



SASTA Energy Workshop

The Challenges of Energy Reporting in a Sugar Mill



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July 2008

Presentation Outline

- **Why the need for energy reporting**
- **What are the:**
 - Tools required for energy reporting
 - Points to measure energy consumption
- **How is energy data reported**
 - Reporting System (EMIS)
 - Example of an Energy Report

Sugar Mill Energy Reporting



Why do we need energy reporting



Proverbial report writing expression!!



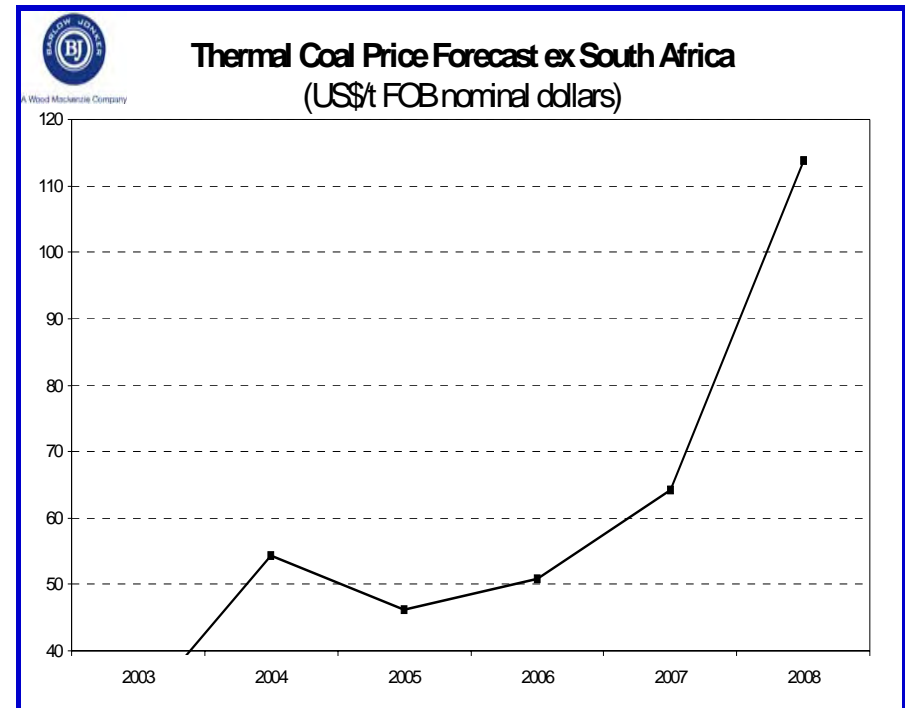
THE JOB IS
NEVER
FINISHED UNTIL
THE
PAPERWORK IS
DONE!

Why the renewed focus on:
Energy Conservation
in a Sugar Mill

Energy Conservation Drivers

- Energy cost impact on profitability
- Import protection deregulation
- Process efficiency vs. Energy efficiency
- Capital / Energy trade-off
- COGEN alternate revenue
- Mandatory greenhouse gas emission reduction & CER
- By-products

Coal Cost



Trash could leave coal 'in the dust'



Energy Conservation Programme Critical Success Factors



- Well defined aims
- Champion
 - With authority
 - Technical 'know-how'
- External Resources
- Measurement
- Maintenance / Housekeeping measures
- Involvement & training
- EMIS must be tailored for different levels
- Internal & External Auditing
- Success breeds success

Why Measure?

LORD KELVIN - 1883

"To measure is to know."

"If you can not measure it, you can not improve it."

"I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind."

How do we
measure up?



