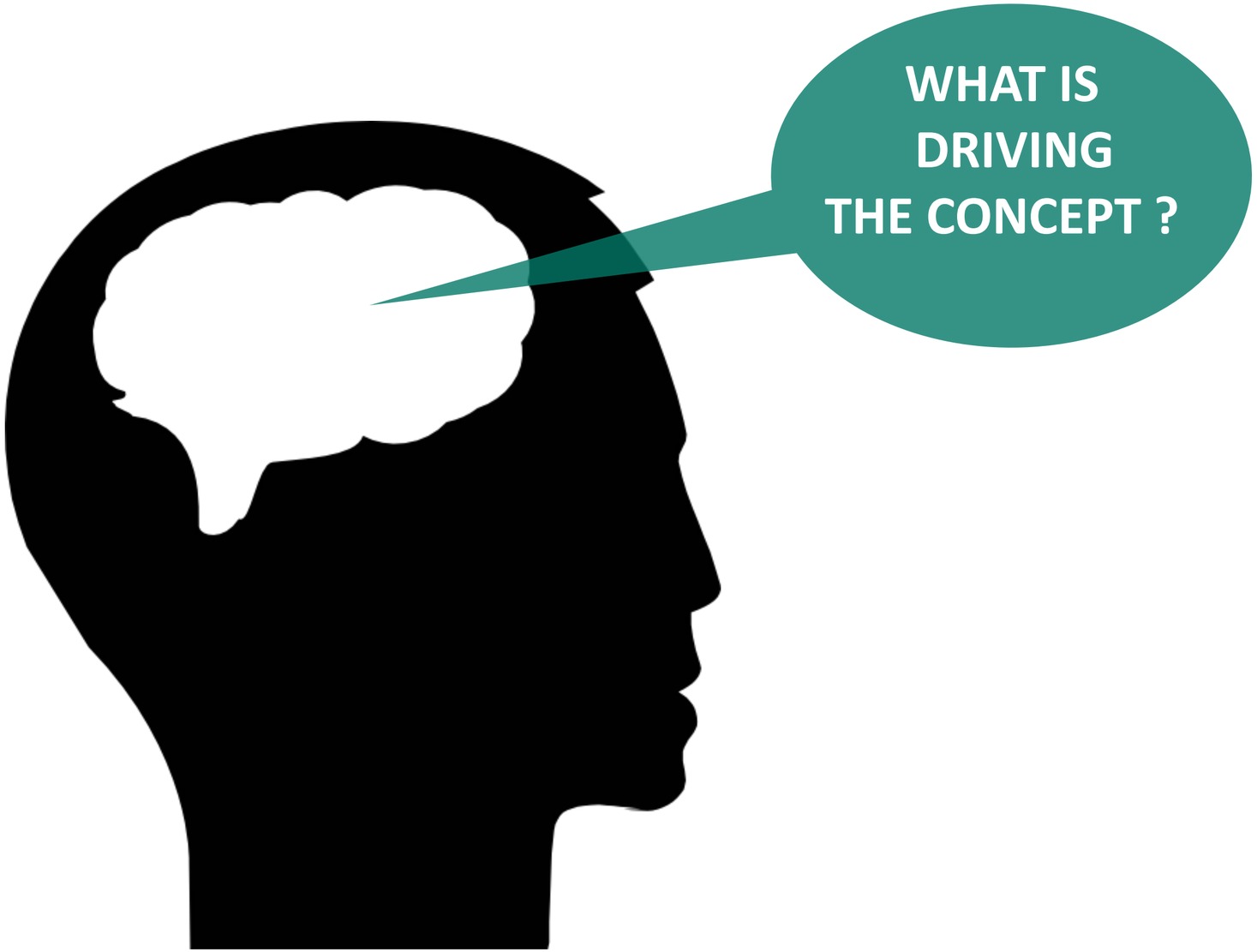
Energy Exchange Opportunities Leveraging Building & Municipal **Sanitary** Water

International Wastewater Systems



Sanitary Energy Exchange

The purpose today is to examine and validate the merits of this alternative energy option


WHAT IS
DRIVING
THE CONCEPT ?


There
is no
Planet B!


CO2


Water
is life

How much energy is available?

“350 billion Kw-Hrs worth of hot water are discarded annually through drains in the United States”

– US Department of Energy

Value of the Energy in Sanitary Water

350,000,000,000 Kw-Hrs annually

Therm equivalent ~ 12,000,000,000

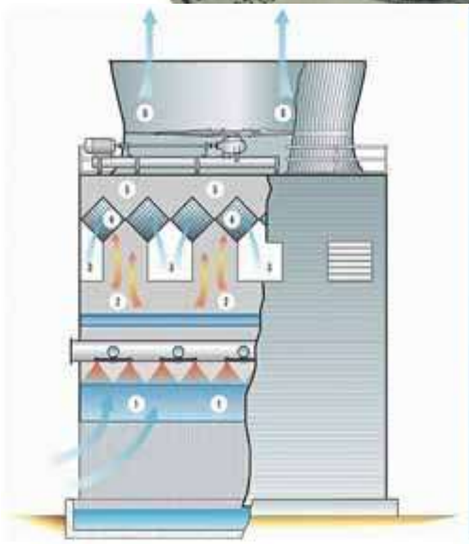
Natural Gas @ $0.80 / Therm

= $ 9.6 Billion Annually

CONVENTIONAL AC

Heat-Rejection

Cooling Towers



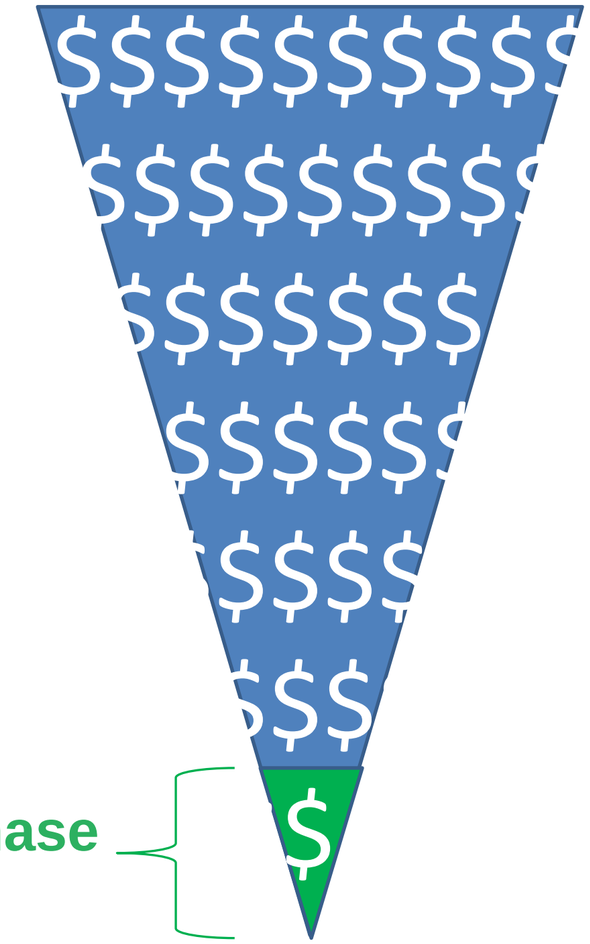
MUNICIPAL SANITARY AC

Heat-Rejection

Eliminates Cooling Towers;

