

To burn or not to burn: Bagasse that is

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- The pulp and paper industry is the largest segment of the forest products industry.
- However, wood is just one and most of the time the cheapest fiber sources for pulp and paper production.

- Among the alternative fibers, bagasse has been used successfully to produce various paper products with quite satisfactory properties.
- It has been used extensively in countries such as Brazil, China, India, Mexico, and Thailand.

- In recent years, it has also become quite popular to discuss wood as a possible source bioenergy.

For bagasse,

- In Florida, Louisiana, and Texas, substantial amount of sugarcane was produced to make cane sugar. Bagasse is produced as a by-product of the grinding operation.

- During the 2014-15 grinding season, Louisiana produced about 4.5 million tons of bagasse while another 3.2 millions and .3 million tons of bagasse were produced in Florida and Texas respectively.

- Most of them were burned as a source of heat and energy for the sugar mills.

- But, is it possible to run the sugar mill with other kinds of energy and free up the bagasse as a source of fiber for pulp production?
- Further down the production process, to turn the pulp into ethanol?

- To divert bagasse from energy generation for pulp production, the minimum worth of bagasse as a fuel to these mills must be determined first.
- At 50% moisture content, one pound of bagasse produces 3206 British thermal units (BTU) of heat.

- Natural gas is a major alternative source of energy for these mills.
- Typically, 1000 BTUs per cubic foot of natural gas is used.

- With natural gas at around \$3.00 per thousand cubic feet, a boiler efficiency of 80% for natural gas and 53.9% for bagasse, one ton of bagasse at 50% moisture content is worth \$13, as of January, 2015. Similar calculations reveal that at 32% moisture content the bagasse is worth \$22 per ton.

