COMPANY OVERVIEW

SHARC Energy Systems headquartered in Port Coquitlam, BC, Canada

Founded in 2010, by a team of engineering professionals with significant experience in the HVAC & Geo-Exchange and Plumbing industries

Developed its first product: the 'SHARC' in 2011

In 2016, released second product the 'PIRANHA' for smaller scale applications

In 2019, released ‘PIRANHA HC’
The Average Person Uses 24 Gallons of Hot Water per Day at 60°C*

- Average Residential Wastewater Temperature is 20°C
- Commercial & Industrial Wastewater Temperature can reach 60°C or Higher

**Wastewater sources:**
- Black and Grey Water Within Buildings
- Sanitary Sewers
- Lift Stations/Treatment Centres

*estimated 60 gallons/day of wastewater
Why Wastewater?

- Limitless Source Material
- Consistent Temperatures Year-Round

**REDUCE**

- Energy Losses from Buildings
- GHG Emissions
- Energy Use & Operational Costs
  - CO₂ Tax savings (where applicable)
- Local Legislation and/or Incentive programs

SHARCenergy.com
PRODUCTS
SHARC Energy’s commercialized and patented technology recovers heat from wastewater for domestic hot water and space heating and cooling applications. The SHARC™ and PIRANHA™ systems provide energy savings and reduce carbon emissions from multi-unit and district heating and cooling networks.
COMMERCIAL
- Hospitals
- Micro-Breweries & Distilleries
- Hospitality
- Commercial Laundry
- Community Activity Centers

MULTI-FAMILY
- 50-350 Unit Apartments/Condos
- Student Housing
- Senior/Assisted Living
- Community Housing
Smaller Applications / Specific Processes
- Domestic Hot Water production

Models: T5 / T10 / T15
- Design heat output
  - 60 / 120 / 180 MBH
  - Increase output scalable with multiple units

NSF-372 rated Brazed Plate Heat Exchanger
- Double-wall, leak detection

The PIRANHA is a self-contained heat pump that uses a specifically designed direct expansion heat exchanger to recover thermal energy from a building’s wastewater for domestic hot water heating

- Average COP of 3.7 (*based on PIRANHA EPRI Challenge results)

R-513a
- 56% Lower Global Warming Potential than R-134a
- Same performance
Models: T5/T10/T15
  - Design heat output
    - 60/120/180 MBH
    - Increase output scalable with multiple units
  - Modular
  - Designed to fit through standard double door access

Average COP of 4.5

DHW and/or Space Heating

NSF-372 rated BPHE

R-513a
  - 56% Lower GWP than R-134a
  - Same performance
PIRANHA HC Combines Wastewater Energy Recovery with Space Conditioning

- Models: T5 HC/T10 HC/T15 HC
  - Design Heat Output
    • 60/120/180 MBH
  - Design Cooling Capacity
    • 48/96/144 MBH
  - Increase output scalable with multiple units
  - Modular
  - Designed to fit through standard double door access
- Average combined COP up to 8
- DHW production while Cooling Spaces
- **NSF-372 rated BPHE**
- R-513a
The PIRANHA is a self-contained heat pump that uses a specifically designed direct expansion heat exchanger to recover thermal energy from a building’s wastewater for domestic hot water heating.

- Hot water delivery temperature up to 140°F/60°C
  - “Destroyer Cycle” – Legionella mitigation

- Hot water heating via multi-pass, incremental rise flow
  - Design 10°F ΔT

- Constant Temperature Output option available
  - Variable potable water flow through a modulating valve

- Wastewater: Full Flow-Through Design
  - Pre-Maceration/Grinding not required

- Completely sealed at point of installation
  - Odour Free
Typical Above-Grade PIRANHA Installation

**Energy Recovery (Heating)**

- **Domestic Preheated Water**
- **Wastewater IN**
- **PIRANHA**
- **Vent**
- **Wastewater OVERFLOW**
- **Wastewater drain OUT downstream of holding tank**
- **Wastewater Holding Tank**
- **Solids Handling Pumps**
- **Wastewater IN**
- **Wastewater OUT**
- **Domestic Cold Water**
- **Hot Water OUT**
- **Cold Water IN**
Typical Above-Grade PIRANHA Installation:

A - Holding tank
B - PIRANHA unit
C - Domestic water line
D - Overflow line
E - Drain line
Typical Above-Grade PIRANHA HC Installation

How PIRANHA Works

Energy Recovery (Heating)

Building condenser loop

Cooling Tower

Process

Domestic Preheated Water

Wastewater IN

Wastewater OVERFLOW

Vent

Hot Water OUT

Cold Water IN

PIRANHA

Solids Handling Pumps

Domestic Cold Water

Wastewater IN

Wastewater drain OUT downstream of holding tank

Wastewater HOLDING Tank

Wastewater OUT
Typical Above-Grade PIRANHA HC Installation:

