Hydrogen without CO2: a Living Laboratory using molten-metal methane pyrolysis

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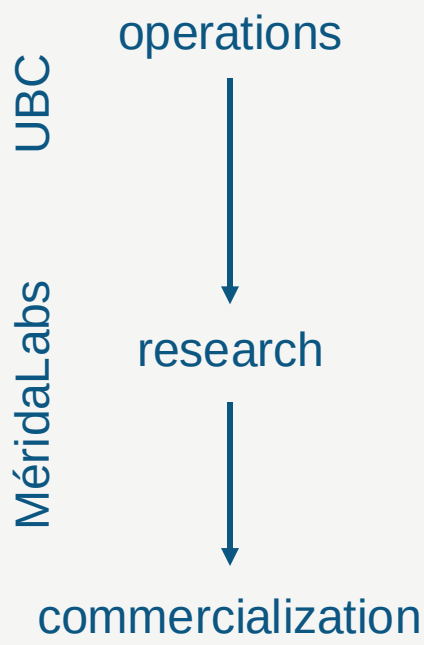
Today's talk

- Living lab model (innovation for speed and scale)
- On campus:
  - Tallwood House
  - Bioenergy plant
  - Smart Hydrogen Energy District
- Off-campus:
  - British Columbia (DAC, with Carbon Engineering)
  - Alberta (pyrolytic hydrogen + carbon, with ATCO)
    - The problem with hydrocarbons



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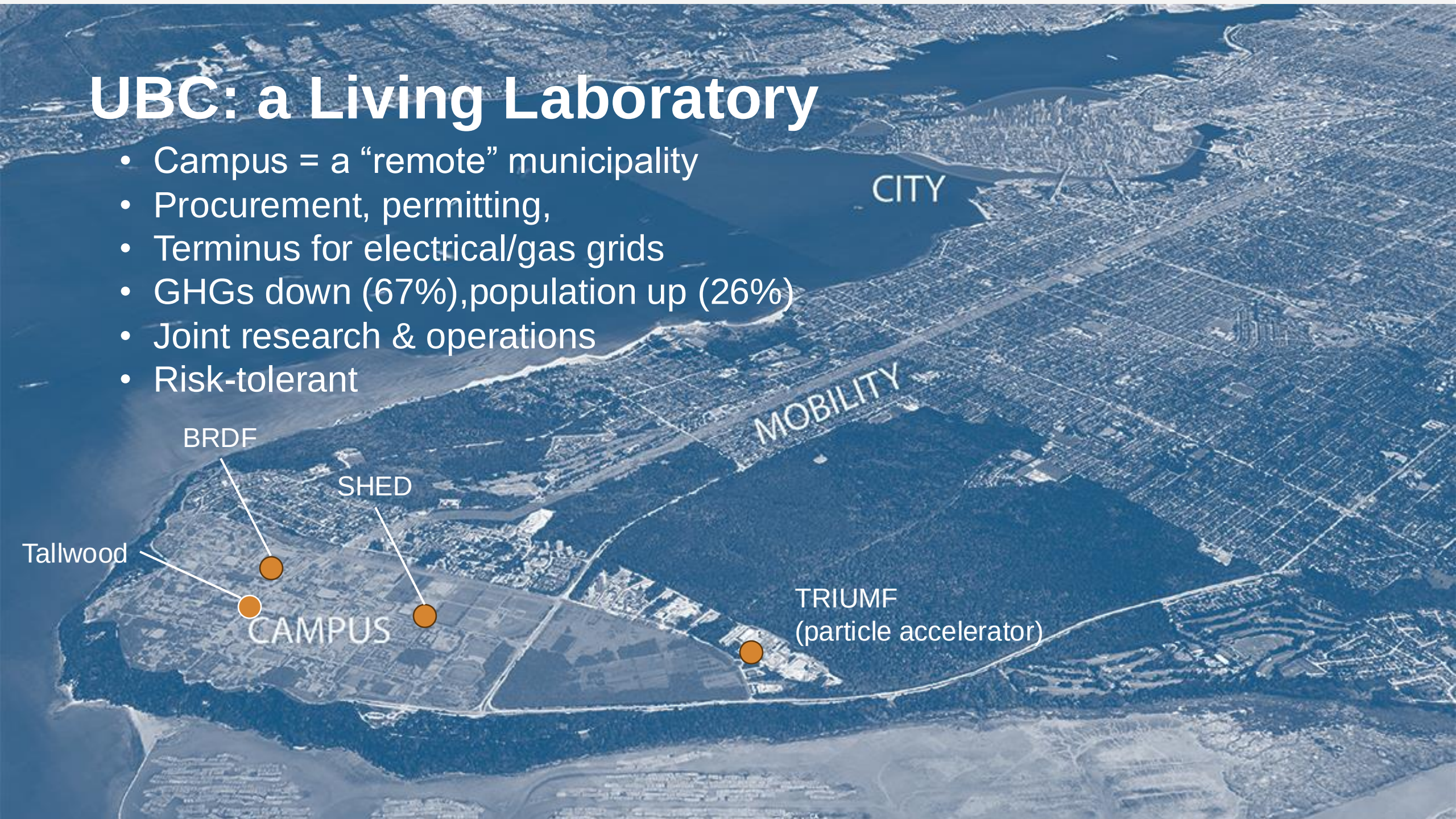
UBC: a Living Laboratory