- ✓ Leverages previously used water
- ✓ Eliminates primary make-up water
- ✓ Eliminates evaporation plume
- ✓ Eliminates chemicals for water-treatment
- ✓ Eliminates mechanical fan energy
- ✓ Eliminates airborne radiated sound
- ✓ Reduces AC Energy Operating Costs
- ✓ Disease – Legionella

Life-cycle Cost - Owning & Operating a Cooling Tower



Initial Purchase

Electricity

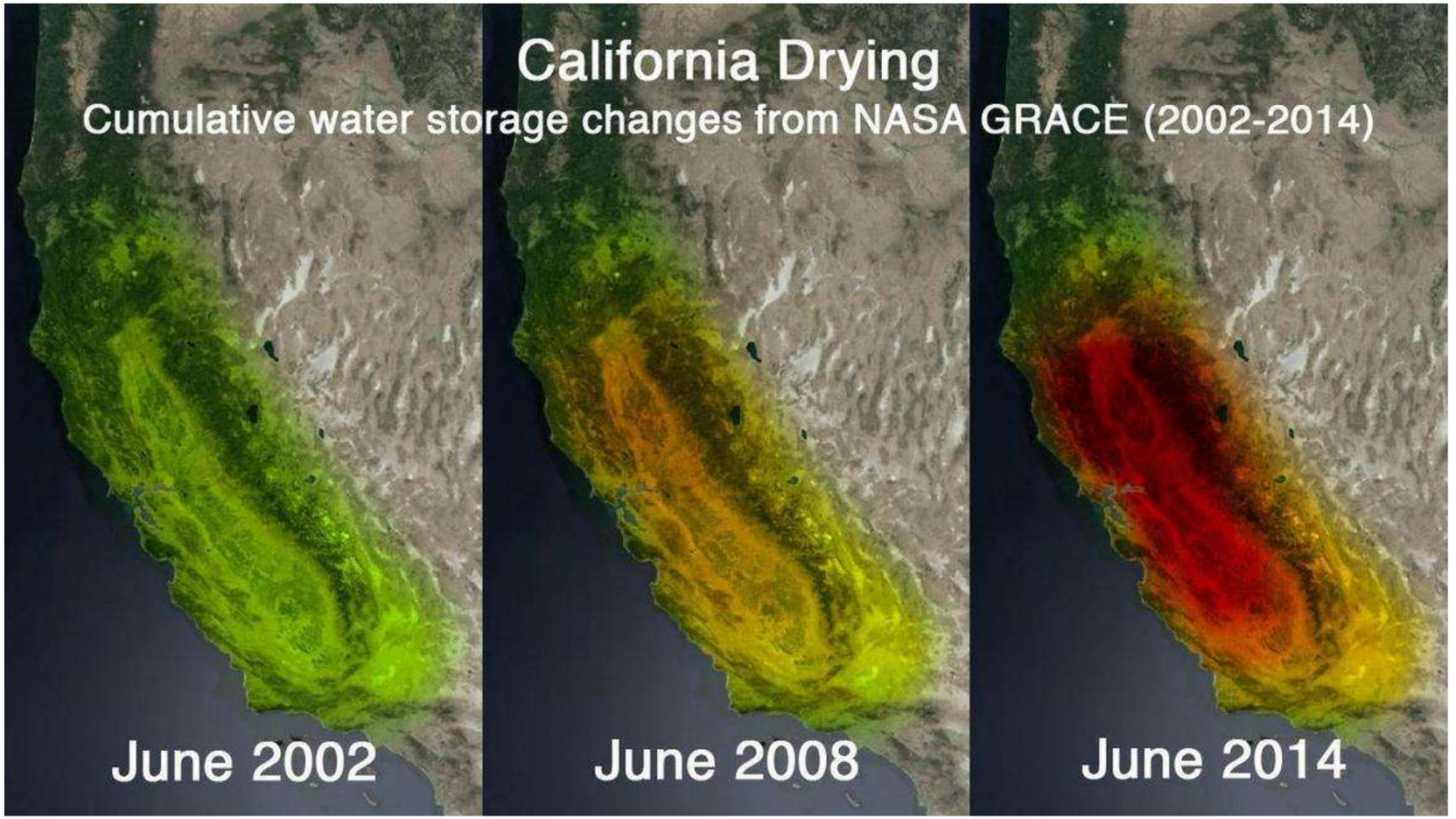
Make-up Water

Chemicals

Maintenance

Repairs

Sound Abatement



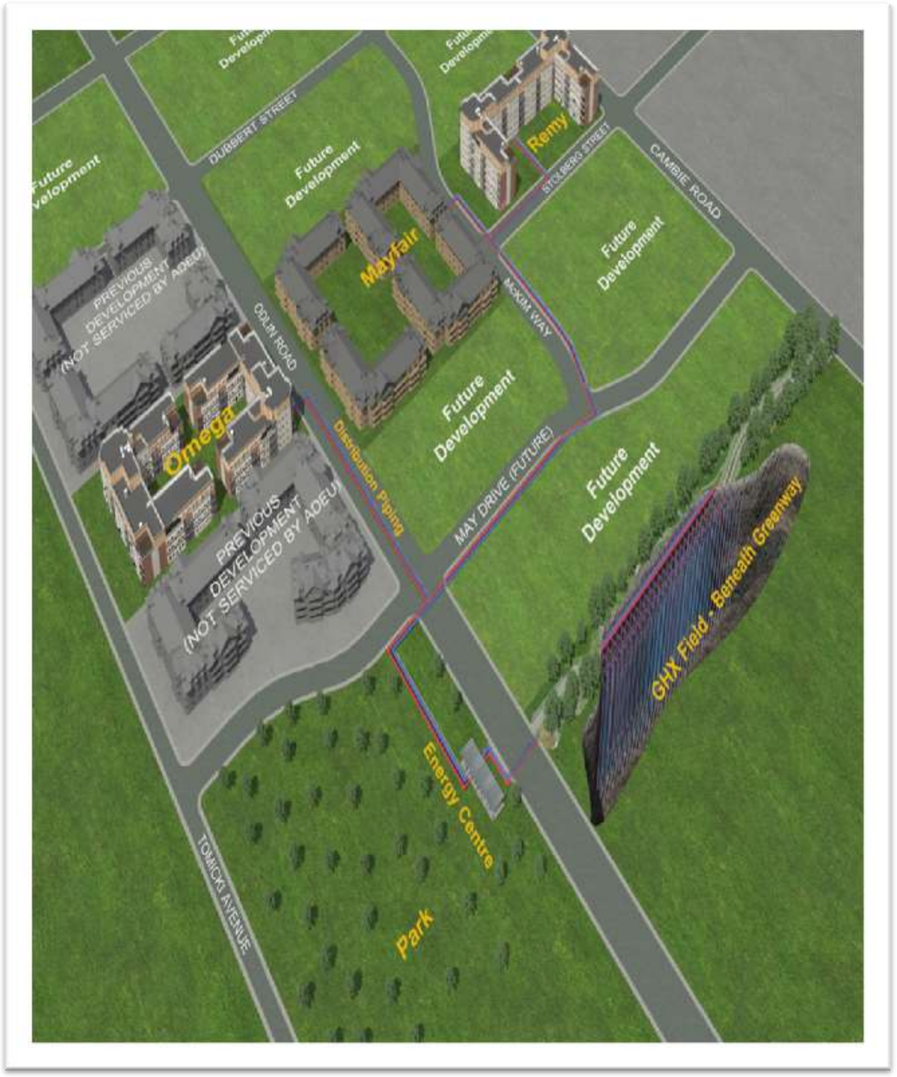
Courtesy LA Times;
http://www.latimes.com/science/sciencenow/la-sci-sn-california-drought-groundwater-satellite-20141002-story.html

Table A1: Total Ontario generation, and related CO_2 emissions, in hour preceding 05:03 EST on Nov 19 2015

FUEL	MWh	CO_2, tons
Nuclear	9,550	0
Hydro	2,978	0
Gas	833	408
Wind	886	0
Biofuel	22	12
Oil & Gas	0	0
Solar	0	0
TOTAL	**14,269**	**420**

CO_2 intensity per kWh (CIPK) in the last hour: 29.43 grams.

