

Circular City

**Redefining logistics and sustainment for
temporary camp utilities through circularity**

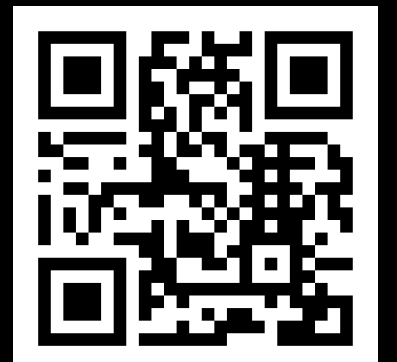
Combat Engineering & Logistics 2024

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What if:

**you could recycle \approx 90% of your
greywater**

and,

reduce your solid waste \approx 10x?

How valuable is that capability?

What else is important to consider?

How would you do it?

Company Background

Come speak with us after

Our management team has proven our ability to advance the state-of-the-art.
We look forward to discussing how we can collaborate with you.

CEO



Aarya Shahsavar, P.Eng.
B.E. Engineering Physics with Great Distinction

CTO

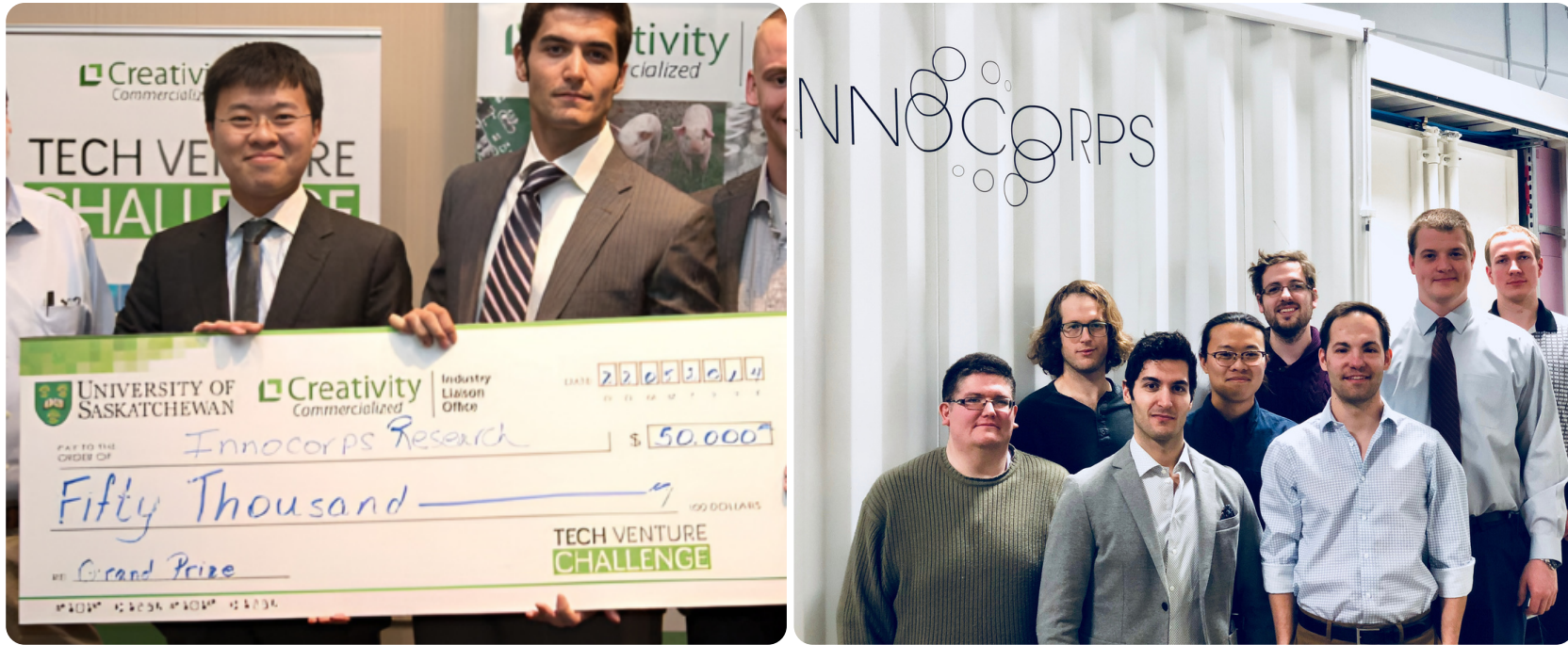


Alexander Chan
B.E. Mechanical Engineering

BD



Ryan Winqvist, CPA
B.Comm. Accounting & B.A. History



Innocorps Unveils Circular City to Win \$2M Defence Competition

Wednesday, 15 November 2023 09:32

Expertise in integrated camp utility systems

Foundation

Launched in 2014, we are a deep tech applied research company focused on developing sustainable technologies to combat **water scarcity**.