- Campus = a “remote” municipality
- Procurement, permitting,
- Terminus for electrical/gas grids
- GHGs down (67%),population up (26%)
- Joint research & operations
- Risk-tolerant



Brock Commons Tallwood House

- 18 storey, 400-bed residence
- Concrete: foundations, elevator shafts, first floor
- Wood: pre-fabricated cross-laminated timber
- 2 floors per week, reduced waste and noise during construction
- Reduced carbon footprint

https://livinglabs.ubc.ca/projects/brock-commons-tallwood-house

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BRDF: Biomass research & demo facility

- Heat and power from biomass
- Thermal Mode: 6 MW of steam
- Biomass CHP: 2.4 MW thermal + 2 MW electricity
- Renewable natural gas: 8.4 MW (thermal) + 2MW (electricity)
- $8,2M: net positive by 2028, $800k/yr savings, cost recovery in 15 years.

https://livinglabs.ubc.ca/projects/bioenergy-research-demonstration-facility

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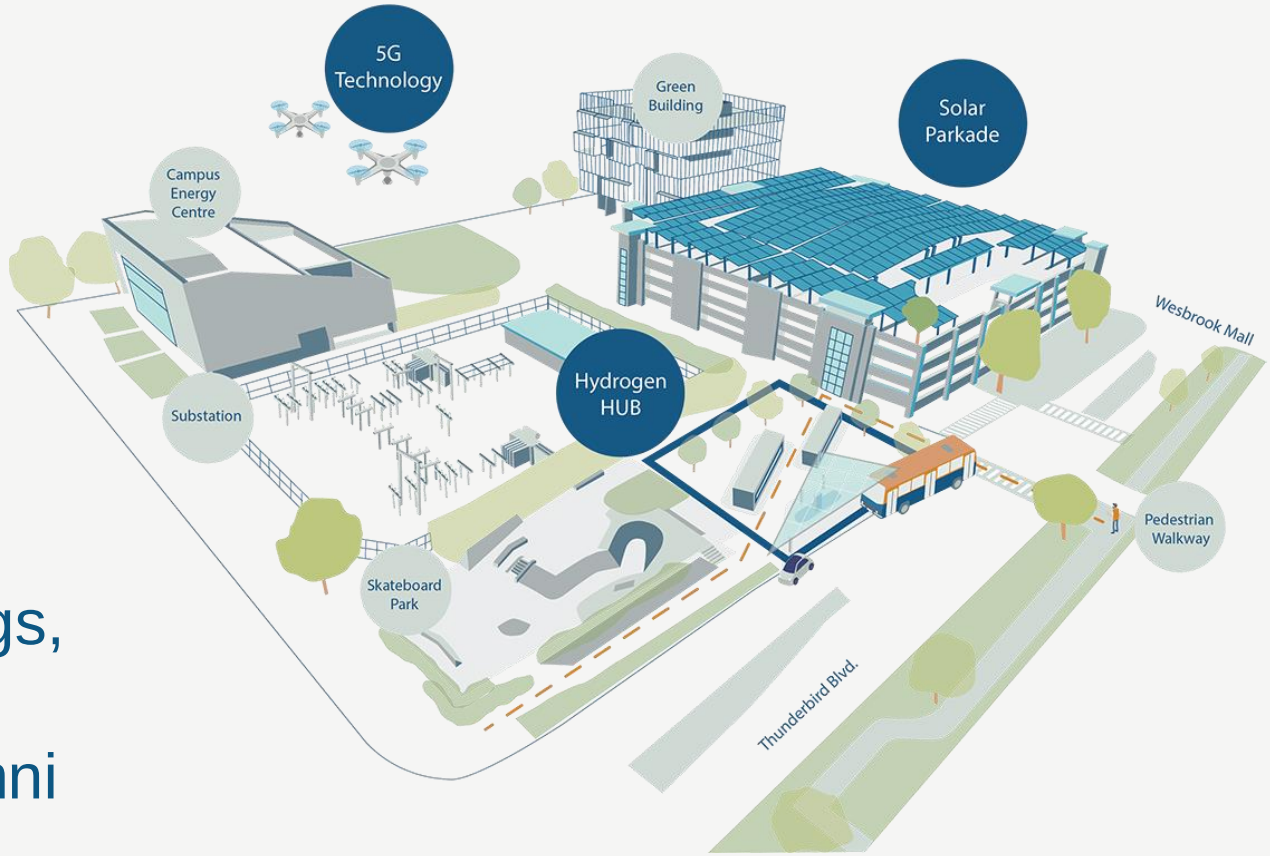
SHED