- 350 Bedroom Mixed-use MURB – TORONTO
- Water @ 40 Gal / Bedroom / Day
- 30 % = DHW
- SCENARIO A
  - **90% Eff Ngas DHW Plant**
  - **67,425 Kg CO2 = 100% Annual Load**
- SCENARIO B
  - **Hybrid 4.0 HCOP / 90% Eff Ngas DHW**
  - **80 / 20 Load-share (HP / NGas)**
  - **15,438 Kg CO2 = 100% Annual Load**
- **B versus A**
  - **75% + Reduction Kg CO2 Emissions**



Alexandra District Energy Utility
Richmond B.C.

Advantages of District Energy

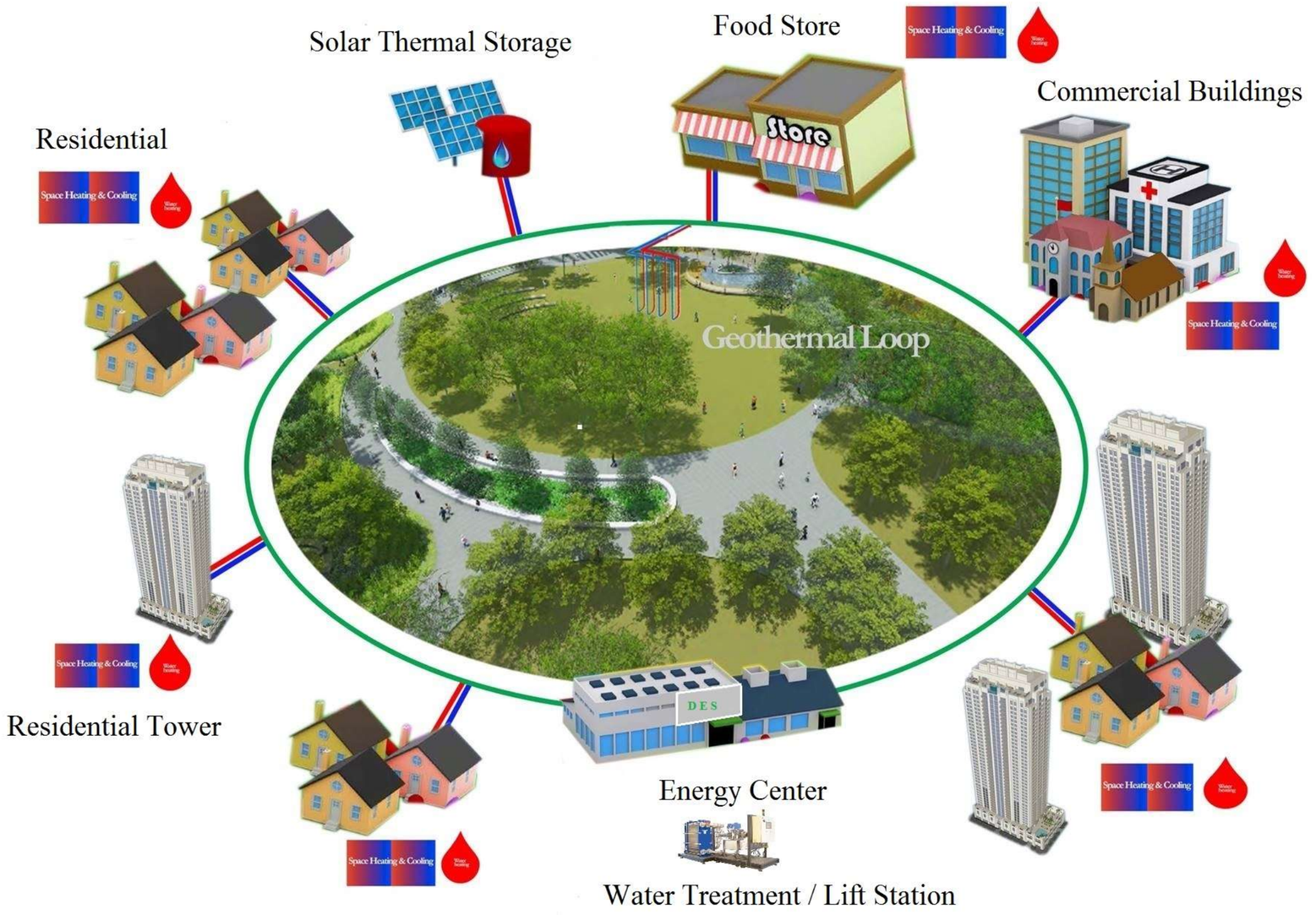
Low-carbon, Sustainable Energy- Multiple buildings connected to more sustainable sources

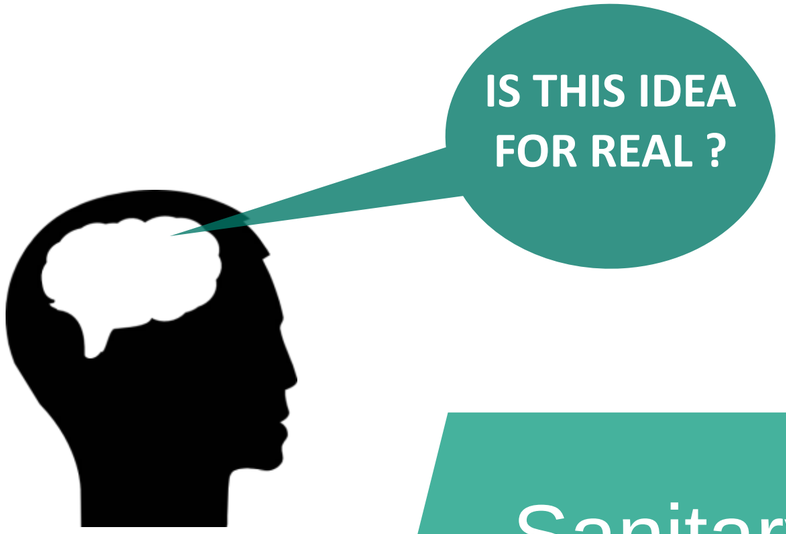
Affordable Energy – More stable and cost competitive prices

Fuel Flexibility –It's possible to switch to different fuel systems, and take advantage of future innovation

Lower Building Costs / Higher Revenue
Less HVAC equipment for each building and more usable space