The Energy Manager's Toolbox

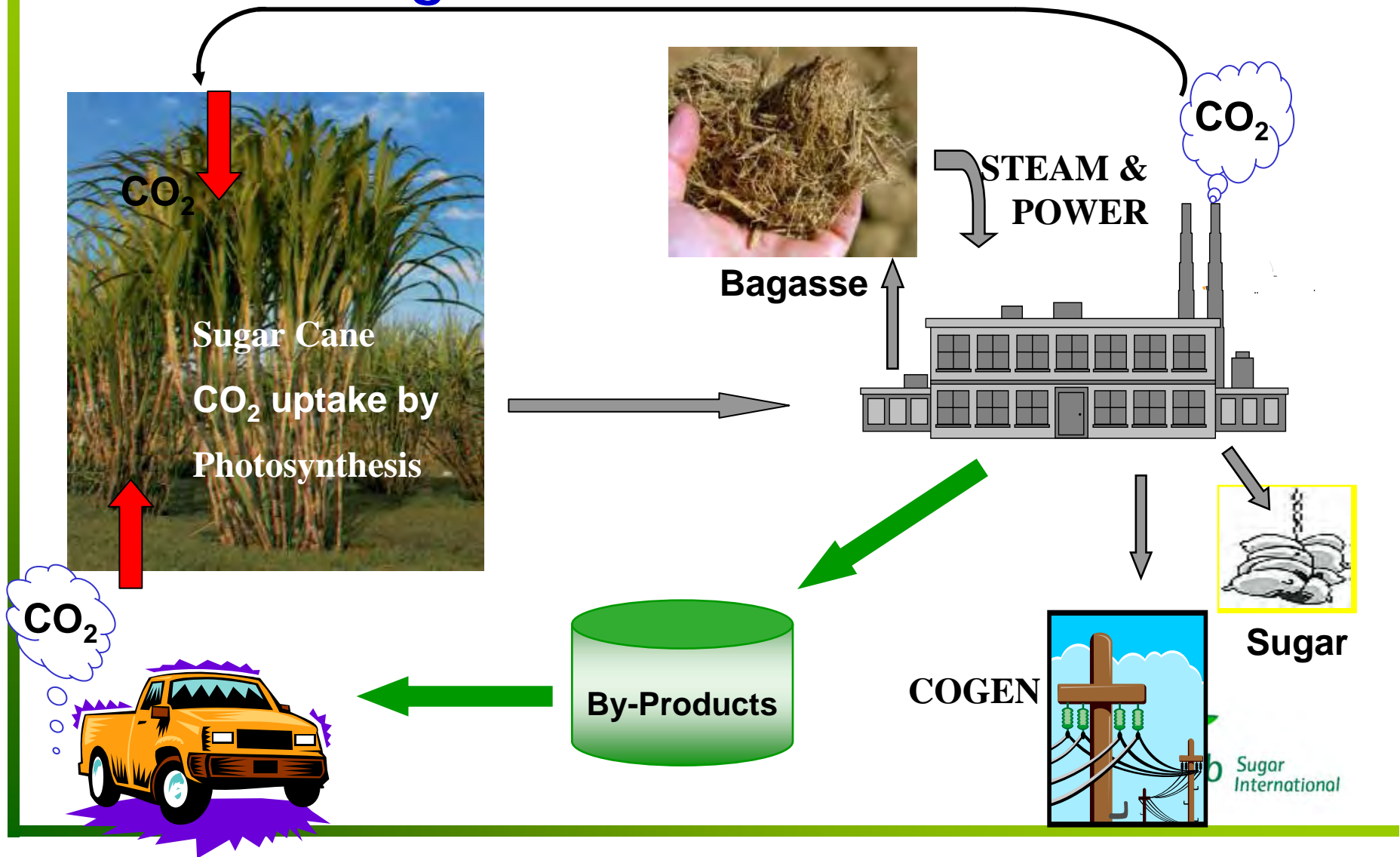


- **Should comprise:**
 - Technical 'know how' to identify the energy sensitive process streams
 - Technical 'know how' to select measurement points
 - Technical 'know how' to select the correct measurement equipment
 - Measuring Hardware
 - ❖ Permanently Installed,
 - ❖ Portable,
 - ❖ Subcontracted
 - Technical Support ?
 - In-house and External
 - Models for Mass & Energy Balances e.g. SUGARS
 - EMIS Reporting System
 - LIMS, CaneLab
 - Historical data (Mill Database, SMRI)

