



## FutureMetrics™ LLC

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### Improving Profit Margins in the Manufacture of Wood Pellets

*“The manufacture of wood pellets is easy, however easy is difficult to achieve and maintain”*

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FutureMetrics' operations experts share decades of experience and accumulated wisdom in this outline of the fundamentals of optimizing wood pellet manufacturing plant production in order to cost effectively maximize pellet output and quality, while maintaining safety and plant asset integrity.

FutureMetrics operations optimization consulting can often result in **“Instant ROI”**. In our experience, improving uptime, quality, consistency, conversion costs, and safety often only require changes in operating protocols. In those cases, no capital investment is needed.

Improving profit starts with optimizing the uptime of a wood pellet plant while maintaining consistent pellet quality... and lowering the total cost per tonne of pellets produced. This can be done without sacrificing quantity, quality, and safety.

Maintaining uptime and quality requires several key fundamentals that contribute to a lower cost per tonne. Fundamentals include:

1. A well-designed manufacturing facility complete with best-in-class process equipment and material handling. Insuring constant flow of material to and from each process center (no plugging and bridging causing flow disruptions) is critical.
2. A well trained and motivated operations team that understand the plants standard operating procedures (SOP's) and the importance of maintaining consistent moisture content (MC) and the particle size distribution (PSD) for the feedstock preparation prior to the pellet presses.
3. A well-maintained plant facility with a solid preventative maintenance (PM) program.
4. Optimize pelletmill production by dialing in the correct die effective and feed rate flow.
5. Maximize die, roller, and bearing life by maintaining proper purging practices when starting up and shutting down the pellet mills.
6. Have comprehensive quality control (QC) practiced from fiber receiving, fiber preparation, pellet production, through to the cooling, screening, storing, and shipping of the final product.
7. Practice well-developed mandatory personal safety protocols and fugitive dust management.
8. Have process safety systems installed throughout the process flow.



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### A more comprehensive look at the items above

#### 1. Process Flow

- Correct sized process equipment
  - Oversize the plant for 20% above the required plant production output.
- Correct process equipment
  - Green fiber size reduction (pre-dryer)
    - Shredder or hammermill for feedstock size reduction.
    - Vibratory screen deck or scalper, or scalper and diamond roll screener (reduces shredder or hammermill load and eliminates redundant size reduction).
  - Drying
    - For immediate response to maintain constant and consistent moisture control, a metering surge bin MUST be positioned directly before the dryer inlet.
    - Rotary dryer efficiency improvement utilizing flue-gas recycling system.
    - Maintain correct and consistent drying temperatures and residence time.
- Material handling equipment
  - Importance of correctly sized conveyance – design for 10%-20% over the required maximum throughput.
    - Take care on understanding material bulk density at each stage in the process flow.
  - ELIMINATE THE POSSIBILITY OF BRIDGING AND PLUGGING - Understand the feedstock characteristics as it goes through size and moisture reductions. **Inconsistent or interrupted feedstock flow causes unstable quality and imprecise production control.**
  - Transition slope angles “open throat concept” - outward transitions – never inward.
- Feedstock Surge Bins/Silos/Hoppers
  - Have surge bins between process centers. For example, between the dryer island and pelletmill island have a buffer of anywhere between 2 to 12 hours of throughput volume. This allows for a production upset of either the dryer or pelletmills without having to interrupt or immediately shut down either process center. Avoiding interruption of the dryer operation is especially important. Once a dryer is operating stably and consistently at setpoints, they should be tightly maintained. It takes significant time (with the potential for aborted substandard fiber) to bring a dryer back to setpoint operations after shutting it down.

#### 2. Operations Management and Personnel (***improves production/reduces OPEX/Improves margins***)

- Operator training manual – all key staff must understand “Wood Pellets 101”
  - Describe the standard operating procedures (SOP) and how each contributes to the stability of up and downstream processes.
  - Understand how important it is to maintain constant and consistent feedstock MC and PSD.
  - Make safety the starting point of everyone’s work practices.
- Process automation and control
  - Human machine interface (HMI) should be operator friendly.