An opportunity to share energy amongst buildings





Sanitary Water Heat Exchange Technology

Off-Line Energy Exchange

In-Line Energy Exchange

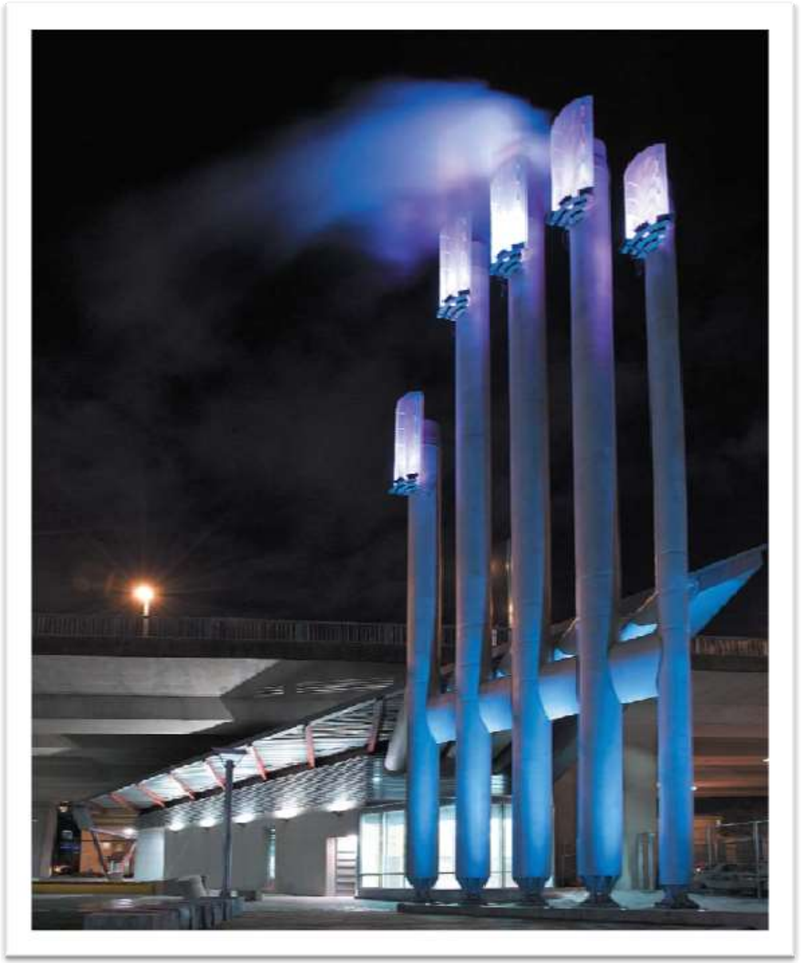
Direct Heat Pump Energy Exchange

PUBLIC SECTOR

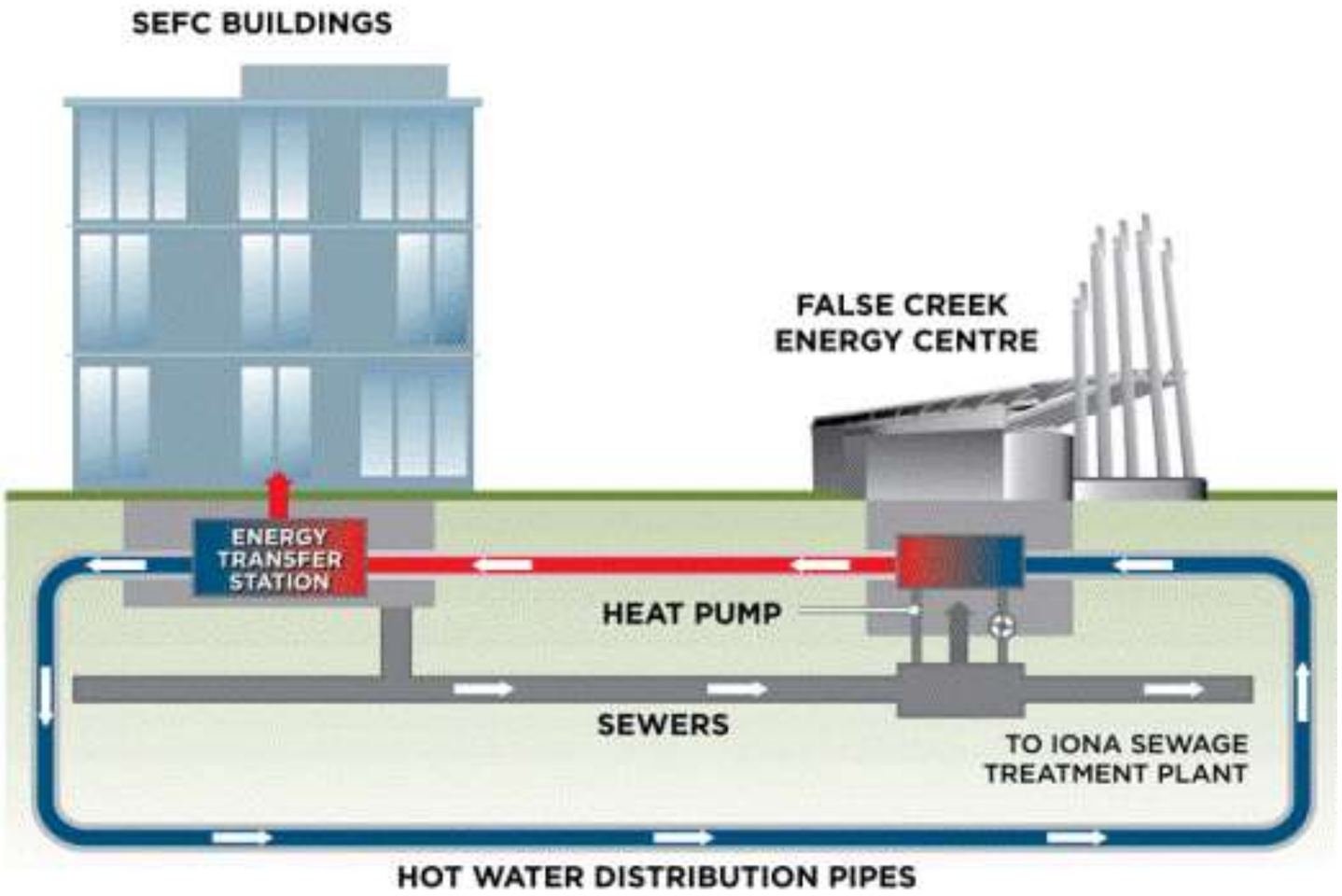
False Creek Energy Centre – Vancouver, BC

1st large-scale wastewater heat recovery system in North America

$42 M publically funded project completed in 2010



False Creek Energy Centre – Vancouver, BC



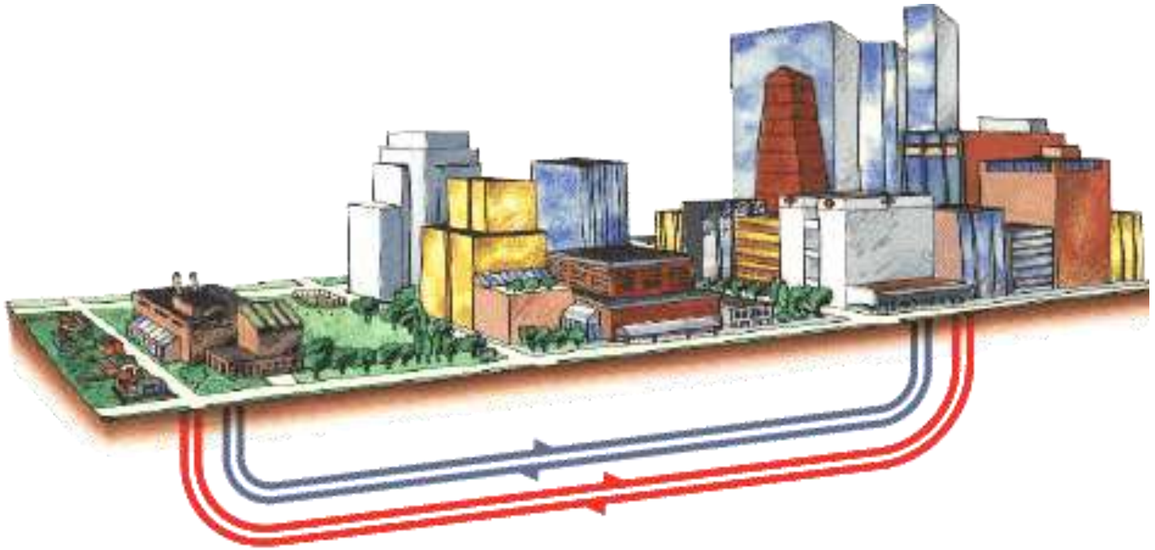
FALSE CREEK ENERGY CENTRE - How it works

