

# Capabilities

## forestconcepts

### Advanced Drying Technologies

Reducing cost and improving product quality through better engineering data, innovative control systems, and optimized hardware design



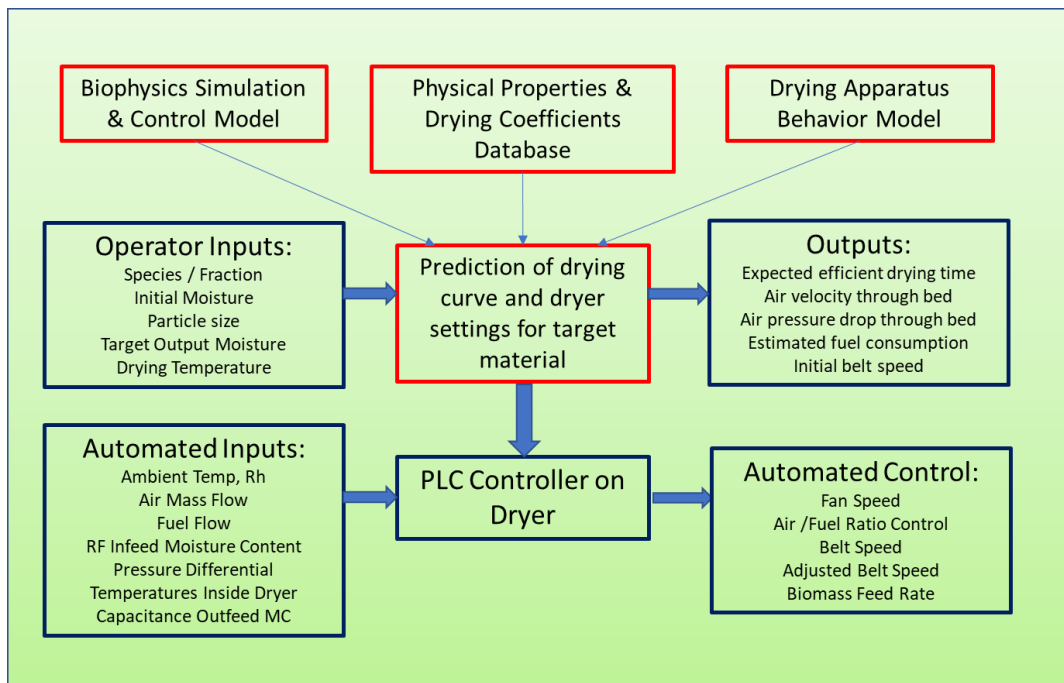
Drying of biomass and bio-based materials consumes more energy than any other operation in most pellet mills, biorefineries, gasification plants, and other dry biomaterials plants. Forest Concepts has been working to improve dryer energy efficiency, improve uniformity of output, and reduce demands on the operator to constantly make changes to operating parameters.

Laboratory characterization of wet materials to determine drying rate curves, quantify dryer engineering design and control properties, and to test new control schemes can be done with Forest Concepts' unique Research Drying Apparatus (RDA) an

innovative test device developed in partnership with US DOE.

Forest Concepts' small industrial belt dryer shown above is available for supersack to truckload-scale production use and to validate control and performance recommendations established with the RDA.

The belt dryer is a Norris Thermal Industries Belt-o-Matic Model 123b dryer that has been extensively modified to be downdraft, operate at low temperatures, and incorporate all of Forest Concepts' advanced dryer control features. The system is easily relocatable and fueled by propane.



Biophysics-based model-predictive dryer control is the holy grail that we pursue on a daily basis. Today, we are very close to such a control system for select biomass materials. We continuously add physical properties and drying engineering data to our database in anticipation of the next generation of control systems.

When available, the biophysics-based control will set biomass-specific parameters that overlay a condition-based control that actually sets fan speeds, fuel flow, belt speed, etc. While all of those “knobs” are turned by human operators in most facilities, for the past two years Forest Concepts has been running our proprietary, but commercially available, condition-based control system on our own Norris Thermal Industries 123b dryer.

Operator interaction with the dryer has been increased from a change every few minutes to a change every hour or so. Even then, the change is to a condition setting such as bed temperature or air velocity across the bed and not to fuel flow or fan speed. The control system does all the match, psychrometric chart interpretation, air-fuel ratio calculations, etc. for the operator.

Our 123b dryer is an integral part of our biomass toll processing unit and is available for separate use to evaluate drying of materials for clients, test drying across a range of conditions, etc.

#### Dryer Specifications:

- Dryer type: Downdraft moving bed (conveyor dryer)
- Belt width: 0.6 m
- Belt length: 2.4 m
- Smallest particle size that can be dried: 1.5 mm
- Material Depth: 40 to 170 mm
- Drying time: 1 minute to hours
- Air temperature: ambient to 125 C
- Fuel source: propane
- Infeed: Hopper or Supersacks to infeed conveyor
- Outfeed: Supersacks, bins, bulk
- Minimum volume to conduct a run: 2 m<sup>3</sup>

#### Sensors and Instrumentation:

- Air temperature above bed
- Air temperature below bed
- Pressure drop across bed
- Fuel mass flow
- Inlet air mass flow
- IR moisture on infeed conveyor
- Belt speed, residence time
- System historic data logging

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