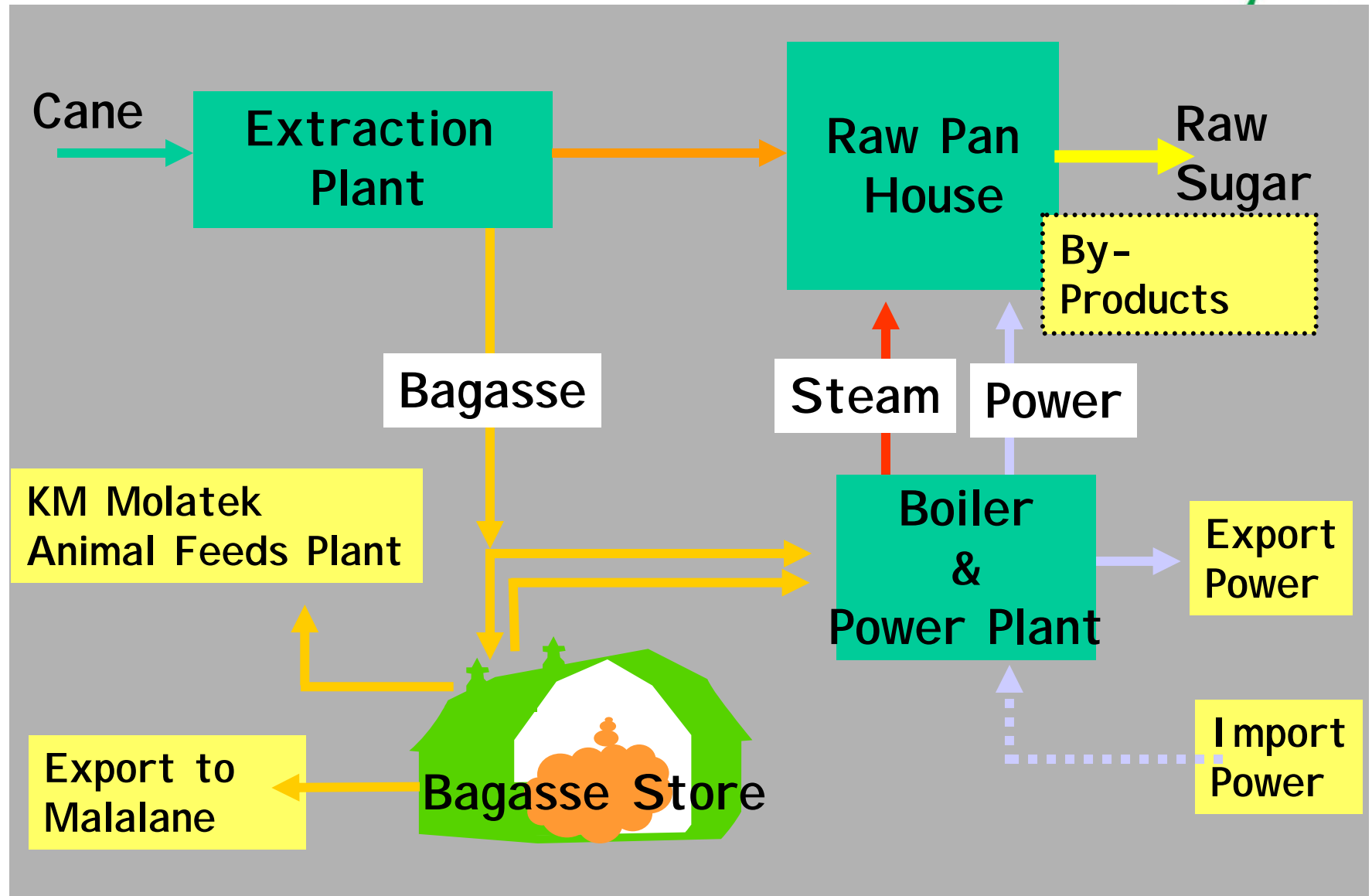


What to measure?