Leaders in the Circular Economy

We led the Circular City consortium to win the Department of National Defence's Innovation for Defence Excellence and Security (IDeAS) **Pop up city Contest** in November 2023 by developing integrated utility solutions to reduce logistics for future Canadian Armed Forces' relocatable temporary camps (RTCs).

Pioneering

practical

solutions to
sustainability
through
circularity.



within the laws of physics
and economically viable

Pop up city Contest Objective:

Reduce fuel, water and waste logistics by 33% for 150 people deployed anywhere in the world without changing behaviour.

Since Pop up city...

we've been busy scouting the globe to understand your challenges and **find the best solutions with you.**



Framing the Problem

No single technology can achieve the required reduction targets for future camps (e.g. Camp Sustain).

No entity has commercialized all of the required technologies to TRL 9, yet.

Camp Sustain is to support up to 4800 pax, scalable in 250 personnel increments.

25 to 50% of fossil fuel

50 to 75% of water demand

50 to 75% of solid waste

50 to 75% of wastewater



High-Level Mandatory Requirements

Reliable

Robustness

Interoperability
or Interchangability

Efficiency

Infrastructure

Transport

Flexibility

Sustainability

Personnel Health & Protection

or Modularity & Scalability

or Maintainability

Other Challenges

Capability Gap — Others currently **limited to 70 to 80% recovery.**

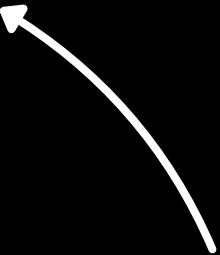
Regulatory Gap — Direct potable reuse (DPR) regulatory frameworks.

Operational Gap — **Seamlessness required. Training/knowledge of new systems is missing.**

Perception Gap — The focus is and should be on operations, not running a base. Bottled-water overused.

Contested Logistics — Supply chains will be severely disrupted. "Attritable" equipment may be desired.