A - Holding tank
B - PIRANHA HC unit
C - Domestic water line
D - Overflow line
E - Drain line
F - Condenser Loop
Typical Above-Grade PIRANHA HC Installation

- **How PIRANHA Works**

  **Energy Recovery (Heating)**

  - **Fan coil loop**
  - **Wastewater IN**
  - **Wastewater OVERFLOW**
  - **Wastewater drain OUT downstream of holding tank**
  - **Wastewater IN**
  - **Wastewater OUT**
  - **Vent**
  - **Solids Handling Pumps**
  - **Wastewater Holding Tank**

- **Domestic Preheated Water**
  - **Domestic Cold Water**
  - **Cold Water IN**
  - **Hot Water OUT**

- **PIRANHA**
Typical Above-Grade PIRANHA HC Installation:

A - Holding tank
B - PIRANHA HC unit
C - Domestic water line
D - Overflow line
E - Drain line
F - Fan Coil Loop
Building Hot Water Production

Cold Water IN

Heat Exchanger
“Condenser”

Expansion Valve

Heat Exchanger
“Evaporator Tank”

Compressor

Heat flows

Double-Wall, Vented BPHE w/ Leak Detection

Heat flows

Wastewater Source

Holding Tank
The SHARC is a wastewater separator/filter that allows access to thermal energy by temporarily removing solids from wastewater.

The filtered wastewater is then passed through a Heat Exchanger where the thermal energy is transferred to/from the building.

### SHARC Series

<table>
<thead>
<tr>
<th>SHARC Model</th>
<th>Max Flow</th>
<th>Typical Energy Transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>660</td>
<td>550 GPM</td>
<td>2,474 MBH/0.725 MW</td>
</tr>
<tr>
<td>880 LF</td>
<td>850 GPM</td>
<td>3,824 MBH/1.12 MW</td>
</tr>
<tr>
<td>880</td>
<td>1,600 GPM</td>
<td>7,197 MBH/2.11 MW</td>
</tr>
<tr>
<td>1212</td>
<td>4,500 GPM</td>
<td>20,242 MBH/5.93 MW</td>
</tr>
</tbody>
</table>

- **Energy Recovery or Rejection**
- **Variable Use Source Energy**
  - Hot Water Heating
  - Hydronic Heating/Cooling
  - Wastewater Cooling
  - Cooling Tower Offset
- Exponential efficiency for 'low-temp' condenser loops
  - Up to MW of energy transferred for low kW energy input
- Load side condenser loops and water source heat pumps/chillers
  - Average COP 3.5-4
- Designed to allow for high flow rates and ease of service.
- Completely Sealed at Installation Site, odor free

**Higher flow rates achieved with parallel modules**
The SHARC System

- SHARC Filter Unit
- Support Frames/Skids
- Control Panel
- Macerator/Grinder
- Piping/Valve Assembly
- Plate & Frame Heat Exchanger
  - Wide Gap

Not shown
- Wastewater Holding Tank & Solids Handling Lift Pumps
  Existing Tank can be used
- Heat Pump
  - May not be needed in ambient/low temp systems

*Sourced Separately
How SHARC Works

Energy Recovery (Heating)

The SHARC System

- Heat flows
- Macerator grinds solids
- Patented, high volume filtration
- Heat Exchanger
  - Heat added to building process loop
  - Recovered heat from wastewater
  - Cool return from building process loop
  - Hot Water Heating

Wastewater

- IN
- OUT

Solids Handling Pumps

Wastewater Holding Tank

Energy Recovery

Heat flows

Cool return from building process loop
A - Wastewater holding tank
B - Macerator
C - SHARC filter unit
D - Reversing valve assembly
E - Heat exchanger
F - Heat pump
Heat flows into wastewater

The SHARC System

Energy Rejection (Cooling)

Patented, high volume filtration

Macerator grinds solids

Heat removed from building process loop

Warm return from building

Cooling & Space Conditioning

Solids Handling Pumps

Wastewater Holding Tank

Wastewater IN

Wastewater OUT

Heat flows

Rejects heat into wastewater
How SHARC Works

District Energy
Heating OR Cooling for Mixed Commercial & Large Residential

District Energy Plant

Low-Temp/Ambient loop (i.e. 70°F)
Each building has heat pumps/chillers etc.
How SHARC Works

District Energy
Heating OR Cooling for
Mixed Commercial & Large Residential

District Energy Plant

Low-Temp/Ambient loop (i.e. 70°F)
Each building has heat pumps/chillers etc.
Unmatched Cleaning Characteristics

- SHARC’s patented design allows for unmatched cleaning characteristics.
- Superior continual cleaning of the filter screen ensures high flow rates to meet demand.
- Minimal wear on internal parts for longer lasting components.
- Low pressure drop across the SHARC filter.
- Little or no fresh-water usage.

