RÉSEAU BIOFUELNET CANADA

Biomass Cluster Activities

The BioMass Canada Cluster seeks to improve agricultural producers' incomes by adding value to agricultural wastes. This Cluster seeks to reduce production costs and increase yields for biofuels and other bioproducts by improving the production processes and technologies. It will also increase market opportunities for biomass by improving the supply chain logistics. It includes the following key factors:

THEME 1: BIOMASS AND BIOENERGY FOR NORTHERN LATITUDES seeks to extend the growing season in northern Canada by producing heat and power from biomass such as crop wastes and greenhouse waste;

THEME 2: OPTIMIZATION OF BIOMASS PRODUCTION will improve technologies used for producing biomass, and resulting biochar and hydrochar from agricultural wastes;

THEME 3: BIOMASS PREPROCESSING, SUPPLY CHAIN LOGISTICS AND ECONOMICS seeks to reduce the costs associated with biomass processing and improve the supply chain logistics;

The BioFuelNet Canada management team (Dr. Donald L. Smith, CEO of BioFuelNet and Dr. Xiaomin Zhou, Director of Operations, BioFuelNet) is responsible for coordination of the science among the research activities. The Cluster also includes a knowledge and technology transfer strategy that seeks to address de-risking decisions through knowledge and evidence-based communication products and training events to mobilize agricultural operators regarding engagement in biomass value chains.

LEAD BY
Donald Smith
BioFuelNet Canada

LEAD BY
Dr. Xiaomin Zhou
BioFuelNet Canada

THEME #1

BIOMASS AND BIOENERGY FOR NORTHERN LATITUDES

BIOMASS FEEDSTOCK FOR FOOD AND ENERGY SECURITY IN THE NORTH: SOLUTIONS TO TECHNICAL ISSUES, ECONOMIC FEASIBILITY AND ENVIRONMENTAL SUSTAINABILITY

LEAD BY
Lope Tabil
University of Saskatchewan

AAFC LEAD
Edmund Mupondwa
Saskatoon Research and Development Centre, AAFC

COLLABORATOR
Duncan Cree
University of Saskatchewan

COLLABORATOR
Tim Dumonceau
Saskatoon Research and Development Centre, AAFC

The aim of this activity is to extend the growing season of agricultural operators in Canada's northern latitudes using locally-sourced biomass feedstock for combined heat and power (CHP) generation. The biomass feedstock includes agricultural crop residues, purpose grown crops on marginal lands, and forest residues. The technical feasibility of using stationary and/or mobile processing facilities will look into various scenarios for biomass size reduction, pretreatment, densification/agglomeration, and storage. The economic analysis will include the life-cycle analysis (LCA) and explore options for thermo-chemical and biochemical conversion of biomass feedstock to various forms of fuels. Dr. Tabil and Dr. Cree are working with Dr. Tim Dumonceaux and Dr. Edmund Mupondwa of Agriculture and Agri-Food Food Canada, Saskatoon Research Centre to provide multi-disciplinary approach to this activity.

RÉSEAU BIOFUELNET CANADA

Biomass Cluster Activities

ZERO-WASTE PROCESS FOR CONVERSION OF WET GREENHOUSE WASTES AND AGRO-FORESTRY RESIDUES INTO RECYCLED WATER/BIOENERGY/HIGH-VALUE BIOPRODUCTS

LEAD BY
Charles Xu
University of Western Ontario University

AAFC LEAD
Zechun Yuan
London Research and Development Centre, AAFC

This activity aims to develop and demonstrate the technical and economic feasibility of an innovative zero-waste technology for valorization of wet greenhouse waste, farm manures and agro-forestry residues. This breakthrough technology converts biomass feedstock, without the needs of costly de-watering and drying pre-treatment of the feedstock, into multiple high-value products, and water reused for plants in greenhouses. The bioproducts include biochar for bioenergy or soil conditioner and bio-oil (as bio-polyols), cellulose and lignin for the synthesis of bio-based polyurethane (BPU) foams used as low-cost hydroponic growing media for greenhouse planting, super absorbent polymers for soil water retention and bio-based formaldehyde-free wood adhesives, etc..

THEME #2

BIOCHAR PRODUCTION FROM CANADIAN LIGNOCELLULOSIC BIOMASS AND APPLICATION FOR CARBON SEQUESTRATION, SOIL IMPROVEMENT AND CROP PRODUCTIVITY

LEAD BY
Ajay Dalai
University of Saskatchewan

This activity aims to study the potential for thermochemical conversion (e.g., pyrolysis and gasification) of local Canadian agricultural biomass such as canola meal, canola hull and oat hull into high energy products (e.g., bio-oil and syngas) along with biochar. Biochar (a solid by-product of pyrolysis and gasification of biomass) is a potential bioresource for energy, soil quality improvement, and carbon sequestration.

VALORIZATION OF AGRICULTURAL AND FOOD WASTES: A CLOSED-LOOP CIRCULAR ECONOMY CONCEPT TO ADDRESS CLIMATE CHANGE, BIOGAS PRODUCTION, WASTEWATER MANAGEMENT, AND SOIL HEALTH

LEAD BY
Animesh Dutta
University of Guelph

Potential of hybrid thermochemical and biochemical approach will be studied for various agri-food co-products for producing hydrochar, activated carbon, biomethane, and biofertilizer especially from wet biomass. **This study will enhance sustainability, resource and energy conservation, soil heath and water management in agri-business sector.**

OPTIMIZATION OF BIOMASS PRODUCTION

PURPOSE-GROWN BIOMASS CROPS: EFFICIENT PRODUCTION, YIELD MODELLING AND REAL-WORLD VERIFICATION

LEAD BY
Kevin Vessey
St-Mary's University

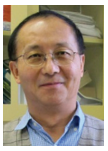
AAFC LEAD
Yousef Papadopoulos
Kentville Research and Development Centre, AAFC

This activity aims to lower the risk of biomass feedstock supply chains. This research will determine the ability of plant-growth promoting substances and organisms to enhance growth and decrease production costs in switchgrass, Miscanthus, hybrid-poplar and willow. The study will determine the yield potential of these four crops at up to 10 on-farm sites on marginal soils in Nova Scotia and build databases and yield prediction models based upon scientific studies of purpose-grown biomass crops from areas around the world with climatic conditions similar to Nova Scotia.