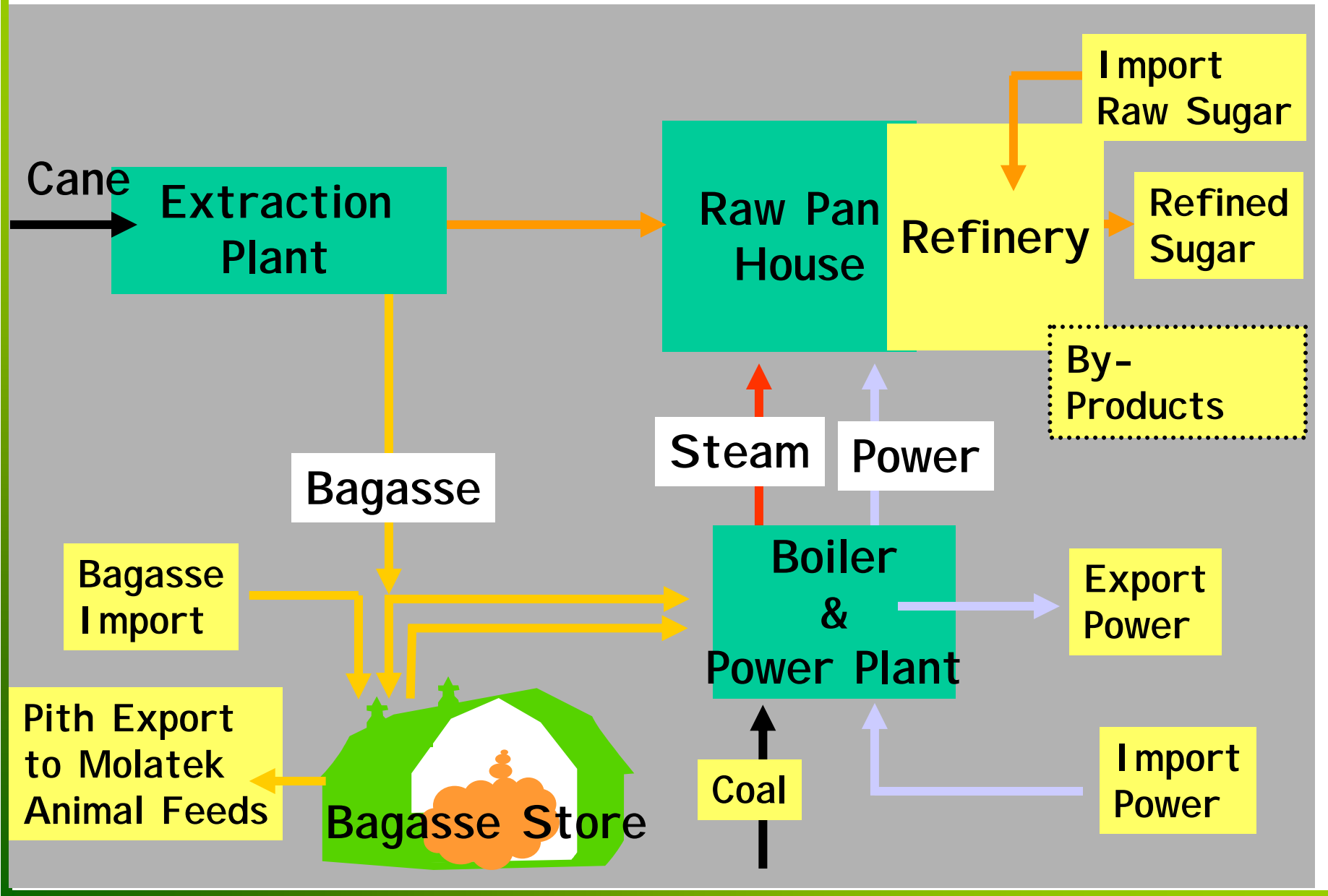
Sugar Cane Value Chain



Komati Factory Energy Value Chain

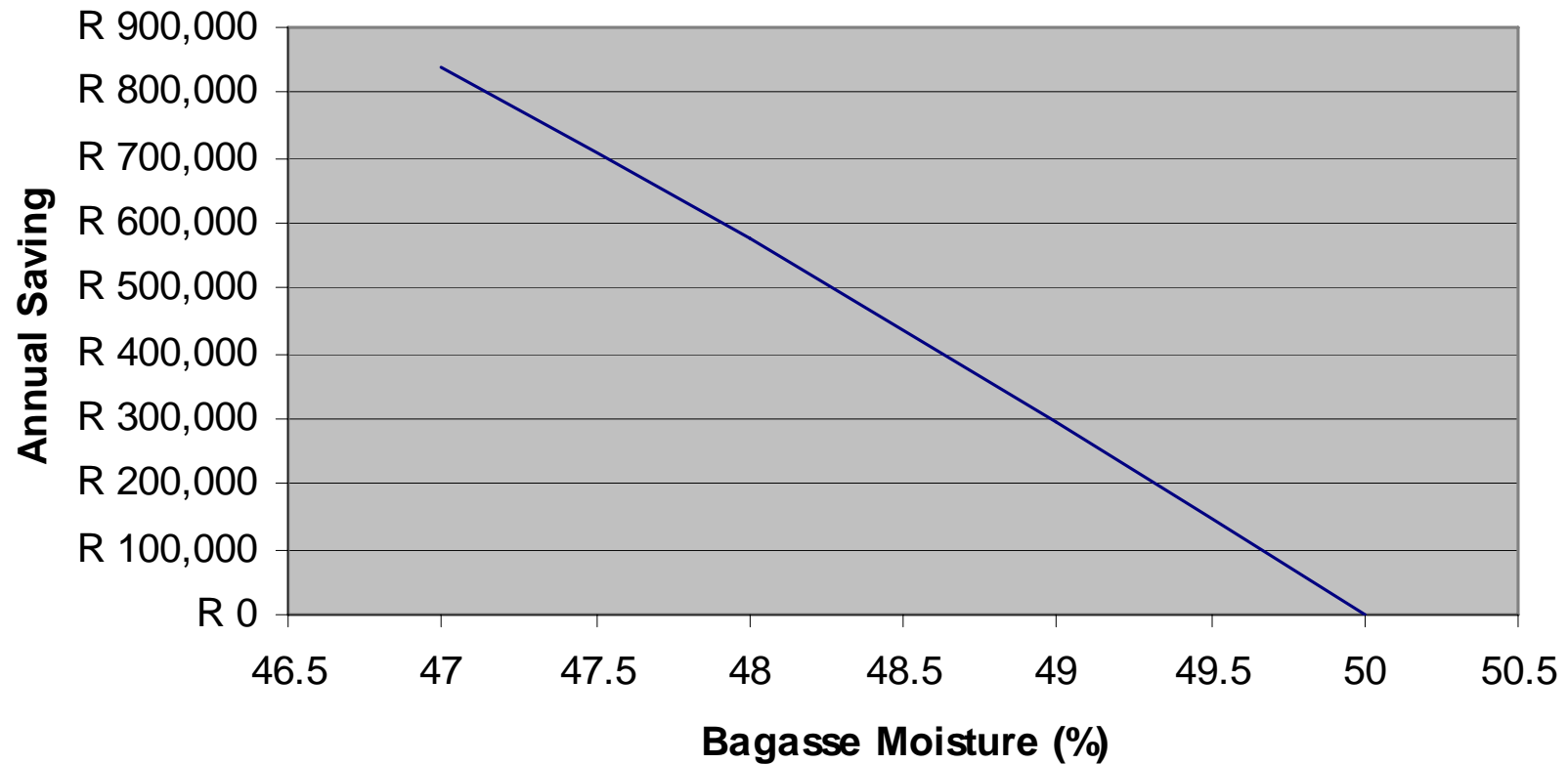


Malalane Factory Energy Value Chain



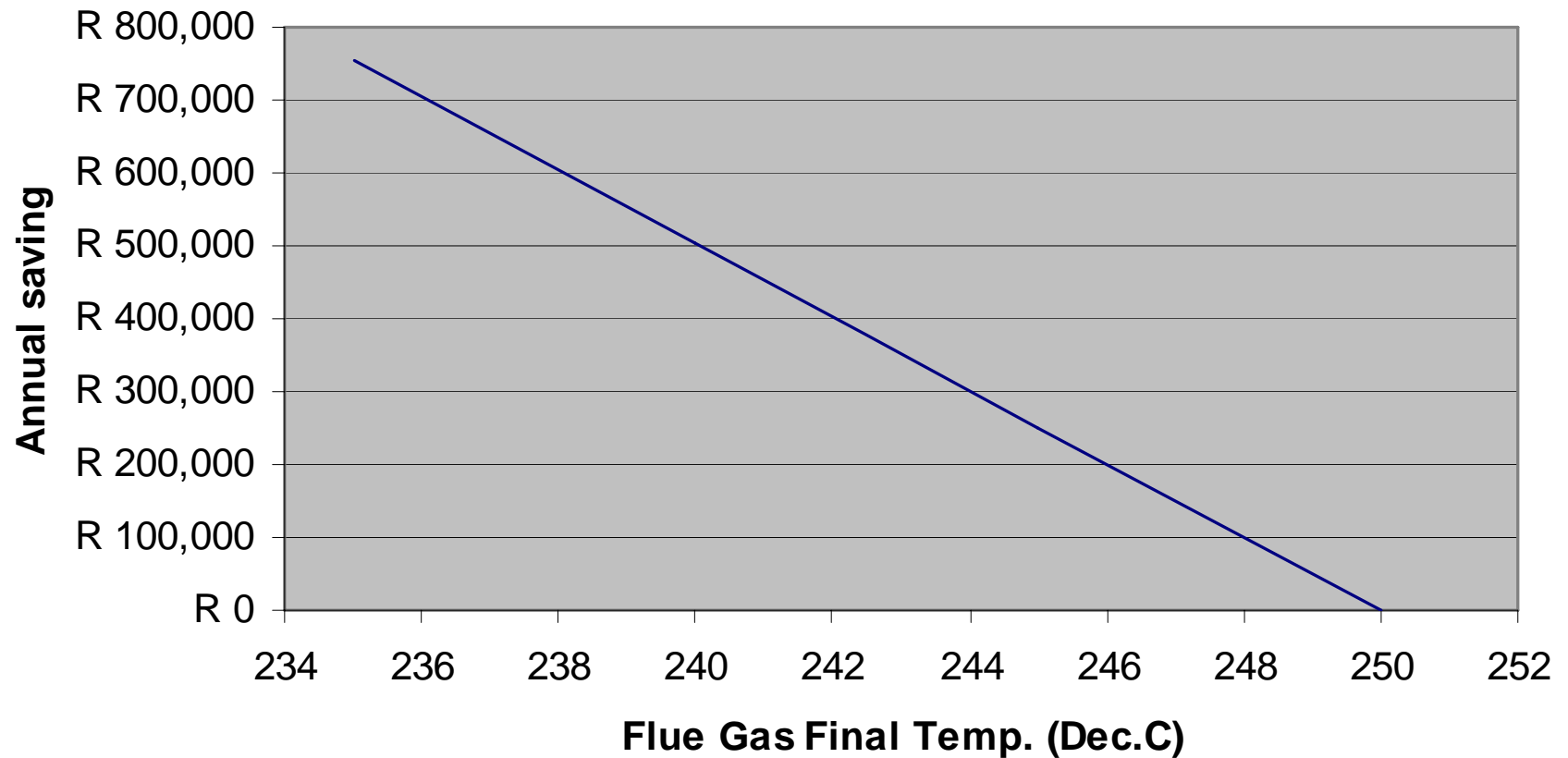
Energy Implications Bagasse Moisture

Effect of Bagasse Moisture on Coal Saving



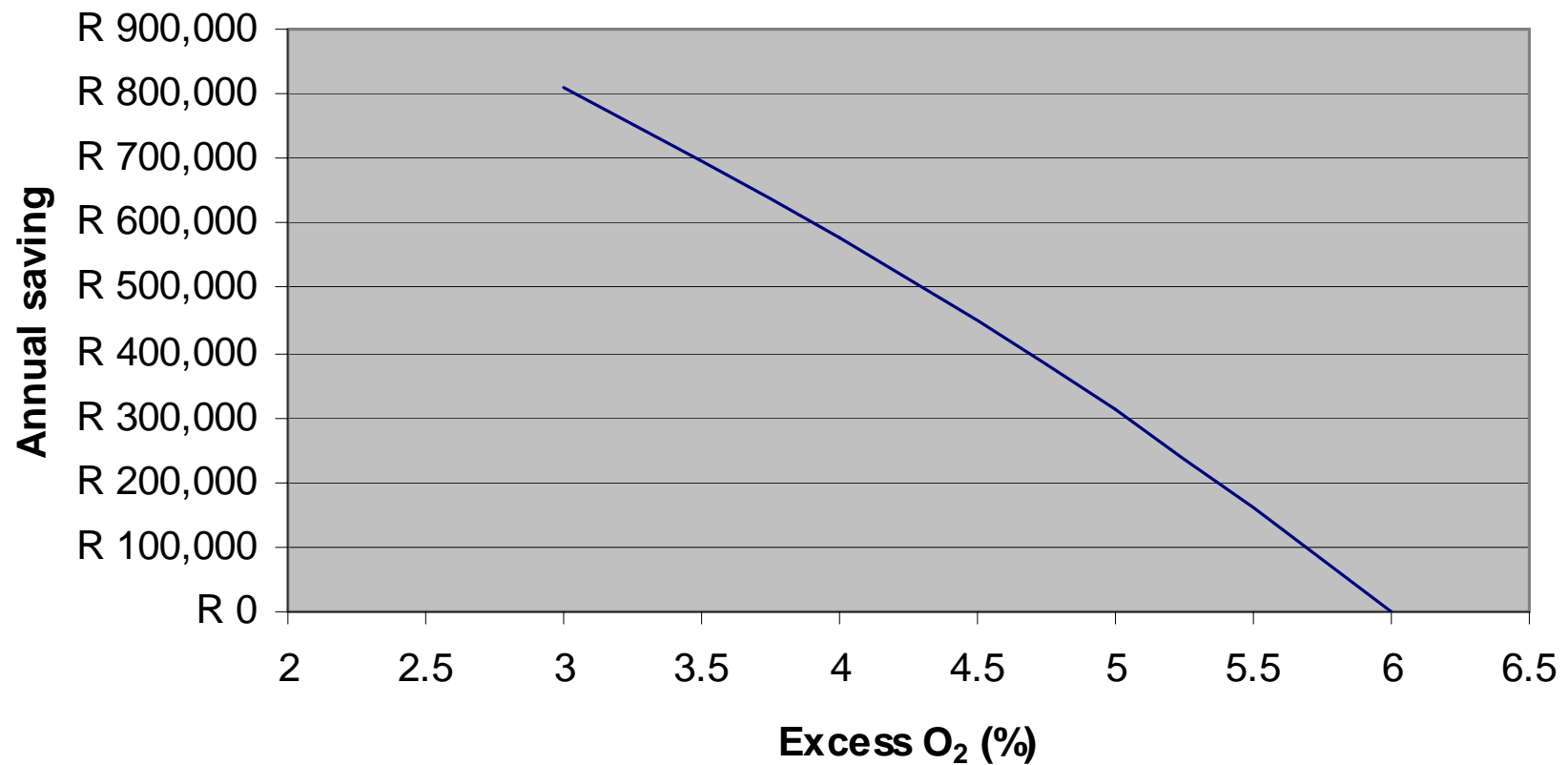