Natural Gas Price
\$/thousand cubic
feet

3

5

7

8

9

11

Value of Bagasse

with 50% moisture
content

13.0

21.6

30.3

34.6

38.9

47.6

with 32% moisture
content

21.9

36.5

51.1

58.4

65.7

80.3

Bleached hardwood kraft pulp production cost

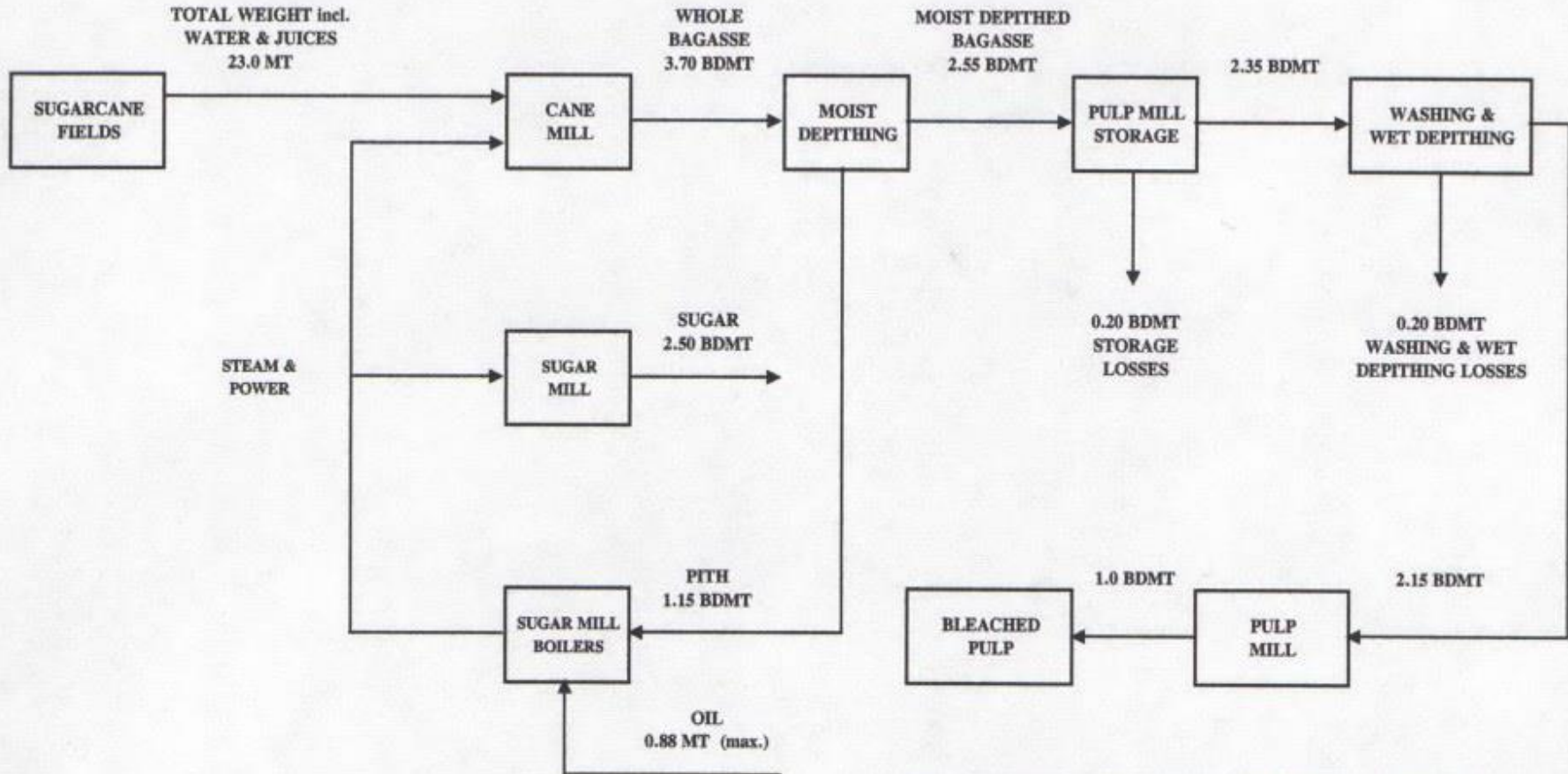
US\$/tonne	Brazil	Indonesia	US South	Portugal	Sweden	France/ Belgium	Canada East	Finland	Spain	WORLD WEIGHT AVERAGE
Wood	71	102	128	188	212	178	158	243	219	132
Chemicals	28	17	37	59	40	60	30	38	41	33
Energy	10	14	23	6	19	13	24	2	11	14
Variable costs	109	134	188	253	270	252	211	283	270	179
Labour	8	13	40	49	51	65	50	41	49	30
Maintenance	12	13	31	22	15	14	23	16	19	18
Other mill costs	24	25	50	37	18	35	35	19	36	31
Fixed Costs	44	52	122	107	84	113	108	77	104	79
OPERATING COSTS fob mill	153	185	310	360	354	365	319	360	374	258
Ocean freight	44	37	53	18	17	17	73	38	26	43
Marketing & sales	17	12	10	5	19	11	7	8	15	12
TOTAL DELIVERED CASH COSTS cif	214	234	373	383	390	393	399	406	415	313

- In order to produce a bone dry metric ton of bleached bagasse pulp, the current best industrial estimate suggests that 3.70 bdmt of bagasse are required when the amount of material removed during moist and wet depithing as well as storage losses are all considered



Sugarcane Bagasse Requirements in BDMT / BDMT of Pulp (SODA or KRAFT PULPING)

BLEACHED PULP - for WRITING & PRINTING PAPER



NOTE: Moist depithed bagasse normally purchased by pulp & paper mill

- With green pulpwood priced at \$128 per metric ton delivered to the mill in the US South, bagasse is worth \$34.60 per bdmt or \$15.69 per ton of bagasse with 50% moisture content using the existing kraft pulping technology, about \$3 more than the \$13.00 value of bagasse as a source of fuel.

- It must be stressed that the \$15.69 per ton price is the price of bagasse delivered to the pulp mill.
- The cost of transportation must be deducted to arrive at the price at the sugar mill..

