CARBON FUTURES

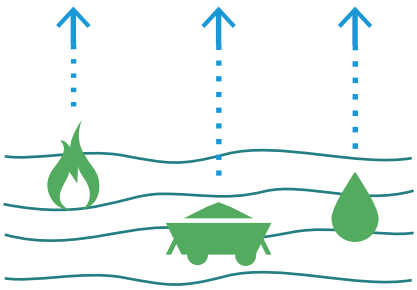
CERC
Clean
Energy
Research
Centre

CARBON CAPTURE, SEQUESTRATION AND CONVERSION

Efforts in UBC are divided in 3 research areas: Carbon Capture and Separation, Carbon Sequestration, and Carbon Conversion. Each one of them has different focus and on-going projects:

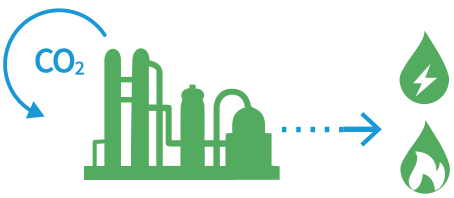
CARBON CAPTURE AND SEPARATION

- CO_2 solid sorbents for pre- and post-combustion systems
- Chemical looping combustion system
- Gas hydrate crystals for pre-combustion capture of CO_2



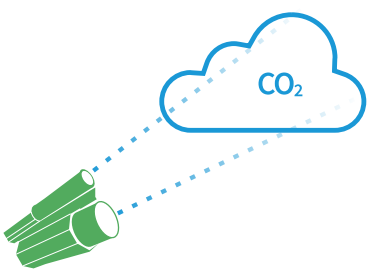
CARBON SEQUESTRATION

- CO_2 storage in mines and mineral precipitates
- CO_2 storage in depleted Natural gas reservoirs
- Air contactor and regeneration cycles



CARBON CONVERSION

- Electrochemical conversion of CO_2 to produce valuable chemicals and fuels
- Co-polymerization of CO_2 to increase the molecular weight of polymers while increasing CO_2 utilization



CO_2 MEASUREMENT

Differential absorption lidar (DIAL) is applied to monitor CO_2 concentration in reactor and other processes. DIAL operates at two wavelengths: one on resonance and one off resonance of CO_2 absorption. The difference between these two signals is proportional to the number density of CO_2.

SAFE, EFFICIENT, AND SUSTAINABLE CARBON CAPTURE AND UTILIZATION

This convergence of advanced technologies will:

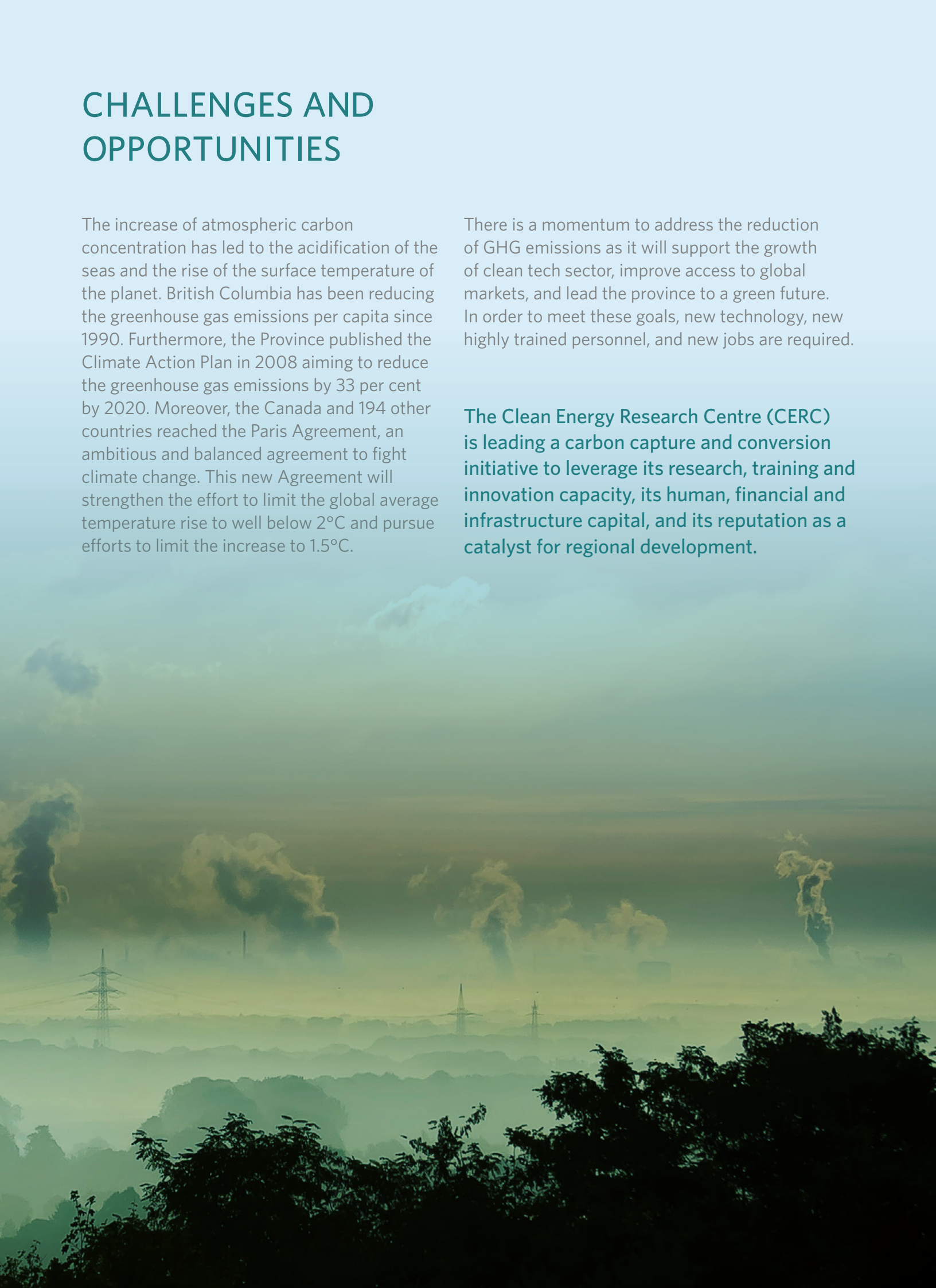
- Enable projects that create local jobs
- Validate technologies and push innovation from bench-top to market
- Train and educate the next generation of technologists, engineers, scientists, and policymakers
- Evaluate the full lifecycle benefits of different carbon capture and conversion technologies
- Develop and execute business models that can be exported to other Canadian and global jurisdictions
- Grow from a regional cluster on the continental West Coast, into a global centre of excellence and leadership

