

## What Makes This Research Cluster a Leader

The “Clean Energy” component provides global leadership in carbon capture and other low-clean energy research activities. It has hosted two phases of a Consortium consisting of provincial, national and international governments, research centres and industry, as well as large projects funded by provincial, national and international governments, research centres and industry. It has become the go-to resource group on all issues relating to carbon capture. The “Water and Environment” components demonstrate national leadership by initiating and conducting large, federally funded, interdisciplinary projects that apply cutting-edge technology to regional problems of international significance. Examples are long-term studies of climate change and hydrological cycles in prairie ecosystems, nitrogen pollution in lakes, impacts of energy industry (oil, gas, nuclear) on aquatic and terrestrial habitats, source tracking of fecal contamination, and use of genetic markers to detect contaminants in wildlife.

## Research Impact

This research cluster houses approximately 36 faculty researchers (including four Canada Research Chairs) that have jointly published more than 1,000 papers in peer-reviewed journals. Many members are nationally and internationally recognized as directors, board members and editors of scientific journals and societies, and serve on national funding panels. This research cluster participates in three Natural Sciences and Engineering Research Council (NSERC) Strategic Networks (AUTO21, H2CAN and CMC) and attracts/supports a large number of NSERC funded graduate students. According to InCites, the University of Regina has the highest number of citations per paper in Canada in the “Clean Energy” component of the cluster, and the third highest number of citations per paper (16.8) in the area of “Environment/Ecology” in western Canada (UBC 21.9, U of Alberta 17.7).

## Critical Mass of Highly Qualified Personnel (HQP)

Faculty for the “Clean Energy” component number 16, one of the highest nationally. The number of HQP is 20 faculty plus post-docs and graduate students for the “Water and Environment” components. While relatively small compared to larger institutions, the interdisciplinary nature of the research provides higher levels of HQP per project than would otherwise be possible.

## Interdisciplinary Research

The “Water, Environment & Clean Energy” research cluster is highly interdisciplinary, bringing together scholars from engineering (process systems, environmental systems, petroleum systems, industrial systems and software systems programs), as well as aquatic sciences, geology, geography, hydrology, cellular and microbial sciences, genetics, behavioral sciences, climatology, physiology, chemistry, botany, forestry, atmospheric sciences, conservation and biomedical research. In addition, many projects involve participation of other Canadian and international experts, as well as provincial, federal government and international agencies, industry, governments and non-governmental organizations.

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## UNIVERSITY OF REGINA RESEARCH CLUSTERS 2016-2021 Alignment with the Saskatchewan Plan for Growth

*Research encompasses creative endeavours and other scholarly activities that foster new knowledge. Critical to the University's success are its research clusters, which have been identified as a function of their critical mass (highly-qualified personnel), performance (impact) and distinctiveness:*

| Anxiety, Stress & Pain | Water, Environment & Clean Energy |  
| Digital Future | Social Justice & Community Safety |  
| Integrated Human Health: Equity, Disease & Prevention |

## Water, Environment & Clean Energy Research Cluster

The “Clean Energy” research component focuses on developing environmental low carbon technologies to mitigate carbon dioxide emissions associated with climate change. It also investigates new policies based on these technologies as well as their public acceptance. In the near term this research will allow Canada to continue to benefit from its fossil fuel resources in an environmentally sustainable manner. In the long term, it will pave the way for a transition towards sustainable carbon-free clean energy systems.

The “Water and Environment” research components focus on impacts of natural and anthropogenic effects on grassland, forest and aquatic habitats. The overall scarce, yet unpredictable availability of water across the prairies poses challenges to balancing the desire for high water quantity, quality and habitat integrity with water withdrawals for industrial, agricultural, urban and recreational uses, and their associated deliveries of pollutants back into lakes and rivers. Accordingly, a large body of research is dedicated to evaluate the impacts of climate, land-use and pollution on hydrology, water quality and food-web integrity of Saskatchewan lakes and rivers. The Long Term Ecological Research approach to identify serious threats to environments in semi-arid regions provides information to decision makers on how to alleviate negative impacts, and develop adaptive management strategies for the impacts of climate change, population growth and increased development of natural resources.

# UNIVERSITY OF REGINA'S WATER, ENVIRONMENT & CLEAN ENERGY RESEARCH CLUSTER

## ALIGNMENT WITH THE SASKATCHEWAN PLAN FOR GROWTH

The Saskatchewan Plan for Growth sets out the Government's vision for a province of 1.2 million people by 2020. The Water, Environment & Clean Energy Research Cluster aligns with 3 of the 6 Core Growth Activities identified by Government to foster economic growth and address challenges.

Growth Activity	How the Water, Environment & Clean Energy Research Cluster aligns with Growth Activity
<b>Ensuring Ongoing Competitiveness of Saskatchewan's Economy</b>	<ul style="list-style-type: none"> <li>• innovative Research and Development (R+D) increases productivity and creates new opportunities in the areas of clean energy, oil and gas initiatives (e.g. enhanced oil recovery), mining, life sciences, crop sciences and forestry</li> <li>• R+D assists the petroleum industry in cleaning up contaminated sites, improves energy efficiency for municipalities and industry, and helps solid waste managers control contaminants and protect human health</li> <li>• R+D creates spin-off business opportunities (e.g., consulting, engineering firms, carbon capture projects)</li> <li>• improved environment and successful reclamation will increase tourism activity around the province</li> </ul>
<b>Advancing Saskatchewan's Natural Resource &amp; Agricultural Advantage</b>	<ul style="list-style-type: none"> <li>• developing new clean energy technologies and studying effects of climate change on natural resources, and inform governments/ industry (e.g. regarding resource development, energy security, policy priorities, governance and environmental limitations)</li> <li>• evaluate impacts of water withdrawal for urban, agricultural and industrial uses on water quality and quantity</li> <li>• evaluate impacts of municipal, agricultural and industrial emissions on water quality in prairie and boreal lakes</li> <li>• groundwater simulation models identify the risks associated with soil remediation methods based on prairie soil and climate conditions</li> <li>• climate models inform public and governments on weather and environment related risks and events (e.g. floods, storms, droughts)</li> <li>• energy systems modeling tools for responsible resource development: evaluate socio-economic impacts to guide best practices</li> <li>• risk management studies of municipal water safety to identify and reduce threats (e.g., study of vulnerability and risks to Regina drinking water examined emergency management and policies regarding water safety)</li> </ul>
<b>Growing and Developing Saskatchewan's Labour Force</b>	<ul style="list-style-type: none"> <li>• job creation, investments and transformation of regional economies with socio-economic study on Carbon, Capture &amp; Storage, Energy systems, Remediation and Waste Engineering</li> <li>• training of Highly Qualified Personnel to handle production of clean energy</li> <li>• training of Highly Qualified Personnel (HQP) who are intimately familiar with the specific opportunities and challenges of terrestrial and aquatic prairie environments (e.g. water quality and quantity, mining, hydrology, forestry, grasslands, agriculture)</li> <li>• research units facilitate recruitment and retention of national and international experts in the areas of clean energy, water and environment, and deliver training to professionals in those areas</li> </ul>