Possibly AI/ML tools such as local LLM+RAG+Agents and/or AR tools can help

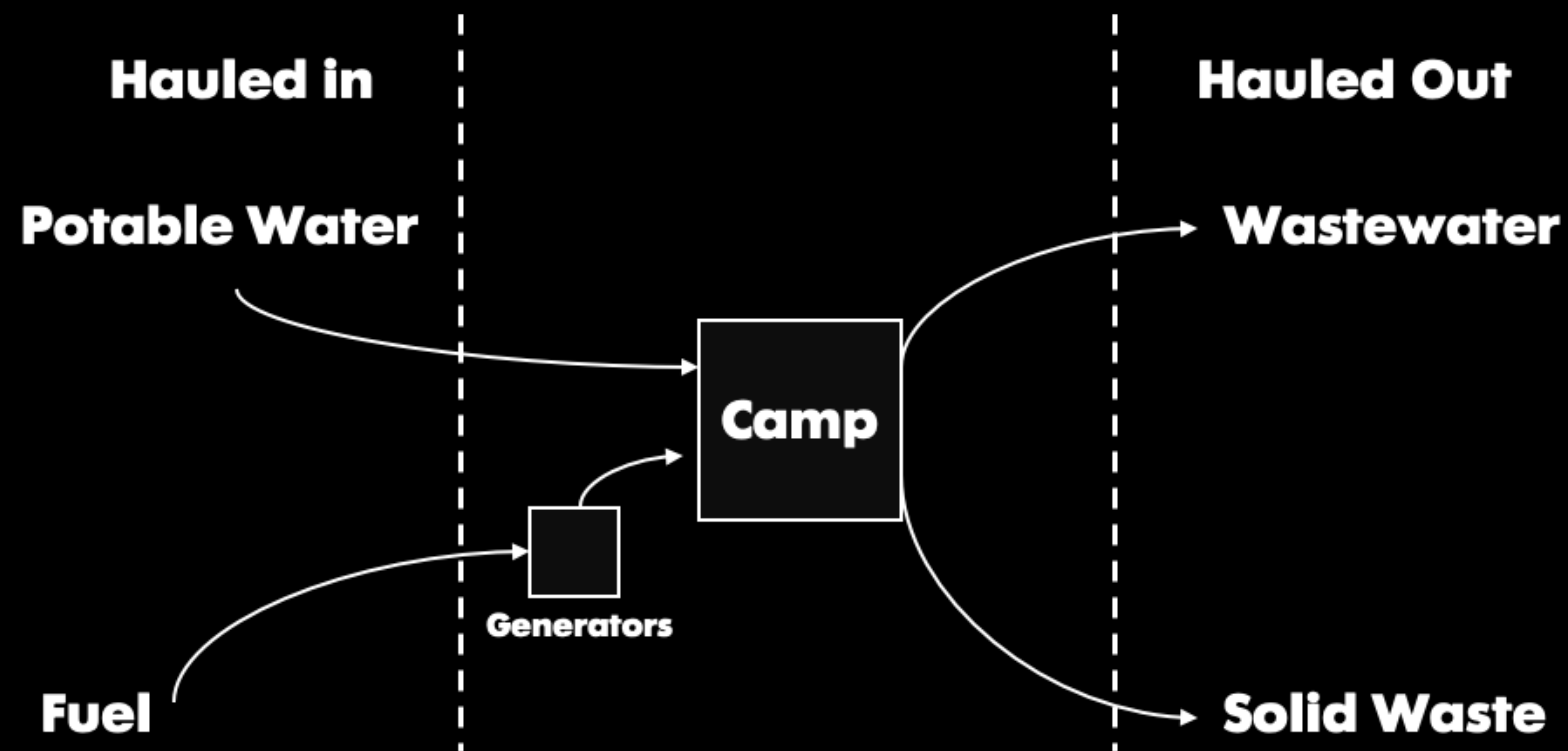


How do we
address this
then?

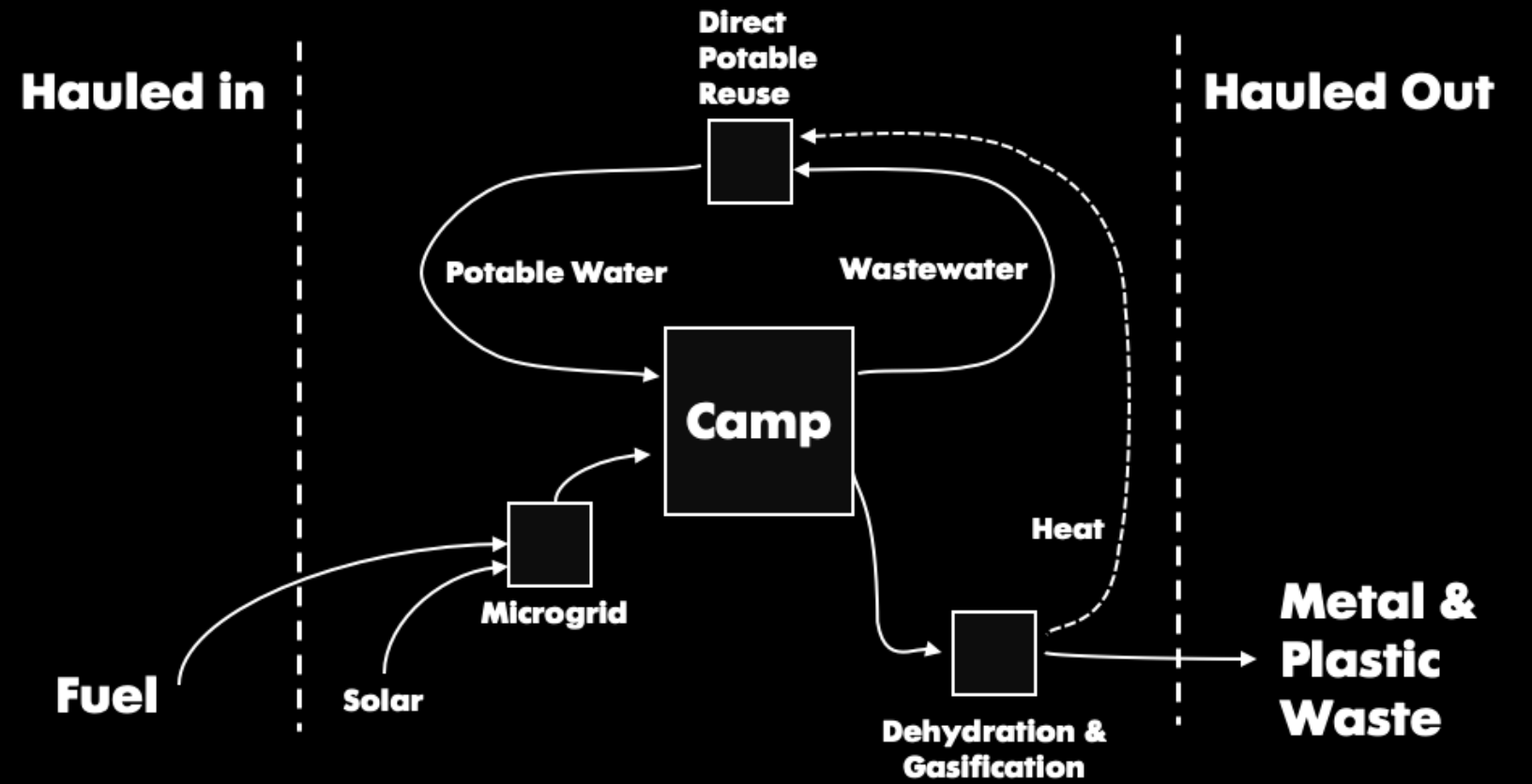
“Amateurs talk strategy,
Professionals talk logistics.”

