Studies on GIS-based Availability and Supply of Cereal Straw as a Feedstock for a Biorefinery in Peace River Region

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Feedstock supply is the largest business risk for any biomass-based industrial facility. A dynamic simulation model of biomass harvest and logistics was created to optimize delivery of biomass from the field or forest to a central processing plant. The model is composed of over 30 individual modules that can be linked in a variety of combinations to enable a comparison of unit operation sequences based upon cost, emissions, and energy consumption. The dynamic model was partnered with a vector-based geographical information system (GIS) biomass resource assessment to identify potential plant sites that met criteria of adequate biomass supply, population, and road/rail infrastructure. Case studies were conducted in the Quesnel Timber Supply Area (TSA) (forestry), for harvest and delivery of Mountain Pine Beetle wood, and the Peace River region of Alberta (agricultural residues). Weather was found to play a pivotal role in delivered biomass cost, particularly due crop residue yield (and hence transportation distance) and timing of operations. Over a 20 year facility lifetime, and after accounting for soil erosion retention requirements, no biomass was available for industrial operations in at least one year. In the case of forestry, competition with existing wood uses and decreasing sources of feedstock following the MPB epidemic meant supplies were insufficient to meet the demands of a 300MW power plant without altering the Quesnel TSA annual allowable cut.