

TSI Direct Contact Rotary Single-Pass-Recycle Dryer System

- 95% of Biomass Dryer Systems in North America are Direct Contact Rotary Dryers

- Rotary Single-Pass-Recycle Dryer System characteristics:
 - Low operating costs, low maintenance costs, and high uptime
 - Single Pass ensures Gas Classification Particle Drying
 - Recycle minimizes emissions and improves energy efficiency
 - High production capacities
 - Design flexibility
 - Quick deliveries, installations, and ramp ups

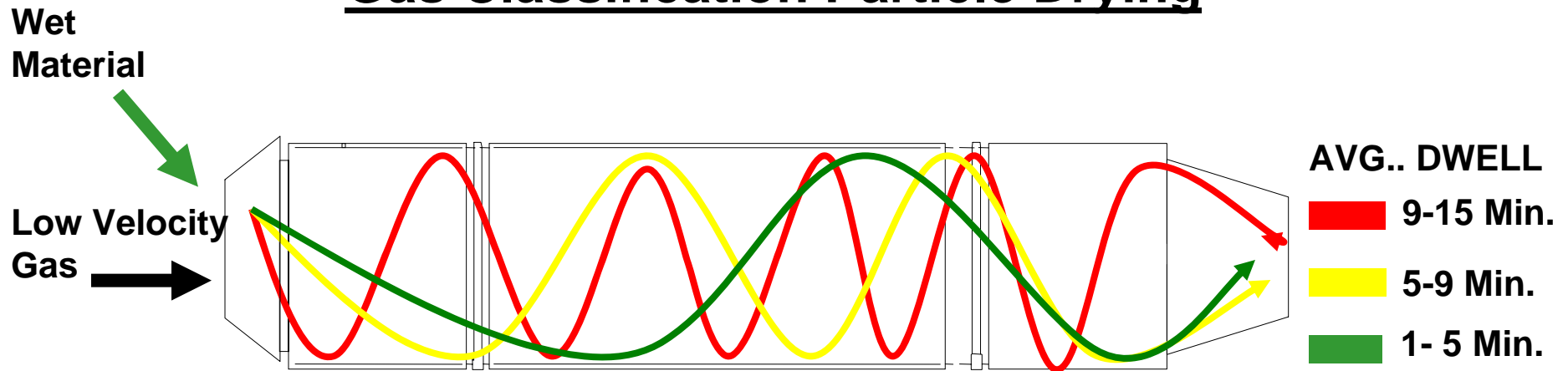
95% of Biomass Dryer Systems in North America are Direct Contact Rotary Dryers

- Weyerhaeuser (World's largest forest product company)
- Georgia Biomass (World's largest Pellet Plant)
- Louisiana Pacific Corporation (World's largest OSB producer)
- Kior (biomass to biofuels company)
- Green Circle (World's second largest Pellet Plant)
- JM Huber (multinational supplier of engineered materials)
- Georgia Pacific Corporation (operates World's largest OSB plant)
- SmartPly Europe (Europe's producer of OSB products)
- Masisa (major supplier of engineered wood products in South America)

Low Operating & Maintenance Costs and High Uptime

- Rotary Dryer Systems utilize low gas flow thus minimizing Brake Horse Power exerted by its Induced Draft Fan
- Four motors run the Dryer System
- Annual maintenance costs low
- Typically Rotary Dryer Systems operate around 95% of the time