Supplies 70% of annual energy demand

62% GHG reduction

Natural gas boilers for back-up and peak heat

Richmond



April 2014 –
Richmond City council approved agreement for new energy district in the Oval Village city center

Sanitary heat exchange has been selected as the main source of heating energy

HELSINKI, FINLAND

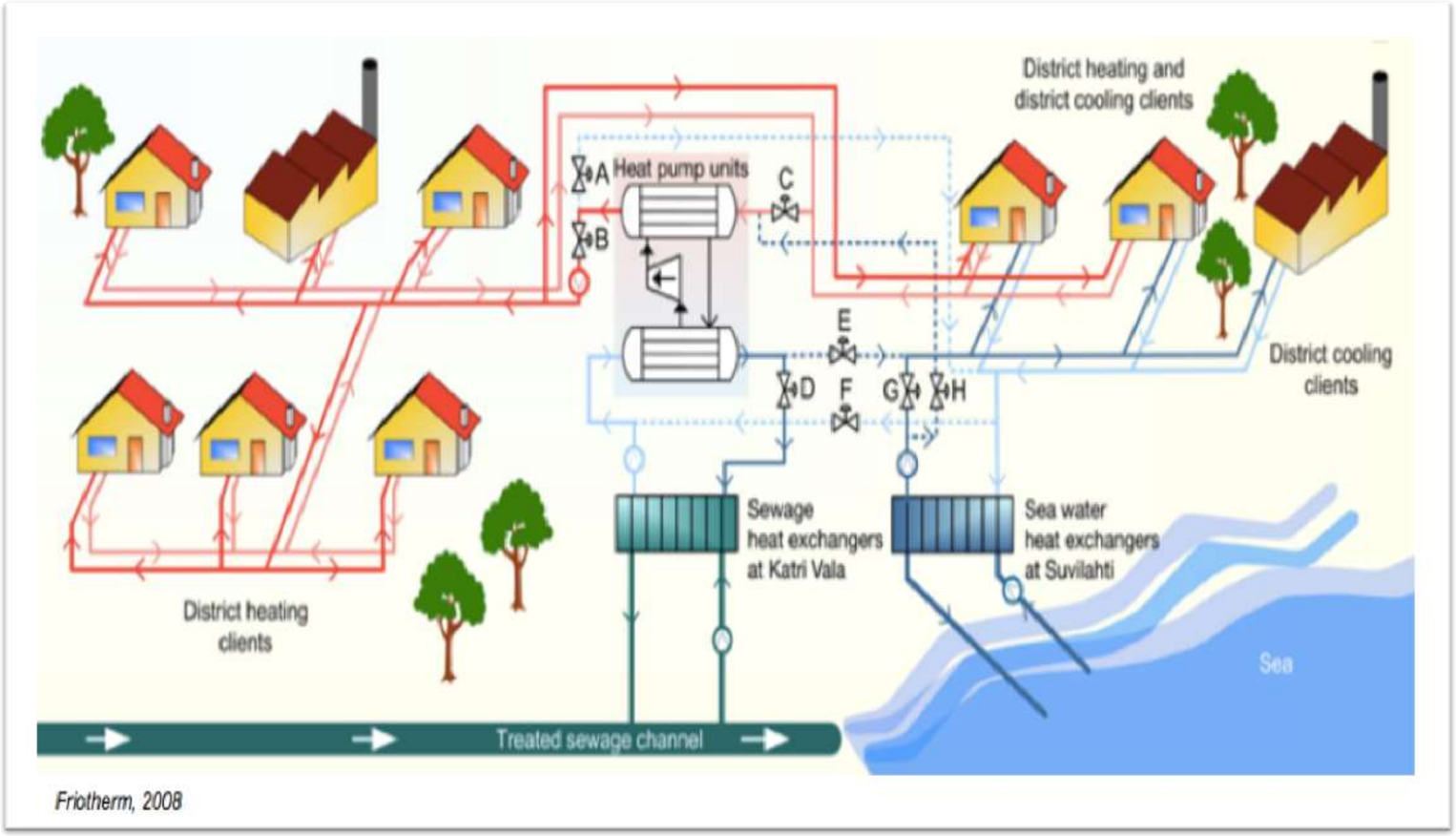
Chose Central Heat Production and District Heating in 1953