Energy Implications Economisers

Effect of Flue Gas Final Temp on Coal Saving



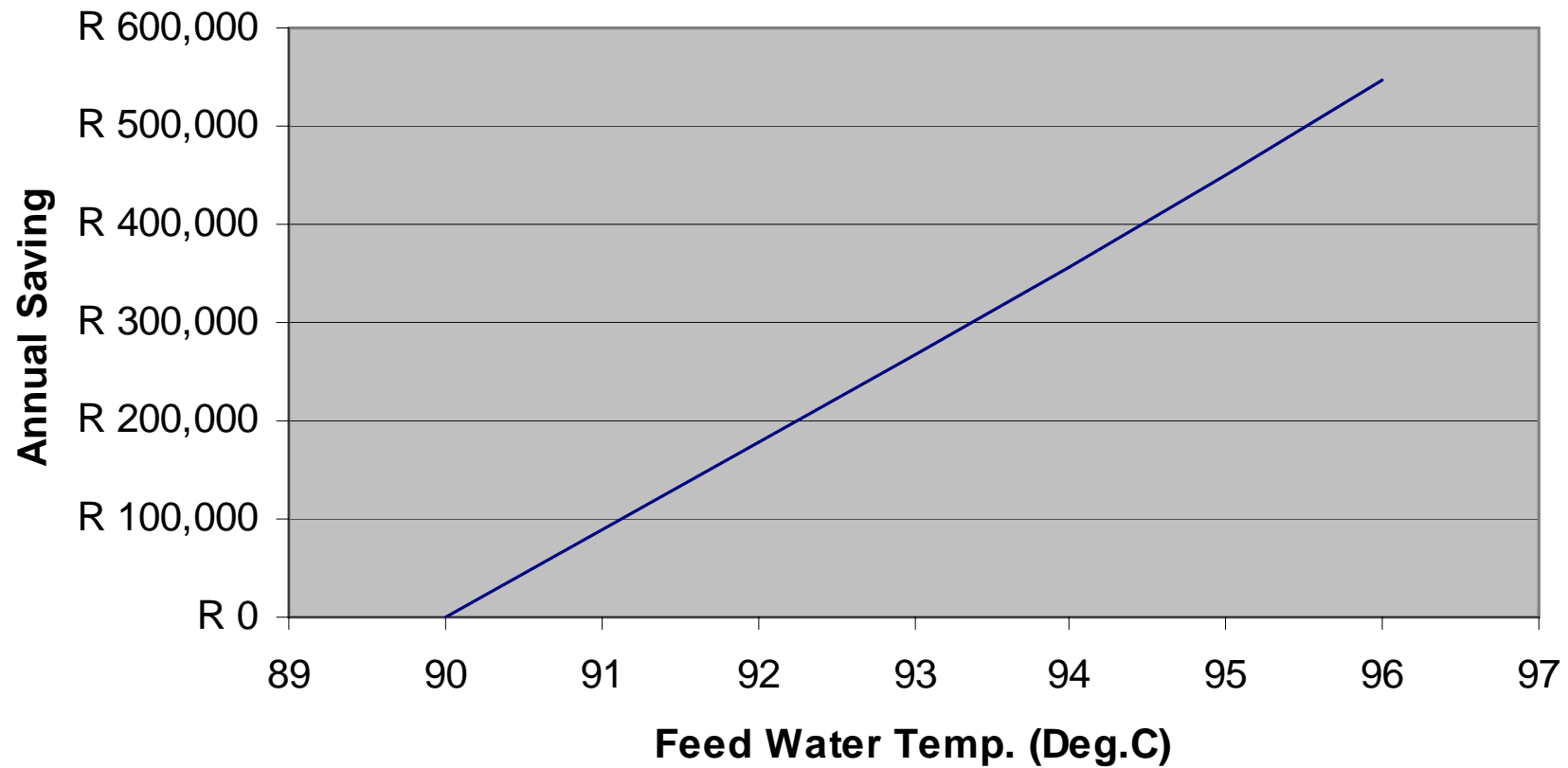
Energy Implications Fuel/Air Ratio

Effect of Exces O₂ on Coal Saving



Energy Implications Boiler Feed Water

Effect of Feed Water Temp. on Coal Saving



Boiler Efficiency

- **Direct Method**
 - Energy steam OUT % energy fuel IN
 - Accurate massing of
 - Fuel
 - BFW
 - Steam
 - Blow down
 - Suited to longer period reporting

- **Indirect Method**
 - Measures Losses around a boiler
 - Instantaneous measure
 - Accepted by boiler manufacturers
 - Coal & ash sampling



Energy Reporting

There are many ways to kill a cat

- LIMS
- CaneLab
- Auto Lab
- Other



Energy Report

How do you eat an elephant?



