FACTORS TO BE CONSIDERED IN CHOOSING YOUR KILN DRYING ENERGY SOURCE

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Introduction

With the price of fuel and electricity increasing at a rapid pace, many plants are taking a good look at energy efficiency of new, as well as old kilns. Maintaining the old ones and making judicious upgrades for energy efficiency can result in big pay back. This study deals with a plant trying to make technical decisions regarding the type of energy they should use fo their new kilns.

- Trade study for a proposed dry kiln
  - natural gas supply, isolated coastal site
  - kiln type and energy source options
  - species and product mix considerations
- Volatile fuel prices and new technology
  - method of wide applicability
  - rigorous analysis key to viability

Factors Considered

- Product characteristics and requirements
- Energy sources: characteristics and considerations
- Kiln type and capabilities
- Initial and operating costs
  - volatile fuel prices and new technology

Product Characteristics and Requirements

- Species/mix drying behavior
  - critical of quality, limits throughput
- MC distribution and drying character
  - average MC, species, dimensions, variability
  - wet pockets, compression wood, collapse
  - gains from sorting
- End use/market requirements and pricing
  - lumber or added value; cost of logs versus yield
  - degrade and final MC, costs of poor quality
- Present and future, likely scenarios

Energy Sources: Characteristics and Considerations

- Energy demand and supply, sources, other factors
  - drying usage and efficiency, peak and annual demand
  - natural gas, fuel oil, wood waste, electricity, waste heat
  - internal and external integration of energy sources/uses
- Long term availability and pricing
  - global and local factors, regulatory impacts
  - alternative uses, value of wood waste, landfill cost
  - scenarios and risks, probability and impact, mitigation
- Incidental costs and issues
  - incremental capital costs, maintenance and reliability
  - emissions and land use, regulations

Kiln Types and Capabilities

- Conventional
  - direct fired, air/air heat exchange, LP steam, thermal oil
  - fuel compatibility, machinery drive, exhaust heat recovery
  - effect on product quality, process capability
- Dehumidifying and vacuum drying
  - mechanical drive power and supplemental heat
  - value of higher quality product, low environmental impact
- Operational considerations
  - conditioning steam/water spray
  - emissions, reliability and maintenance
  - operator skills requirements

Initial and Operating Cost Analysis

- Capital cost baseline and differences
  - kiln construction, equipment, and energy supply
  - supplier quotes and historical data
- Fuel and electricity cost outlook for kiln lifetime
- Labor/staffing differences
  - operators, maintenance staff
- Other differences
  - repairs and parts, outsourced versus in-house

Summary

- Changeable market demand, volatile costs, and new technologies may obsolete traditional approaches to kiln drying.

- Identify and investigate available energy supply options vs. kiln heat and heat exchange options.

- Rigorous and systematic analysis challenges assumptions, defines optimal, robust solution.

Analysis of Selected Technical Options

Kiln/System Options	A: Baseline LPG Direct Fired	C: LP Steam + LPG	Ca: Thermal Oil + LPG	D: Dehumid-ification	C2: LP Steam + Wood
Model 1: 90% 1"-2":	350 mBDft capacity (826 cu. m.); nominally 3 side load package kilns				
1. Capital cost including site preparation ($CDN, 1996)	1,000,000	1,175,000	1,550,000	1,225,000	2,175,000
2. Fuel cost/year ($)	418,000	522,000	522,000	76,000	nil
3. Electricity Cost/year ($)	66,600	66,600	74,000	152,900	80,400
4. Added man-power/year, vs baseline ($)	N/A	400,000	100,000	100,000	600,000
5. Operating cost ($) increase from baseline	484,600	988,600	696,000	404,900	680,400
Model 2: 60% 3"-4":	585 mBdft capacity (1380 cu. m); nominally 5 side load package kilns				
1. Capital cost including site preparation ($CDN, 1996)	1,650,000	1,725,000	2,350,000	1,725,000	2,725,000
2. Fuel cost/year ($)	502,000	626,000	626,000	74,700	nil
3. Electricity Cost/year ($)	113,300	113,300	123,700	244,800	127,200
4. Added manpower/year, vs. baseline ($)	N/A	400,000	100,000	100,000	600,000
5. Operating cost ($) increase from baseline	615,300	1,136,300	849,700	419,500	727,200

Economic Evaluation

Kiln/System Options: Wood	Heat Source	Heat Transfer	Operational Considerations		Commentary
			Advantages	Disadvantages	
Baseline: Direct LPG Fired	Liquified Petroleum Gas (LPG)	Direct Fired	Simplicity & maintainability, low skill reqm'ts. High temperature capability.	Waste/steam sprays req'd, humidity control poor. LPG supply logistics & cost variability.	Selected as baseline for study due to low capital cost & B.C. service experience. High temperature not required.
Low Pressure Steam; LPG Fired	Liquified Petroleum Gas (LPG)	Low pressure boiler & steam coils	Integral steam conditioning capability, good humidity control. Good product quality.	Boiler maintenance, LPG supply logistics & cost variability. Higher skills requirements.	Proven high product quality option.
Thermal Oil: LPG Heat	Liquified Petroleum Gas (LPG)	Thermal oil system	Lower maintenance than LP boiler. See Note 1. See Note 1.	Added water/steam spray. LPG supply. Higher skills requirements. Safety considerations (Note 5).	Lower manning requirements than boiler.
Dehumidification with LPG pre-heat	Dehumidification system + LPG pre-heat	Dehumidification system + direct firing.	Best humidity control & product quality.	Dehumidification & LPG system maintenance. Freon & LPG supply logistics & cost variability. Higher skills requirements.	New technology, high product quality option.
LP Steam; Wood Waste	Shavings, sawdust, &/or hog fuel.	Low pressure boiler & steam coils	Integral steam conditioning capability, good humidity control.	Boiler & waste wood system maintenance. High skills requirements. See Note 3.	Proven solution for wood waste firing & high product quality.