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- Automation of process timing, startup and shutdown sequences, and correct and functioning interlocks are fundamental to optimal control of the process.
  - Employee motivation
    - Set a culture in which employees enjoy coming to work and feel safe and secure.
  - Communications
    - Involve all personnel in all operations (SOP) changes at all times.
3. Fiber Management – ***(improves pellet quality/reduces costs/ improves margins)***
- Quality of the fiber
    - Maintaining a constant flow of sawmill and/or forest harvest residues are somewhat challenging these days with the downturn in sawmilling industry. The challenge of using forest harvest residues comes with issues such a bark, dirt, stones/rocks, etc. Efforts must be made to classify (cleanup) forest residuals as those contaminates cause excessive wear in many of the process centers in the plant and they cause pellet quality degradation.
    - When varying sources of fiber are being utilized (sawdust, chips, shavings) and/or when varying tree species are used in the incoming feedstock, it is important to maintain a consistent ratio to maximize output and to maintain pellet quality. Consistent premixing with a bucket loader is prone to human error. Individual infeed hoppers may be required.
    - Low MC feedstock, such as dry planer shavings, should bypass the dryer and should enter the process post dryer and pre dry hammermill.
    - Consistent clean fiber extends the hammer and screen life in hammermills, in pellet press dies and roller life, and in dryer and baghouse pneumatic venting.
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4. Preventative Maintenance Program (PM) ***(maintains uptime/improves margins)***
- Nothing impacts positive uptime better than a well-developed and practiced PM.
  - PM software programs assist with PM timing, replacement parts and trending/tracking etc.
5. Optimize pelletmill production ***(reduces unit costs/improves margins)***
- Upon achieving a quality feedstock with a consistent MC and PSD, optimization of the pelleting can begin.
    - Correct die effective.
    - Increased pellet mill feed rate.
    - Depending on feedstock characteristics, there may be a net benefit from additives and/or steam injection just prior to feeding the pellet press.
    - Well designed and maintained steam extraction system.
6. Maximize pellet press major consumables life (die, rollers, bearings) ***(improves OPEX and uptime)***
- Pellet mill purging practices
    - Upon pellet mill startup and shutdown purge with either some form of grain (barley, wheat, oats, corn, soya), or with pellets mixed well with oil.
    - Ensure the die is well purged at shutdown to ensure a smoother startup.



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7. Quality Control (QC) MUST be practiced from the receipt of the inbound fiber to the outbound product.
  - QC points
    - Inbound fiber – MC levels, fiber quality (no rot or contaminants)
    - PSD post wet/green hammermill and dry hammermill.
    - MC post dryer and dry hammermill.
    - MC, density, durability, fines post cooler and pellet screener.
    - Temperature monitoring post cooler and in storage (bins, silos, warehouses). If long term bulk storage is used, review the workshop materials on self-heating produced by FutureMetrics, the Wood Pellet Association of Canada, and Orsted.
8. Safety Protocol – Develop and practice safety policies to insure a safe secure environment, and to protect assets and cash flows.
  - With no exceptions, “Safety Protocols” (both personal and process) have been developed and are being practiced, understood and owned by all personnel (including management and owners) of the pellet plant.
  - Personal
    - Safety practices exercised by all.
    - Support for bottom-up communications for any perceived safety concern.
    - A codified rubric for managing and communicating all safety concerns.
  - Process – Fire and explosion potential sources and propagation channels identified and understood
    - Fire and explosion detection and suppression systems are installed throughout the production facility (process equipment centers and material handling equipment).
    - Incident response plans developed, workshoped, and understood by all plant staff and local emergency responders.

Input costs and markets for heating market pellets and coal-replacement pellet fuel are evolving.

**Ongoing success for producers will require lowering the cost per in-spec tonne for every tonne of pellets that are produced.**

FutureMetrics’ operations experts have decades of experience that cover the fundamentals that underpin the design and process flows of a pellet factory. Building on those fundamentals, they have been continuously at the forefront of improvements in pellet plant design, equipment, control systems, operations, and safety since the 1990’s.