*Internal filter screen after 4 months of 24 hour-a-day black water filtration – That's over 276 million gallons filtered!*
SHARC developed Controls program

- Touch screen interface
  - Default Settings / User Configurable

- Remote Monitoring capabilities
  - Emailed warnings & alarms
  - Data Trending

- DDC & BMS integration through BACnet or Modbus

- BTU Meter / Power Meter Options

- Factory Support
PROJECTS
Who have we done it for?

DC Water Headquarters
Washington, DC

- Commissioned Summer 2018
- SHARC 660 System
- 250 Gallons Per Minute (GPM) flow
- Design heat transfer of 1.25 MMBH
- Estimated 30+ MMBtu/day transfer

- Wastewater lift station sees 5M gallon per day average sanitary flow
- 150,000 ft² facility w/ 350 to 400 tons water-cooled HVAC (HPs / Chilled Beams / DOAS)
- LEED® Platinum

Saves building 830 metric tons of CO2 per year – equivalent to reduction of 182 cars
Who have we done it for?

Southeast False Creek Neighbourhood Energy Utility, Vancouver, BC

• Retrofit Project - Commissioned Spring 2017

• Uses waste thermal energy recovered from sewage to provide space heating and hot water to buildings in Southeast False Creek

• NEU currently serves 5 Million ft² of residential, commercial, and institutional space, planned expansion to 20 Million ft²

• 3.2 MW plant capacity output, planned expansion to 8MW.

• 2-qty SHARC 880 units provide an average 1800 GPM filtration to the wastewater which is then used as a direct source for the heat pump
  • 9 MMBH heat recovery through existing Heat Pump
Who have we done it for?

National Western Center
Denver, CO

- North America’s largest District Energy wastewater recovery system (Jan ‘21)
- 3.8 megawatt (MW) district energy system
- Will process ~3,000 gallons per minute
- Denver Post reported the National Western Center system will "prevent 2,600 metric tons of carbon dioxide from being emitted into the atmosphere each year by circumventing the need to burn fossil fuels."
- Hailed as showing leadership & commitment to Denver’s Climate Action Plan
Seven35
North Vancouver, BC

• The first multi-family LEED® for Homes Platinum building in Canada

• Certified BuiltGreen Gold

• 60 Residential Units
  • PIRANHA T10 Commissioned Spring 2016
  • 820 GJ Natural Gas reduction
  • GHG Emission reductions of approximately 41 t CO₂e/year

• PIRANHA system provides domestic hot water preheating

• Piranha contributed to LEED® Platinum certification of the building

• Currently PIRANHA HC EPRI Challenge Site
Who have we done it for?

Lake Louise Inn
Lake Louise, Alberta

- Commissioned Summer 2018
- 247 room Hotel
- In-House Laundry
- PIRANHA T10 recovering heat from 4 commercial laundry washing machines
- Produce an average of 1700 Gallons of Hot water per day
  - *Average COP of 5.25*
- Main fuel source – Propane
  - *Approximate load reduction of 22,680 liters/year*
  - *GHG emission reduction of approximately 35 t CO₂e/year*
Wall Centre Central Park
Vancouver, BC

- Two-Phase Development by Wall Financial in Vancouver
- Phase 1 – 700 Residential Units,
  - **SHARC 660 system**
  - Commissioned Summer 2017
- Phase 2 – 350 Residential Units,
  - **2-qty PIRANHA T10 units** running in parallel
  - Commissioned Summer 2018

- Approximately 4,800 GJ Total Natural Gas Reduction
- GHG emission reductions of approximately 248 t CO$_2$e/year across both phases
- Both systems provide domestic hot water preheating
- SHARC and PIRANHAs contributed to LEED® Gold certification of the building

Who have we done it for?
King County
King County, WA

- This pilot program is open to two final projects

- Project diversity measures may include **retrofit vs. new construction**, standalone buildings vs. energy district, square footage, projected energy demand, and building use type.
Who have we done it for?

Boulder Commons
Boulder, CO

- **3200 Bluff Street is the second phase of a larger mixed-use development in Boulder, Colorado.** This two-building, 98,000 square foot development will be directly adjacent to the first Boulder Commons project for which Integral Group also provided engineering and design services.

- One building will consist primarily of offices and the second building will be a **multi-family residential building.** There will also be retail space on the first floor of both buildings.
Energy. Full Circle.

Thank you!