**A stochastic mixed integer linear programming model to optimize the inventory management policy for a biomass pellet production facility**

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**First stage decision variables (aimed at robust IM policy)**

*: the fill-up-to level of raw material inventory in each month*

*: the lower bound that triggers the order of raw materials in each month*

**Second Stage Decision variables (tracking the resource decisions and the consequence of the policy for each scenario )**

*: binary variable tracking whether we will reorder raw material at the end of period t for scenario*

*: binary variable tracking whether we will reorder raw material from source i at the end of period t*

*: the amount of end products in storage during period t*

*: tracking total raw material owned at the end of period t including in-transit*

*: raw material moved to production during period t that still have u days to be converted to end-product*

**Parameters set for each stochastic scenario**

**Parameters shared by all scenarios (we need those data to populate the model)**

**Mathematical Equations**

***Subject to:***

*(1)*

*(2)*

*(3)*

*(4)*

*(5)*

*(6)*

*(7)*

*(8)*

*(9)*

*(10)*

*(11)*

Objective function will minimize the total average cost of inventory management by the facility for the entire year. Constraint (1) make sure if we order any product from a facility during a day, there will be a fixed cost associated with those orders. The fixed cost does not have to exist; if no fixed cost is associated with each order, we will set it to zero. Constraint (2) limits the amount of biomass purchased from each site during each day cannot be more than the amount of biomass available from that site in the corresponding day. Constraint (3) calculate the total biomass purchased in each day from all sources. Constraint (4) calculate the total amount of biomass in stock at the facility plus the biomass in transition at the end of each day. This is the total amount of biomass owned by the facility at the end of each day. Constraint (5) assigns value to a binary variable to track whether we will reorder raw material at the end of a day depending on whether the total amount of biomass owned by the facility is bellow the lower bound. Constraint (6) calculates the amount of biomass that should be purchased to meet the “order-up-to” requirement at each day. Constraint (7) accounts for biomass in transition and how many days still left for them to arrive at the facility. Constraint (8) calculates how much biomass in hand (in storage) at the facility after accounting for the consumption from production and newly arrived biomass. Constraint (9) tracks how much biomass is still used in the production process and the number of days left before they can become the final product. Constraint (10) tracks the total amount final product in storage at the facility after accounting for the demand of the final product and the newly produced final product by the facility. In case there is not enough final products from the facility, we will track the loss of sale amount required to meet the final demand in day t.