RÉSEAU BIOFUELNET CANADA

Biomass Cluster Activities

DEVELOP A LOW-COST AND HIGH PRODUCTION SYSTEM FOR SORGHUM BIOMASS ON MARGINAL LANDS



LEAD BY
Lining Tian
London Research and Development Centre, AAFC

COLLABORATOR
Julia Lu
Ryerson University

COLLABORATOR
Kevin Vessey
St-Mary's University

This activity aims to develop a system to grow sorghum on marginal lands in Canada by evaluating sorghum genotypes, and selecting hybrids/genotypes that are most suitable to grow on marginal lands for high biomass. Nitrogen fixing bacteria will be studied in order to reduce or eliminate nitrogen fertilizer usage.

DEVELOPMENT OF BIOLOGICALS AS LOW INPUT, SUSTAINABLE PRODUCTION PRACTICES FOR FUEL AND RESIDUE/FOOD PRODUCTION

LEAD BY
Donald Smith
McGill University

This activity aims to develop biological inputs for Canadian crop production, including microbial strains and biostimulants (e.g., flavonoids), and isolate novel plant-growth-promoting cultivatable microbes from Canadian crop and uncultivated plants. The isolated microbes will be evaluated for enhancement of crop seed germination (soybean). Effective strains and compounds identified will then be evaluated under field conditions for ability to enhance the growth of biomass crops (switchgrass, Miscanthus and Spartina pectinata), that are suitable for CHP and the production of biochar, hydro-char and other high value bioproducts, and to enhance residue biomass production by food crop plants.

THEME #3

BIOMASS PREPROCESSING, SUPPLY CHAIN LOGISTICS AND ECONOMICS

APPLICATION OF THERMO-CHEMICAL AND HYDRO-THERMAL PRE-TREATMENTS IN PRODUCTION OF FUEL PELLETS USING AGRICULTURAL WASTES

LEAD BY
Ajay Dalai
University of Saskatchewan

This activity aims to produce high quality biomass fuel pellets from low-value agricultural feedstocks or by-products obtained after processing agricultural feedstocks, using the torrefaction and hydro-thermal pre-treatments. These processes enhance biomass feedstock hydrophobicity, heating value, and thermal stability.

DEVELOPMENT OF LOGISTICS, PRETREATMENT AND COMMERCIALIZATION OF AGRI-PELLETS

LEAD BY
Shahabaddine Sokhansanj
University of British Columbia

Building on years of collaborating with wood pellet industry, this activity addresses the barriers to the commercialization of agri-pellets from wheat straw. It will also conduct research on other agri-residues and purpose-grown energy crops such as switchgrass, willow and Miscanthus. This data from the agri-pellet production will serve to develop supply chain simulation models, and best practices on safe handling and storage of agri-pellets.

RÉSEAU BIOFUELNET CANADA

Biomass Cluster Activities

IMPLEMENTATION OF A REGIONAL BIOMASS DEPOT FOR THE HANDLING, CONDITIONING AND PRE-TREATMENT OF AGRICULTURAL CROP RESIDUES FOR FURTHER BIOREFINING: CENTRE-DU-QUÉBEC REGION CASE

LEAD BY
Simon Barnabé
Université du Québec
à Trois-Rivières

This activity aims to develop a regional biomass processing depot model, assuming co-location at a pig or dairy farm, in order to produce cellulosic sugars at a competitive cost from large crop residues (e.g., corn, wheat and soybean) for biofuels or more valuable products. Such a regional biomass processing depot aims to reduce the cost of the agricultural crop residue supply chain for primary and secondary transformation into second generation cellulosic biofuels and co-products. In addition to model development, research on value addition to coproducts (hemicelluloses & lignin) will be conducted. This work will also go in the field in order to inform farmers of the benefits of supplying biomass and creating a regional biomass processing depot. One pilot-scale experiment is also planned for biomass fractionation and biochemical conversion to cellulosic sugars to get fresh data in relation with the agricultural crop residues available in the area of Centre-du-Québec region.

PARTNERS

Listed in Alphabetical Order

Acadian Seaplants Algues Acadiennes
ADECO BioResources Inc.
AERC Agriculture Environmental Renewal Canada
Agroworld
BioApplied Innovation Pathways
Biofueltech Corporation
Custom Stam Inc.
Floating Gardens
GS Bioresource Systems
McGill University
Mistik Management Ltd. Creating opportunity since 1989
MLTC Industrial Investments LP
Nova Scotia Innovation Hub
NSFA 1895 Federation of Agriculture
NULIFE GreenTech reducing your carbon footprint
Port Hawkesbury Paper
PROVETA Nutrition Ltd. Feed to Succeed....
SaskPower Powering the future
Saint Mary's University Since 1802
Shrimp Canada
synAgri
UBC a place of mind The University of British Columbia
University of Guelph Improve Life.
Ulysse Biotech
Western Maple Bio Resources Inc.
Wood Pellet Association of Canada

Canadian Agricultural Partnership | Partenariat canadien pour l'agriculture
BioMasse Canada
Réseau BIOFUELNET Canada
Canada