- Smart hydrogen energy district (SHED): a city block becomes an innovation platform

- Breaking silos: finance, research, education, operations, IT, buildings, water, procurement, waste management, government & alumni relations, civil engagement



https://meridalabs.ca/research/testbed/

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Off-campus: regional impact & engagement

British Columbia

https://squamish.ca/yourgovernment/news/ubc-clean-energy-research-centre-collaboration/

Alberta

https://gas.atco.com/en-ca/community/projects/energy-discovery-centre.html

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J.L. Boucher and W. Mérida. *" Inflated lives and a clean tech privilege in Washington State: Policy amidst spatialized affluence."* Energy Research & Social Science, **85**, 102418 (2022.)
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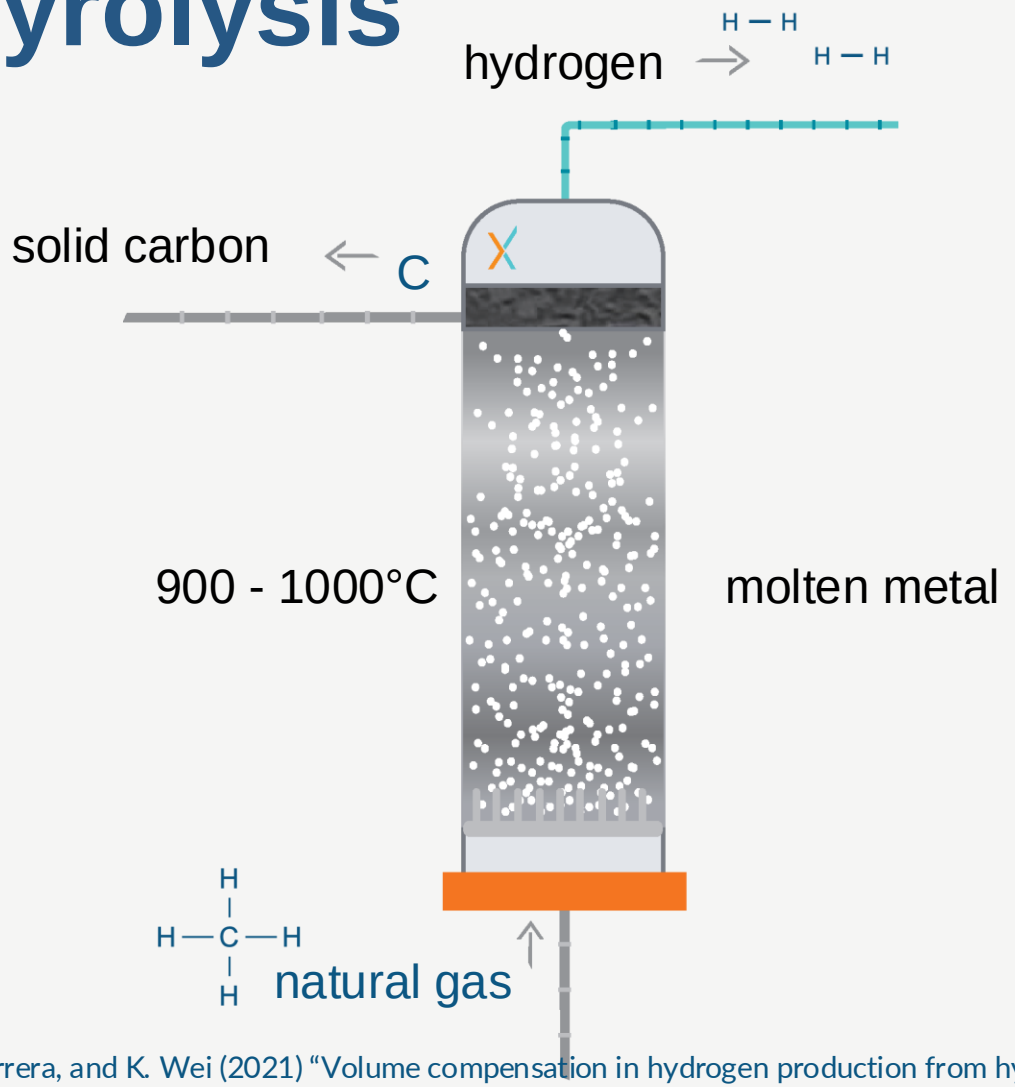
Methane pyrolysis