CHALLENGES AND OPPORTUNITIES

The increase of atmospheric carbon concentration has led to the acidification of the seas and the rise of the surface temperature of the planet. British Columbia has been reducing the greenhouse gas emissions per capita since 1990. Furthermore, the Province published the Climate Action Plan in 2008 aiming to reduce the greenhouse gas emissions by 33 per cent by 2020. Moreover, the Canada and 194 other countries reached the Paris Agreement, an ambitious and balanced agreement to fight climate change. This new Agreement will strengthen the effort to limit the global average temperature rise to well below 2°C and pursue efforts to limit the increase to 1.5°C.

There is a momentum to address the reduction of GHG emissions as it will support the growth of clean tech sector, improve access to global markets, and lead the province to a green future. In order to meet these goals, new technology, new highly trained personnel, and new jobs are required.

The Clean Energy Research Centre (CERC) is leading a carbon capture and conversion initiative to leverage its research, training and innovation capacity, its human, financial and infrastructure capital, and its reputation as a catalyst for regional development.



FEATURE PROJECT

CONVERTING WASTEWATER AND CARBON DIOXIDE INTO VALUE

The technology is a waste-to-value innovation that converts waste carbon dioxide and high salinity waste-water into value added chemicals and desalinated water for re-use. An electrochemical cell applying concepts of fuel cell technology, electrolysis and electro-dialysis is used to desalinate wastewater to a desired salinity level, remove carbon dioxide as a mineralized form and generate chemicals for on-site utilization. The technology creates value for end-users by significantly reducing the need for water, wastewater and chemical supply management. The system is a tail-pipe solution which is modular, scalable and mobile.

Seed-grant funding from the Climate Change and Emissions Management Corporation (CCEMC), Western Economic Diversification (WED) and the Natural Science and Engineering Research Council (NSERC) have been used to accelerate commercialization of the technology from a prototype reactor to a fully functioning pilot plant. A commercial scale pilot plant built by NORAM Engineering and Constructors is currently being demonstrated at B.C. Research Inc. in Burnaby, B.C. An in-field demonstration of this pilot plant is expected within the next two years.

A single **1,000 barrel per day** wastewater treatment capability system integrated with a waste-gas to power system is expected to:

remove
30,000 tonnes
of carbon dioxide
=
6,337 cars

conserve
> 58 million liters
of water every year
=
24 Olympic size swimming pools

create **value**
for the end-user
=

THE CERC ADVANTAGE

Collaborating with CERC means access to a variety of reliable resources and unique opportunities, including:

EXPERTISE

Research areas on campus include transportation networks, communications, alternative fuels, and urban design, planning and infrastructure design.

STRONG RELATIONSHIPS

Connections to a diverse group of government and industry partners help maximize both the relevance and impact of our efforts. Some of our partners include:

- Carbon Engineering
- City of Burnaby
- City of Vancouver
- City of Squamish
- Government of Alberta
- Highbury Energy, Inc.

CAPABILITIES

- Thermogravimetric analyzers accommodating pressure and temperature swing (dual mode) operations are available to study the solid reactivity over many adsorption and desorption cycles.
- Solid attrition-testing units capable of mimicking conditions to which solids may be physically exposed are used to characterize the physical durability of sorbents.
- Chemical looping combustion system that produces nearly pure stream of steam and CO2.
- Hydrate crystals production
- Electrochemical systems evaluation and design
- Polymer testing and production

CERC RESEARCH APPROACH

BREAKTHROUGH TECHNOLOGIES

- Innovative microliquefaction, storage and insulation, sensors, controls and automation
- Game changers

SYSTEM SIMULATION MODELLING

- Modelling and simulation: economics, thermodynamics, CFD, FEa, etc.
- Validates technological benefits

PARTNERSHIPS + NEW VENTURES

- Commercialisation of research product(s)
- Work with existing partner companies, new start-ups, and licensing

EXPERIMENTATION + TESTING

- Bench and lab scale experiments
- Full-scale testing capabilities under development

THE UNIVERSITY OF BRITISH COLUMBIA
Clean Energy Research Centre

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