**ONE PIECE
AT A TIME!**

Malelane

Daily Energy Report

Daily Report

2008-07-21

Season 2008

Week 21

Day 7

item	Day	Week	Month	Year
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001. EXT PLANT

Tons Cane Crushed	7118	39849	135789	700671
Fibre % Cane	13.44	12.93	13.00	13.13
Ash % Cane	1.39	1.41	1.48	1.75
Imbibition % Fibre in Bagasse	358	357	337	344
Moist % No 1 Mill	0.00	0.00	0.00	0.00
Moist % No 2 Mill	50.81	52.82	52.34	52.07
Brix % Mixed Juice	13.87	13.59	13.96	13.39
MJ Water % Cane	106.21	118.58	107.29	107.42
Lost Time % Available	0.83	5.66	6.35	4.10

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national

Item	Day	Week	Month	Year
002. JUICE PREP				
Mixed Juice % Cane	123.31	121.98	119.31	120.42
MJ - CJ Brix %	0.07	-0.96	-0.26	0.01
003. EVAPORATORS				
Exhaust Steam Press	116.44	106.80	106.73	109.26
Exhaust Steam Temp	131.08	129.74	129.95	112.95
V1 Pressure R/H	45.42	42.71	43.41	44.07
V1 Pressure Ref	40.87	38.82	38.18	35.61
V2 Pressure	45.42	12.91	8.18	7.84
V3 Pressure	-26.77	-18.71	-19.55	-25.55
V4 Pressure	-86.16	-79.60	-82.16	-71.46
Evaporator Eff	77.72	77.14	78.50	79.82
Brix % Syrup	61.93	62.33	65.69	66.10
SK 1 Condensate Flow	861.74	6300.32	22434.08	74249.86
Evaporator 1A Condensate	0.00	0.00	0.00	7046.00
SK 2 Condensate Flow	0.00	4791.76	7187.51	34514.32
Ave Raw Water Temp	22.69	23.62	22.93	23.80

Item	Day	Week	Month	Year
006. BAGASSE				
Tons Bagasse	2046	11125	38189	198459
Ash % Bagasse	2.79	2.99	2.93	3.54
Tons Bagasse/Hr	85.96	81.28	86.23	82.63
Pith to Molatek	0	779	5460	29182
Moisture % Bagasse	51.30	51.63	51.64	51.54
Tons Coal	115	991	2753	18863
Tons Coal Off-Crop	0	0	0	0
Bag Store Level 1	2.50	24.92	38.80	19.36
Bag Store Level 2	75.00	75.00	76.43	48.37
Bagasse Imports From Komati	0.00	1221.07	5411.19	13885.06
Bagasse LCV	7.04	6.75	6.87	6.94
Hours Crushing	23.80	132.62	438.22	2369.17

Item	Day	Week	Month	Year
007. STEAM PRODUCED				
Run Hrs Boiler 4	0.00	73.50	317.16	1062.86
Boiler 4 Steam	0.00	5129.94	23196.66	74796.06
Water Flow Boiler 4	0.00	5677.60	25387.93	84369.17
Steam Tons/h Boiler 4	0.00	274.32	1082.59	3342.39
Run Hrs Boiler 5	23.86	141.94	319.99	1716.90
Boiler 5 Steam	2881.00	16828.72	36402.42	169877.83
Water Flow Boiler 5	3217.00	18775.65	40943.15	191739.81
Steam Tons/h Boiler 5	120.75	808.98	1676.03	7343.18
Run Hrs Boiler 6	23.86	116.51	370.01	4825.81
Boiler 6 Steam	2243.00	10170.04	41446.54	275115.83
Water Flow Boiler 6	2324.00	10728.30	43304.54	286598.46
Steam Tons/h Boiler 6	94.01	433.10	1782.74	11468.72
008. STEAM CONSUMP				
De-Sup/h Steam	643.00	6740.61	21398.49	113676.94
Mill Turb Steam	1285.00	6767.08	23186.32	97714.17

Item	Day	Week	Month	Year
008. STEAM CONSUMP				
Steam Flow Blr 5 ID	137.00	846.84	2000.88	9148.84
De - Aerator Blr 5	77.00	912.26	2703.75	12980.58
Total tons exhaust steam	5617.00	40970.97	102019.17	435010.49
009. POWER GENERATION				
Turbine 1 MWH	0.00	0.00	0.00	0.00
Turbine 2 MWH	109.60	639.92	1887.07	9233.32
Turbine 3 MWH	154.61	1069.54	3290.73	17225.26
Turbine 4 MWH	132.58	958.26	2868.19	14779.34
Total MWH Produced	396.79	2667.71	8046.00	41237.92
010. POWER IMP/EXP				
Power Exported	60.41	289.83	862.53	3479.14
Escom MWH	0.02	98.02	143.94	667.51