Gas Classification Particle Drying



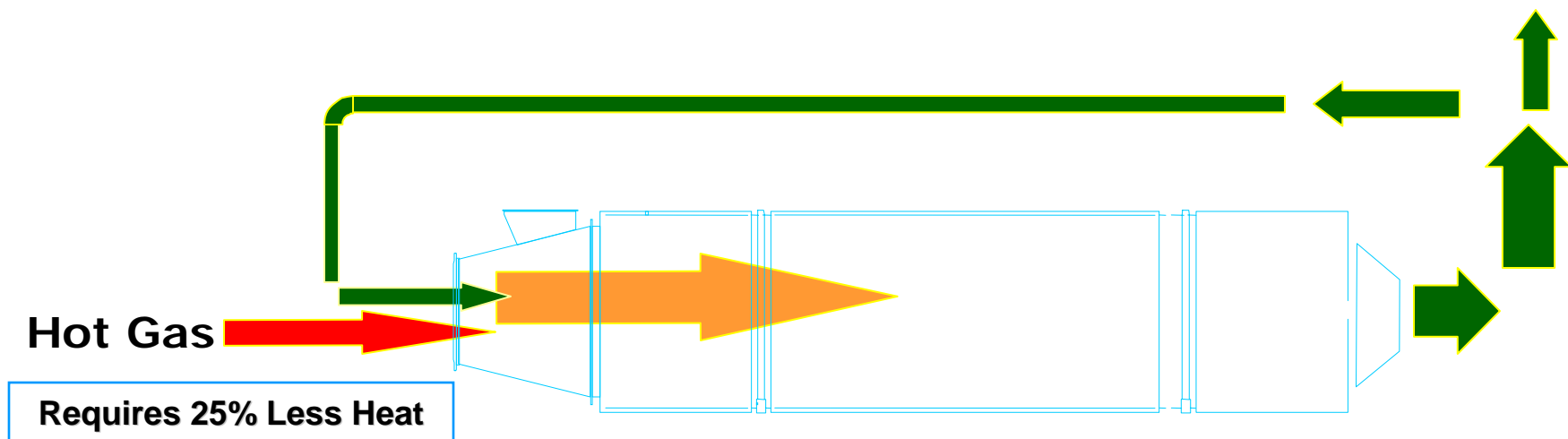
- Roseburg Forest Products (Dillard, OR)
 - Originally six 8' diameter 3-Pass Drums:
 - 3 Drums drying shavings from 50% to 3% moisture content wet-weight-basis
 - 3 Drums drying sawdust from 35% to 3% moisture content wet-weight-basis
- Single 18' diameter Drum:
 - Drying both shavings and sawdust from 50% & 35% respectively to 3% moisture content wet-weight-basis

Roseburg Forest Products (Dillard, OR)



Recycle System

- Typically recycles 50% of Dryer System exhaust flue gas and up to 75% depending on Dryer Drum design inlet temperatures
- Improves energy efficiency by 25%
- Lowers emissions and size of Pollution Control Equipment (if required)
- Increases humidity of the drying gas thus providing for better conditioning of the biomass
- Reduces oxygen level within the Dryer System thus minimizing sparks carried over from the Heat Energy System



Typical Recycle System



High Production Capacities

- TSI Rotary Single-Pass-Recycle Dryer Systems can handle various production capacities and some of the highest production capacities in the world.
- Currently TSI Dryer Systems handle anywhere between 1 ton/hr up to 60 tons/hr for a single Dryer System when drying from 50% moisture content to 3% moisture content wet-weight-basis
 - Rotary Dryer Systems are easily scalable
 - Modular construction
 - Small foot print
 - Easy manufacturing

Masisa (Porto Alegre, Brazil)

Ø24'x140' Long Drum - 60 tons/hr (50% to 3% m.c.)



Martco (Oakdale, LA)

Ø20'x100' Long – 40 tons/hr (50% to 6% m.c.)



Louisiana Pacific Corp.
Ø20'x100' Long – 30 tons/hr (50% to 4%)



Lee Energy Solutions

Ø14'x70' Long – 20 tons/hr (50% to 10% m.c.)



Design Flexibility

- Combine multiply biomass streams at various moistures and dry to specified moisture content
- Combine various size biomass streams and dry to specified moisture content
- Minimize power consumption of the Dryer System
 - Higher Dryer Drum inlet temperatures
 - Hopper/Multi-Clone exhaust system
- Minimize energy consumption of the Dryer System
 - Able to process low energy flue gas from other plant processes
- Minimize emissions and possibly eliminate need for Pollution Control Equipment
 - USA (only country in the world that regulates Volatile Organic Compounds (VOC))
 - Hardwoods emit less VOCs when compared to Softwoods

Delivery, Installation, Ramp-up

- Typical TSI Rotary Dryer System equipment delivery is between 4 and 6 months
- Typical installation of a TSI Rotary Dryer System ranges between 2 and 5 months
- Typical ramp-up of a TSI Rotary Dryer System ranges between 7 and 30 days
- Return on investment between 6 and 12 months