Low CO_2

No water

< $2/kgH2

W. Mérida, A. Sharafian, O. Herrera, and K. Wei (2021) "Volume compensation in hydrogen production from hydrocarbons," US Provisional Patent, No.: 63/280902
W. Mérida, A. Sharafian, and O. Herrera (2021) "Hydrogen production from hydrocarbons without carbon dioxide emissions," PCT application No.: WO/2021/232158.

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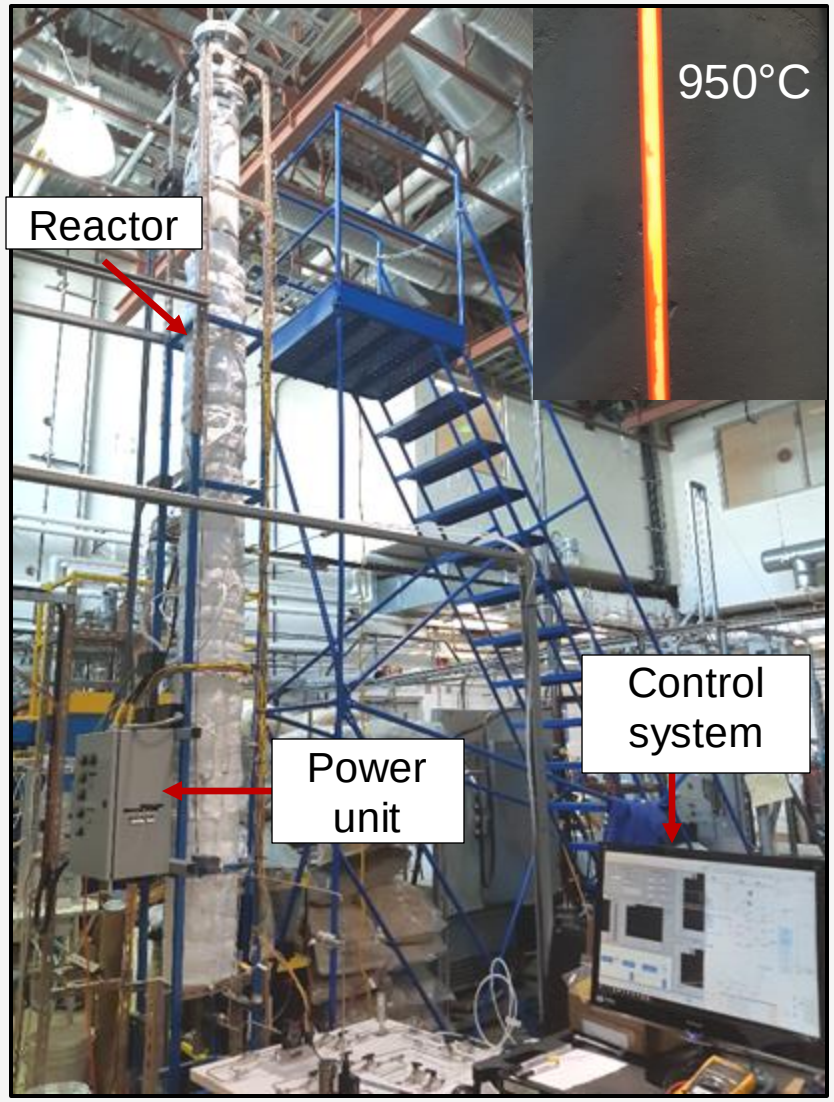
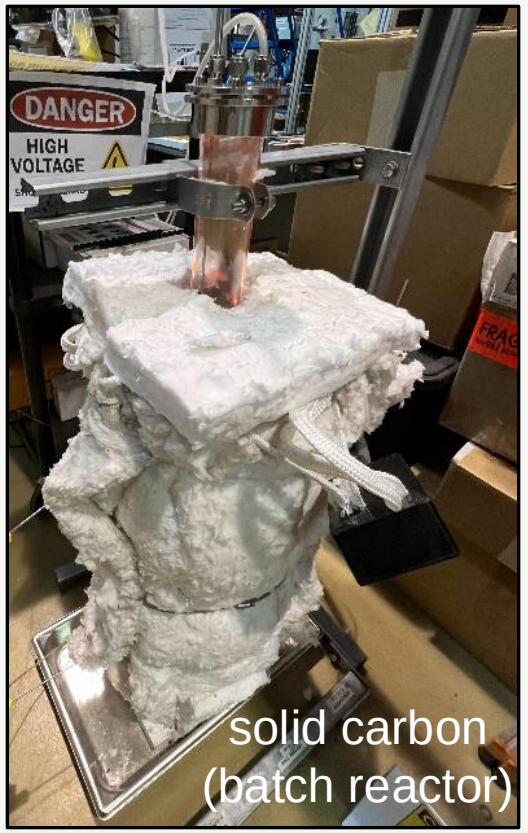
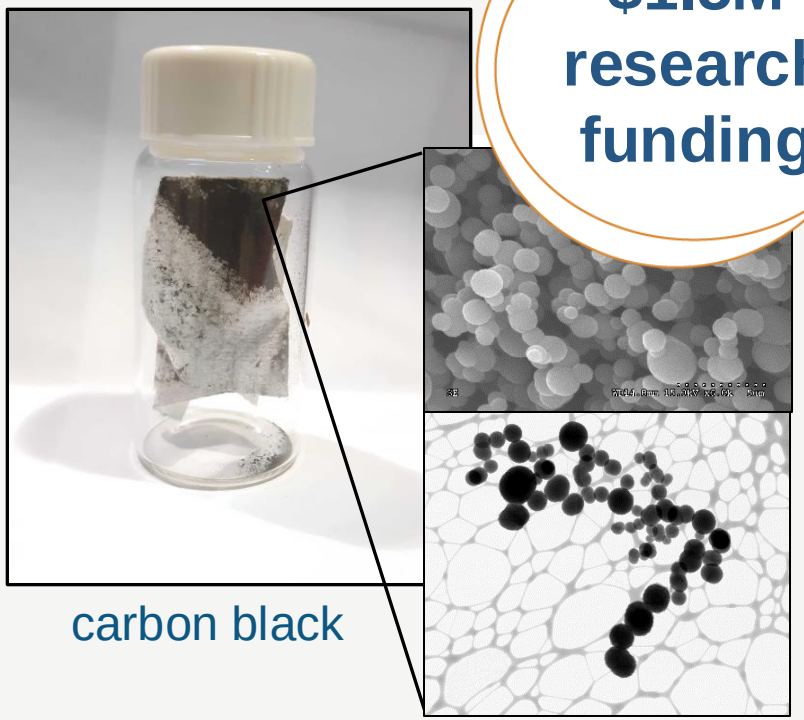
VX0: 1 kg per day (lab prototype)