- In 2014, the trucking cost is about \$.30 per ton mile.
- When the transportation distance exceeds 50 miles, the trucking cost would essentially render the bagasse worthless.

- The inevitable conclusion is that even when natural gas is relatively cheap, sugar mills are better off burning bagasse than selling it for pulp production and downstream for bio-ethanol production.

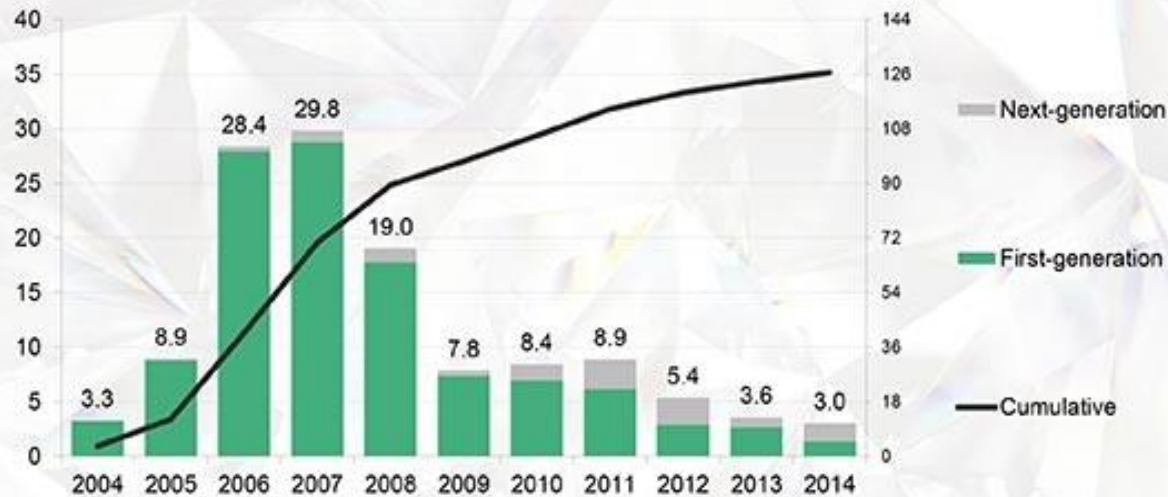
- The harsh reality is that on the surface it may seem attractive to consider bagasse for pulp production as the first step in bioethanol production.
- When the cost of natural gas is high, bagasse is too valuable as a fuel to be diverted.

- Conversely, when natural gas is cheap, giving bagasse away for free cannot cover the transportation cost.

- Further processing of pulp into ethanol produces 250 kg or about 84 gallons of ethanol per bone dry metric ton (BDMT) of pulp.
- At \$1.48 per gallon wholesale (first quarter 2015), the ethanol is worth about \$123.
- This is about $\frac{1}{4}$ of the value of pulp at \$500 per BDMT.

- Stated another way, ethanol must be worth \$6.00 per gallon while pulp price remains at \$500 per BDMT to make processing pulp into ethanol worthwhile.
- Most likely, this will not happen.

GLOBAL INVESTMENT IN BIOFUELS BY TECHNOLOGY, 2004–2014 (\$BN)