District Cooling added 1998

Sewage heat recovery added as a fuel source in 2006

Helsinki Energy, Finland

Katri Vala
Heating and Cooling Plant



District Heating

Connected capacity 3,300 MW with over 14,500 connections

Covers 90% heat demand of the city

District Cooling

135MW
250 Connections

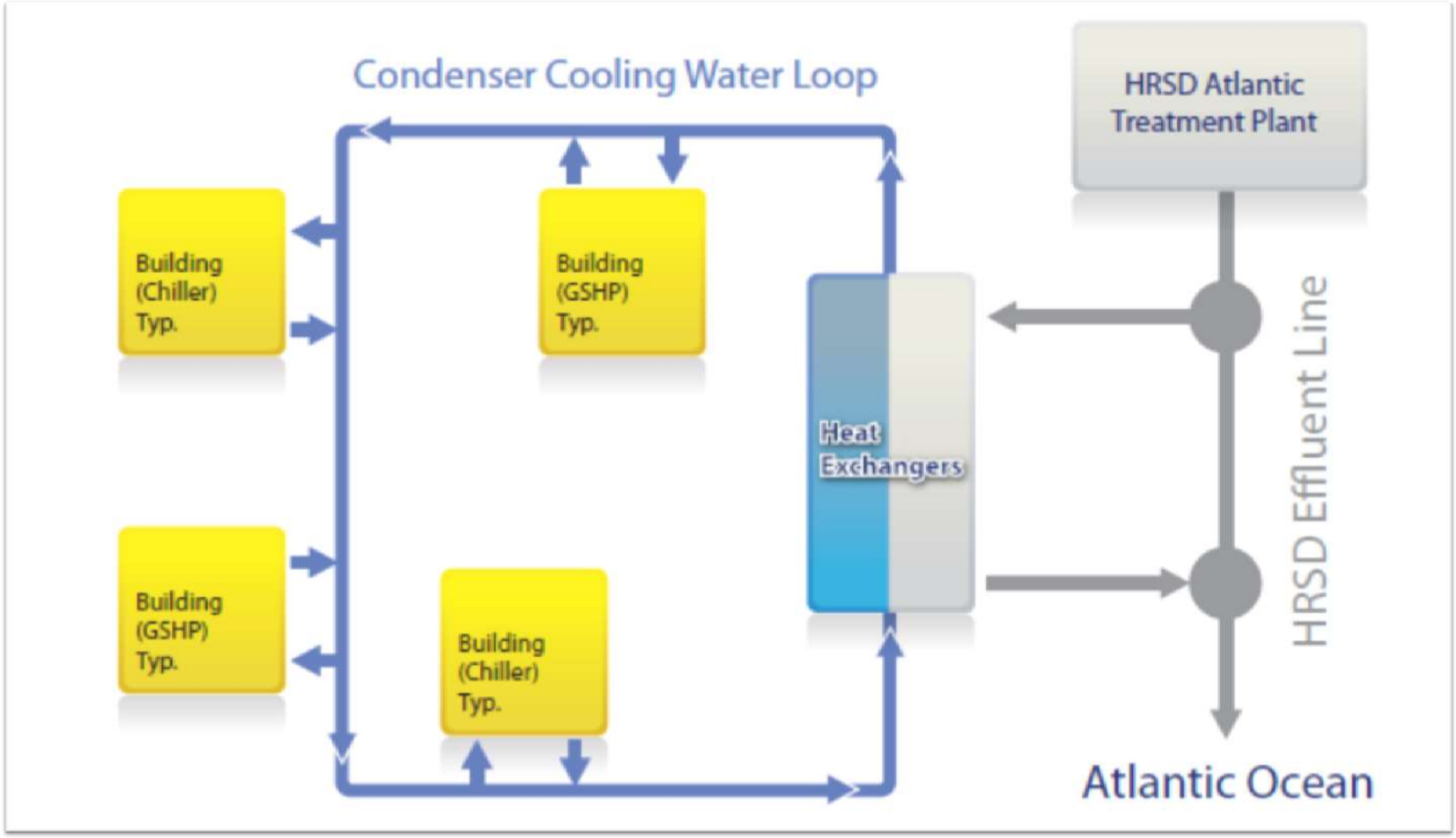
Dam Neck Naval Base, Virginia Beach

4400 Tons Heat Rejection

Displaced large GSHP-concept

$2.5M annual energy savings

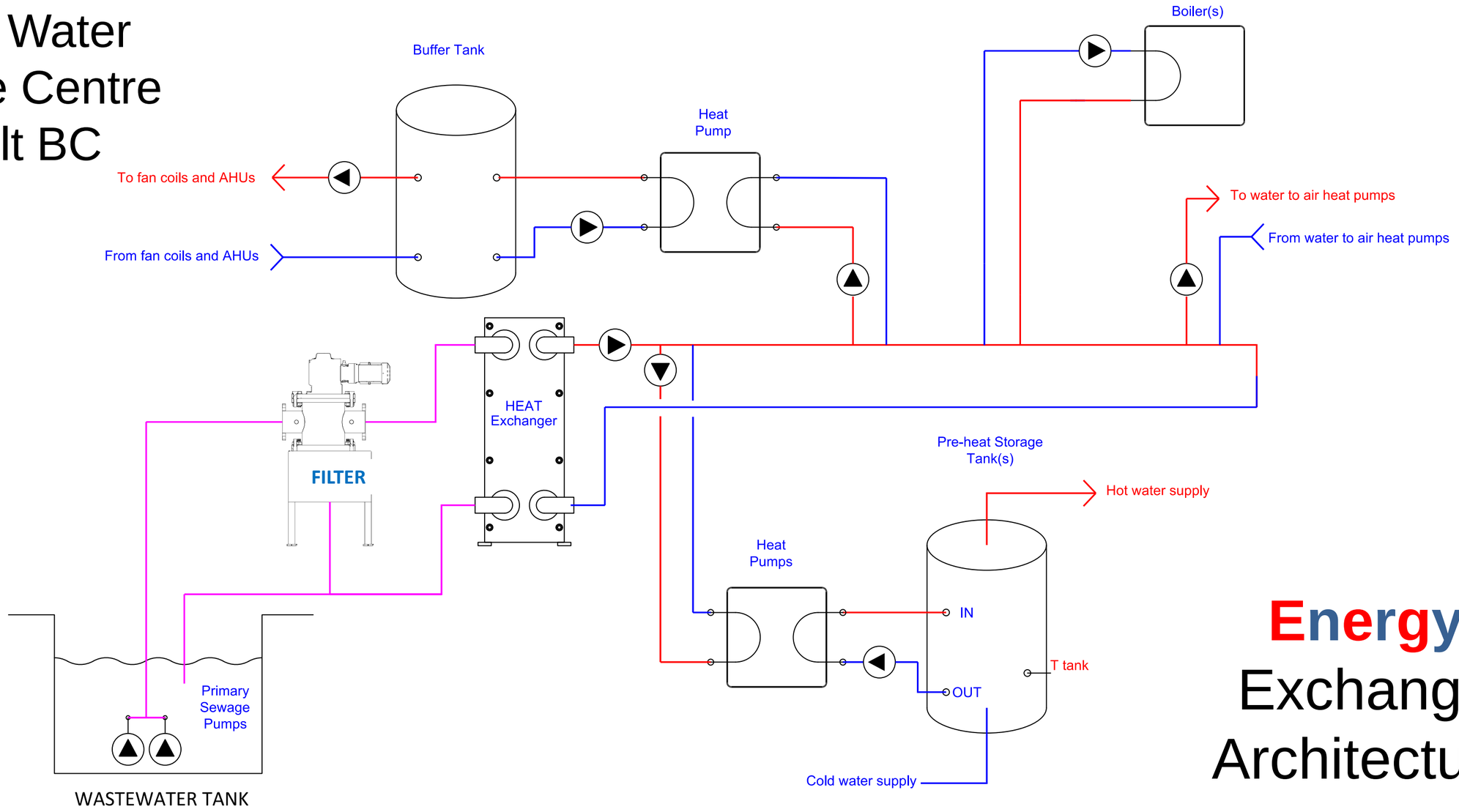
$500K additional op cost savings


Condenser Cooling Water Loop
HRSD Atlantic Treatment Plant
Building (Chiller) Typ.
Building (GSHP) Typ.
Heat Exchangers
HRSD Effluent Line
Building (GSHP) Typ.
Building (Chiller) Typ.
Atlantic Ocean

Regional Water Resource Centre
Sechelt, BC

- Commissioning date: Feb, 2015
- 1,790 square meter facility
- OFF-LINE HX System used to extract thermal energy from inflowing untreated sanitary water to heat the facility
- OFF-LINE HX System is the only heat rejection equipment for the building air conditioning
- OFF-LINE HX System contributed to LEED® Gold certification.