— General Omar Bradley

Current CONOPS versus Circular City



Current RTC



Circular City

Production at the Point of Need with Direct Potable Reuse (DPR), Microgrid Power Generation, Waste-to-Energy Processes and Thermal Integration

Value Created

by Producing at the Point of Need



KPIs: wastewater recovery ratio and energy usage

Systems must be combined holistically so that the big picture makes sense and it's worth it to do.

Operate Anywhere with a Lower Environmental Footprint

Address water scarcity & minimize effects on Host Nation water supply

Lower Logistics & Costs; Improve Sustainment & Lethality

≈ ≥ \$2 million/year savings per 1000 pax base*

Save Lives by Eliminating Unnecessary Resupply

In peacetime operations, reducing unnecessary resupply also cuts carbon emissions.

*Based on ERDC Advanced Low Logistics H2O (ALL H2O) projections of only 25% reduction in net water demand alone. Retrieved 2024, from <https://www.erdc.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/1314159/advanced-low-logistics-ho/>

Key Results



These are some key results achieved during testing at CFB Suffield in August 2023.

25 kW

Average Power Required
(Max 43.34 kW)
for 150 pax camp utilities

Wastewater

The world's first mobile DPR system recycled greywater and combined greywater/blackwater into purified potable water meeting Health Canada Guidelines.

Energy

A reliable off-grid power solution using solar, batteries, and generators with advanced climate control for challenging environments.

Water

State-of-the-art batch reverse osmosis subsystem achieved up to **90 to 95% recovery ratios** in a direct potable reuse application.

Solid Waste

Carbon neutral hot water supply achieved by integrating solid waste and water systems, eliminating fuel use; **Up to tenfold reduction in solid waste.**

Key Learnings and Design Basis

The Circular City project used a **circular design philosophy** and a **bottom-up, first-principles approach**.

1

Design for Austere Environments

Think space mission design: **energy integration and optimization are crucial**. Consumables also need to be minimized.

2

Valorize Waste thru Circularity

Circularity rethinks waste as value: e.g. pyrolysis or gasification of solid waste, or wastewater reuse. Heat integration can improve **Arctic operations**.

3

Simplify & Optimize

Avoid over-optimizing one subsystem at the expense of others or systems that shouldn't exist. See also: **Elon's Algorithm**

4

5

6

Optimize Recovery & Efficiency of Reuse

Water and wastewater treatment will always be net energy consumers. **Recovery ratios must be high ($\geq 90\%$) in the most efficient way possible**

(Loosely Coupled) Integrated Modularity & Redundancy

Different applications will benefit from modularity. Redundancy ensures fault tolerance. Loose coupling minimizes dependencies.

Integrated modularity enables a comprehensive solution when combined together while still working as independent systems.

Flexibility & Autonomy in Human-Machine Interfacing

Camps must be quickly mobilized and demobilized anywhere worldwide, requiring layout flexibility, easy setup, teardown, operation and maintenance. Simple autonomy that enables soldiers to **focus on the mission**, not operating the equipment.

Why not?

Atmospheric Water
Generators/Extractors

Bottled water

Dry/vacuum toilets

Integrated reuse directly at showers,
laundry, etc...

Thank you

A special thanks to Harmony Desalination Corp. (dba Harmony Desalting), Southern Alberta Institute of Technology (SAIT), Eco-Growth Environmental Inc., Pop Up City Inc., a subsidiary of Continvest Technologies Plc., AXSOL GmbH, and the Saskatchewan Research Council (SRC) for their contribution to the Circular City consortium.

Let's create the sustainable future together.

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