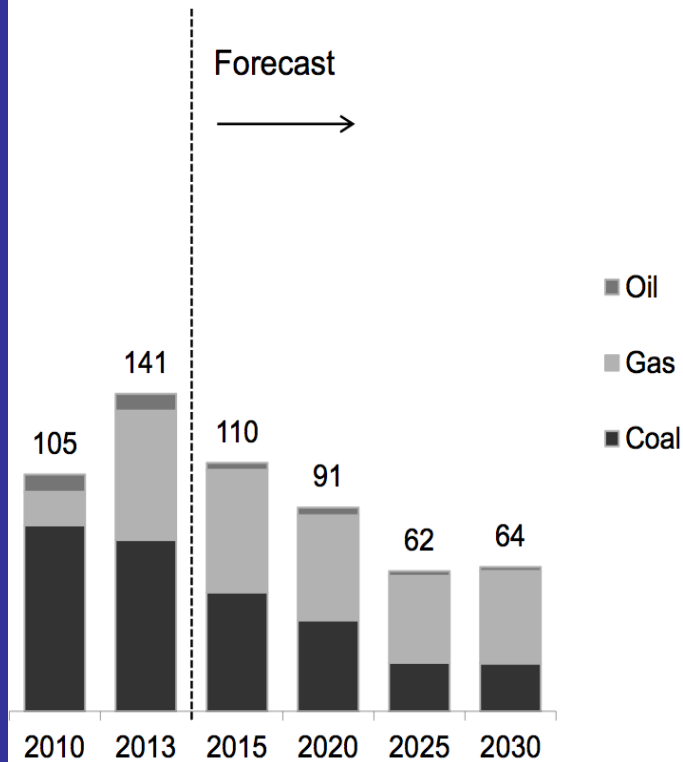


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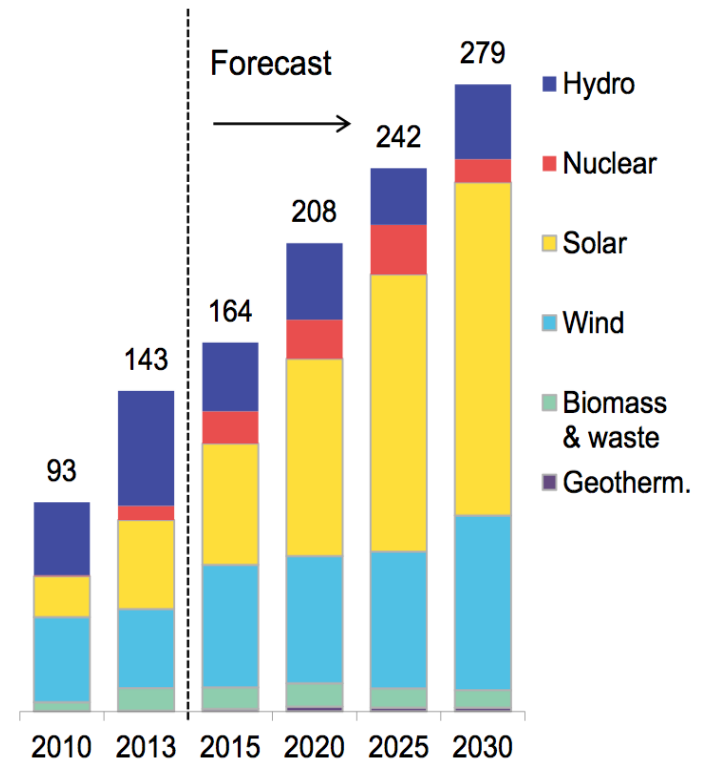
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NEW ENERGY FINANCE

- Source: BusinessWeek, Big oil is about to lose control of the auto industry. Accessed 04/20/2015

FOSSIL FUEL



CLEAN ENERGY



- Source: BusinessWeek, Fossil Fuels just lost the race against Renewables. Accessed April 20, 2015

Reality check

Mill	Gross Tons of	Tons of bagasse produced	Tons of excess bagasse available
Alma Plantation	750,756	218,363	19,702
Cajun Factory	1,154,571	354,365	24,171
Cora-Texas factory	1,111,763	305,318	Very little
Lafourche Factory	619,251	192,641	40,000
La. Sugar Cane Coop, Inc.	838,328	304,806	Very little
Lula-Westfield, LLC.			
Lula Factory	620,645	183,500	45,000
Westfield Factory	748,900	212,032	Deficit
M.A. Patout & Son, Ltd.			
Enterprise Factory	1,545,738	504,225	18,000
Raceland Factory	689,285	222,462	40,000
Sterling Factory	689,761	216,959	Very little
St. Mary Coop	992,631	313,799	Very little
Total	10,778,024	3,227,054	