Sechelt Water Resource Centre Sechelt BC



Energy Exchange Architecture


Sewage SHARC

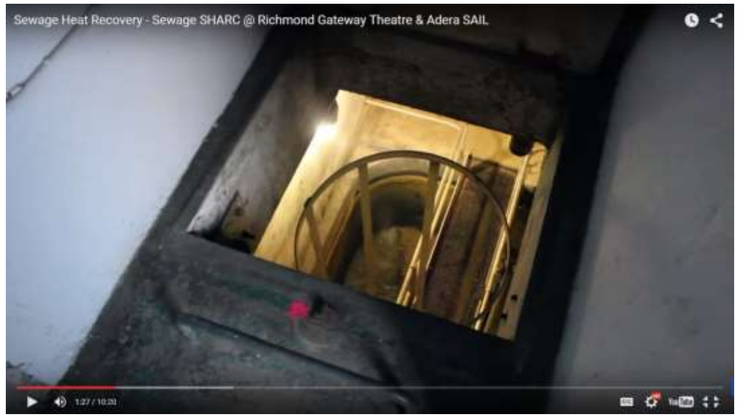

Sewage SHARC

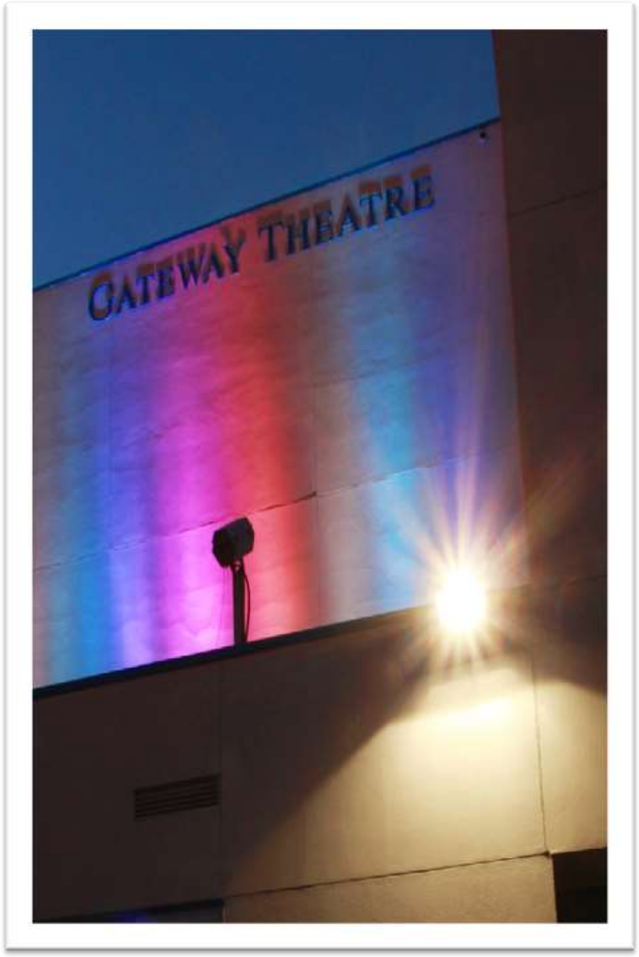
Gateway Theatre – Richmond, BC

50,000 sq ft public theatre owned by the City of Richmond

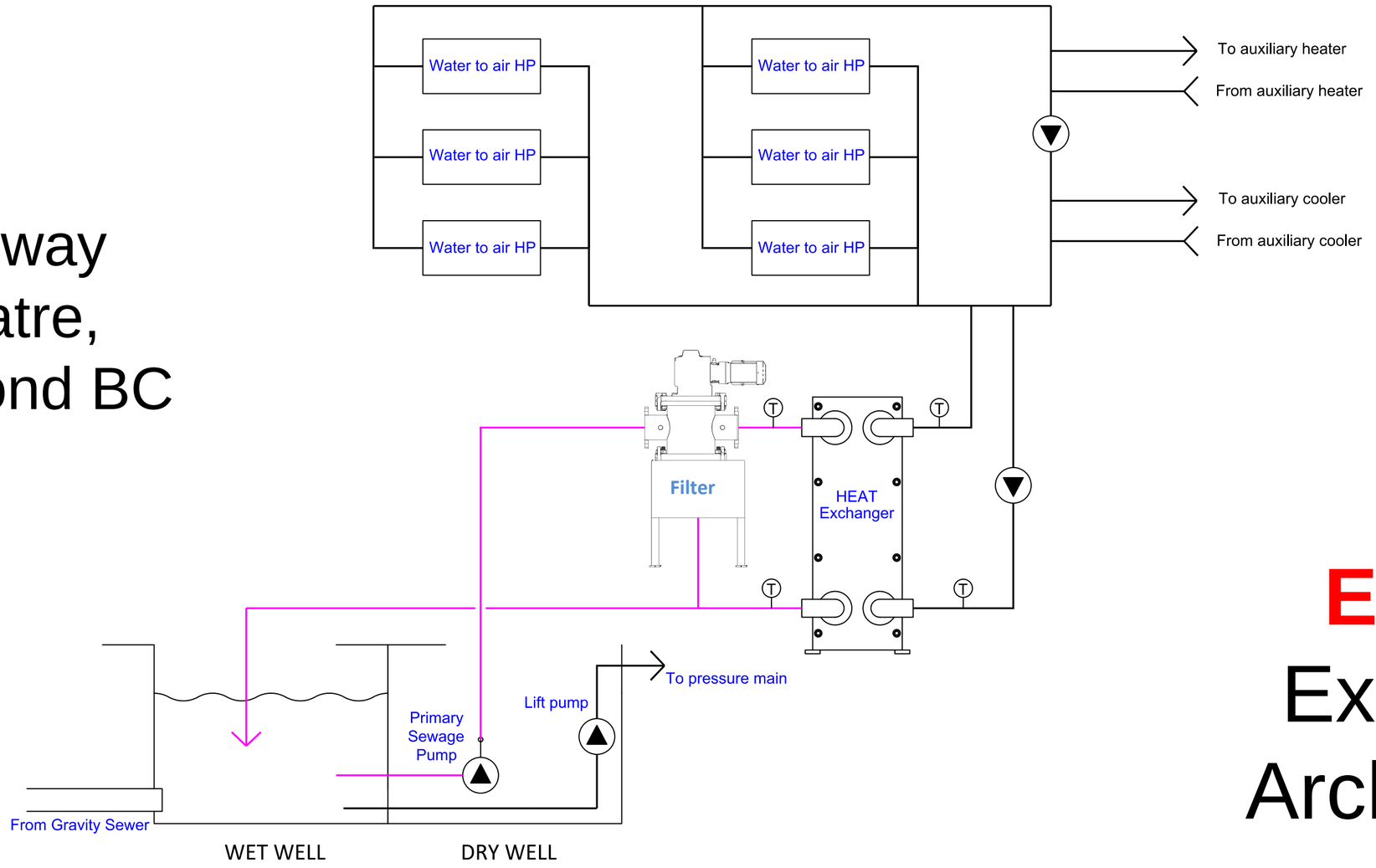
Built in 1984, an ideal candidate for significant energy retrofit projects (existing water source heat pump heating system with natural gas boiler)

Additionally the theatre is built over an existing city sanitary lift station





Gateway Theatre, Richmond BC



Energy Exchange Architecture

✓ Decommission Boilers and Cooling Towers

70 Tonnes Reduction in GHG Emissions / Year

20,000 Gallons Water Savings / Year

PRIVATE SECTOR

Seven35 –
North Vancouver, BC

Canada’s first multi-family project built to LEED Platinum and Built Green Gold Standards