$1.5M research funding

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S. R. Patlolla, A. Sharafian, and W. Mérida. *"Characterization of Solid Carbon from Hydrocarbon Pyrolysis in Molten Aluminum."* Carbon. **224** 119054 (2024.)

S.R. Patlolla, K. Katsu, A. Sharafian, K. Wei, O. E. Herrera and W. Mérida. *"A review of methane pyrolysis technologies for hydrogen production."* Renewable and Sustainable Energy Reviews **181**, 113323 (2023.)

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Energy Discovery Centre: pilot plant

- Commissioned in May 2024,
- First building in North America heated by 100% hydrogen
- Centre includes several projects
- Pyrolysis plant

https://gas.atco.com/en-ca/community/projects/energy-discovery-centre.html

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VX1-2: 55kg/day - 1 t/day (spinoff company)

UBC RESEARCH

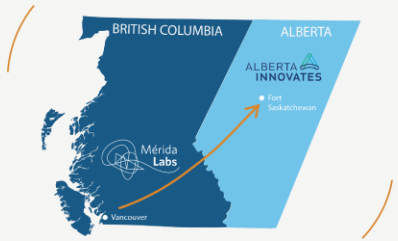
Lab prototype,

Optimisation

Next generation hardware

2018

UBC PILOT (Alberta)



Pilot plant in Fort Saskatchewan

Environmental permits

Construction, contracting, components

2021

SPINOFF

VULCANX

Technology scale up

Looking for investment to enable technology scaleup & deployment (1 – 10 tonnes H_2/day)

De-risking commercial plant construction

2024

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Thank you!
¡Gracias!
Merci!

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