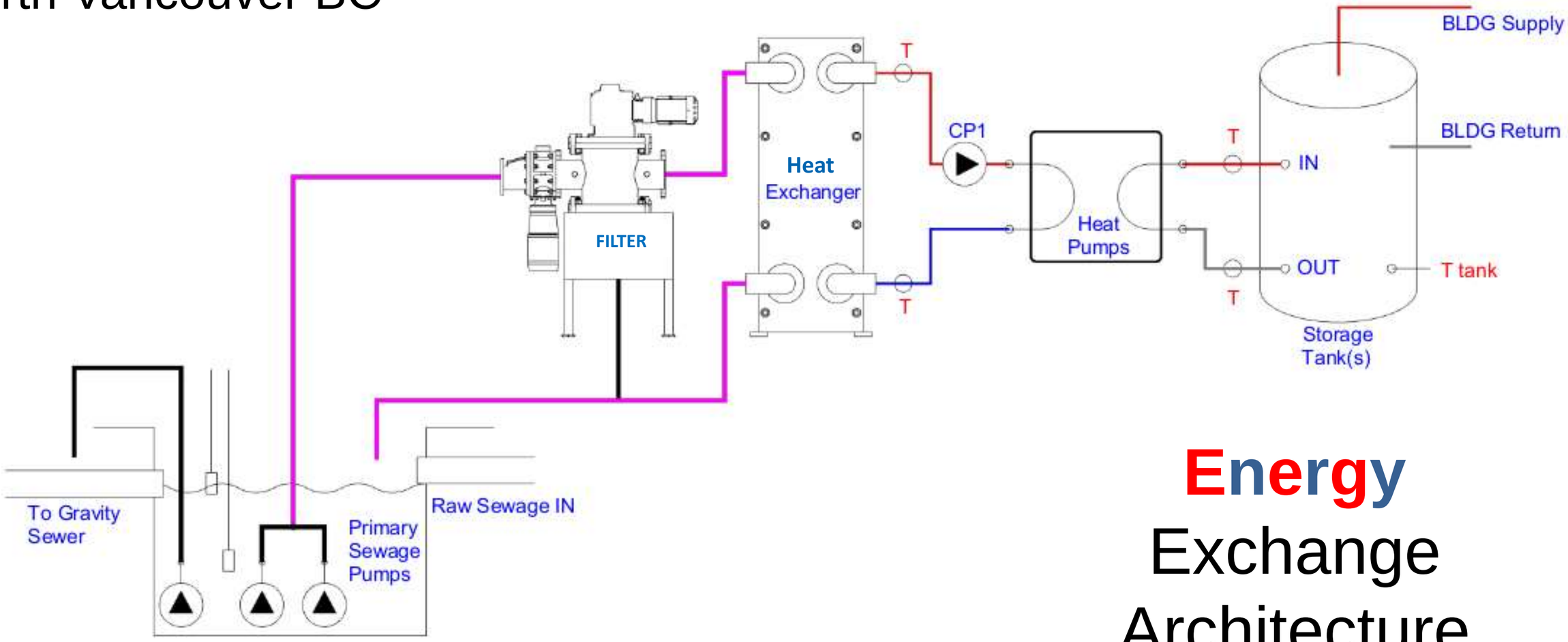
Wastewater heat recovery used for domestic hot water heating

Seven35 – Condos North Vancouver, BC

Off-Line Heat Exchange System

Site Sanitary Storage

Seven35 Condos
North Vancouver BC



Energy Exchange Architecture

Issue
1.2
Nov 2013

CASE STUDY

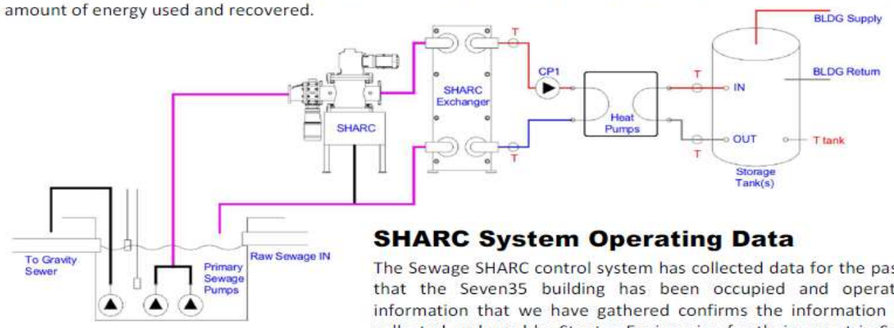
SHARC Sewage Heat Recovery System

Installed in Seven35 Building - North Vancouver, BC, Canada

The purpose of this case study is to review the operating data from the Sewage SHARC system operating for the past 2 years in the Seven35 Building in North Vancouver BC. This study will re-confirm the information provided by Stantec Engineering provided in the case study done on September 20, 2012. The system has now collected 2 complete years of operational data. For the purpose of this study we have 20 randomly selected days for analysis. This study will show operational data from operating the SHARC system to preheat the domestic hot water for the 65 suites and common usage.

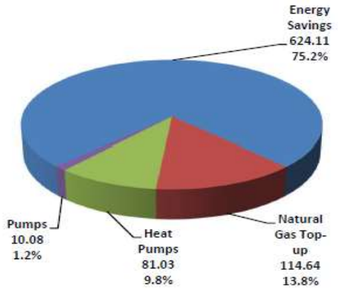
Operating System

The Sewage SHARC system utilizes 2 FHP water-to-water heat pumps to extract heat from the wastewater leaving the Seven35 building. The 2-5 ton FHP heat pumps preheat incoming domestic hot water to 52°C(125°F) and store 480 gallons of preheated domestic hot water in the mechanical room storage tanks. The 52°C-preheated water is then flowed into 2 booster tanks that are heated to 57°C (140°F) by a natural gas boiler. Flow meters, temperature sensors and electrical meters were installed throughout the sewage heat recovery system in order to monitor and log the system operation and the amount of energy used and recovered.



SHARC System Operating Data

The Sewage SHARC control system has collected data for the past 2 years that the Seven35 building has been occupied and operating. The information that we have gathered confirms the information originally collected and used by Stantec Engineering for their report in September 2012. The original data used showed that a total of 829.86 kWh was the average usage per day of domestic hot water heating if a conventional 90% efficient equipment had been used.



Analysis of the data collected shows that the heat pumps used 81.03 kWh per day, pumps used 10.08 kWh per day and the top up by the boiler used 114.64 kWh of energy. The original data confirmed a 75.2% reduction in energy usage as a result of using the Sewage SHARC system at Seven35.

The data collected over the past 2 years actually shows slightly better performance overall than the previous study. The 2-year average energy usage as logged by the SHARC system shows the daily energy usage by the heat pumps and the other pumps to be 85.68 kWh per day. The energy used to top up the domestic hot water with the natural gas boilers remained consistent to the first report at 114.64 kWh per day. There was a slight increase in system operating efficiency to 75.9% energy savings.

International Wastewater Heat Exchange Systems Inc.
4638 Hastings Street | Burnaby BC Canada | V5C 2K5 | Ph: 1.604.569.0313 |Fx: 1.604.294.0042 | www.sewageheatrecovery.com

Seven35 – Condos
North Vancouver, BC

- **Independent Validation by Developer**

✓**75% Energy Reduction vs Ngas**

✓ **OFF-LINE Sanitary HX System – HP**

✓**Primary DHW Heating system**

Benefits of Sanitary Water Energy Exchange;

- ✓ Environmentally & Economically benefits ;

  Heat Source **Reduced fossil fuel consumption / Improved Carbon Position**
  Heat Sink **Water consumption reduced / Reduced Electrical Energy Demand**

- ✓ Facilitates the inherent benefits delivered by the District Energy concept
- ✓ Delivers LEED® goals & supports High Performance Building Culture
- ✓ Increased Asset Value of Buildings

THANK YOU FOR YOUR ATTENTION

International Wastewater Systems

CONTACT

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