Item	Day	Week	Month	Year
011. BOILER FEED WATER				
Softener 1 Make-Up	0.00	1729.00	3842.00	16388.00
Softener 2 Make-Up	0.00	2372.00	6258.00	28721.00
Total Softener	0.00	4101.00	10100.00	45109.00
BFW Condensate	21.21	1415.42	2472.28	17366.01
Raw Pan Condensate	21.38	1596.95	2373.29	27227.84
Total Condensate	42.59	3089.37	4922.57	45124.15
Boiler Feed Temp	109.00	105.70	106.84	107.57
012. OTHER UTILITIES (M³/t)				
Dunda Pump Flow	4800.00	32398.34	94095.71	365670.98
River Water Pump Flow	53996.00	381809.28	924550.61	6316369.34
Return Flow to River M ³	21577.00	114199.02	395526.31	1865418.94
Raw Water to WTP	4549.00	40585.25	133309.21	972886.12
Comp Air Flow	109393.00	725077.07	2077038.63	9871525.91
CO2 Capacity/hr	0.00	0.00	0.00	130.18

Item	Day	Week	Month	Year
004. RAW SUGAR				
A Masecuite Exh	61.96	56.07	57.98	57.52
B m/c Exhaustion	57.49	59.02	56.85	56.10
Brix % Remelt	74.71	72.95	71.22	67.59
Brix % A mol	77.53	75.78	76.58	76.76
Brix % B mol	82.09	82.55	83.02	80.81
C.J % A&B m/c	377.42	400.78	360.50	343.41
005. REFINERY				
Brix % Raw Melt Tk	62.37	60.87	61.28	61.44
Brix % S/Water	3.05	5.24	5.07	5.00
Brix % Refinery Filter Cake	17.38	13.09	12.39	11.77
Brix % Thick Liquor	70.81	68.24	69.57	69.61
Water % Ref m/c	11.96	10.88	10.31	13.12
Bagasse burnt	0.00	0.00	0.00	0.00

Item	Day	Week	Month	Year
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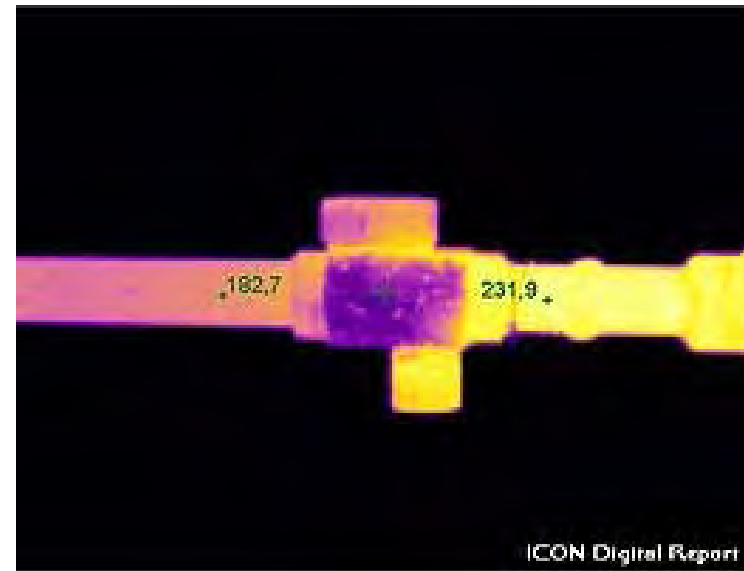
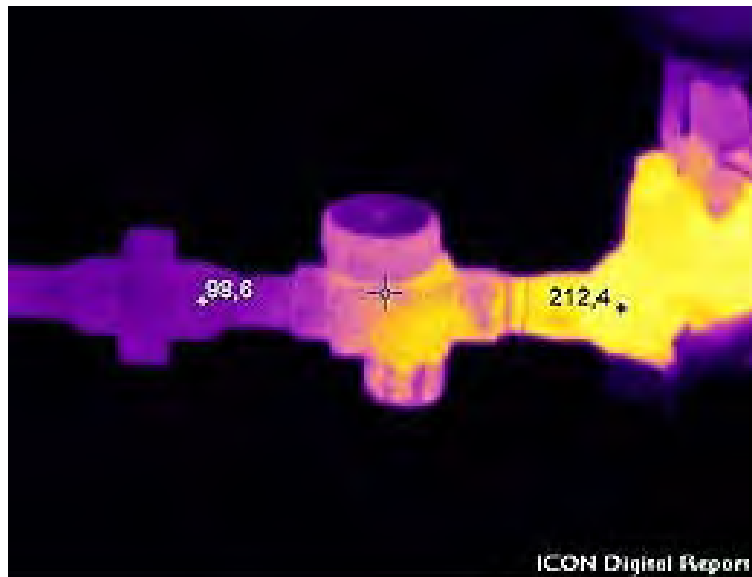
015.PERFORMANCE INDICAT

HP Steam % Cane	71.98	80.63	74.41	74.18
Tons HP Steam/Tons Coal	44.44	41.24	47.61	37.64
Alt Steam/Elect Generated	7.52	6.64	6.71	7.34
Total HP Steam/Ton Total Sug	3.55	3.68	3.50	3.89
Tons Coal/1000 Tons Cane	16	52	30	39
Coal % Ref Sugar Made	9.66	13.94	12.20	22.58
Coal % Ref Sugar Off-Crop	0.00	0.00	0.00	0.00
Exh Steam/Ref Sug Made	4.71	5.42	4.36	4.17

Is there a place for
Infra Red Thermal Imaging
in Energy Management?

You be the judge to this ‘burning’
question:

Steam Trap Infrared Images



Normal steam trap operation – on the right

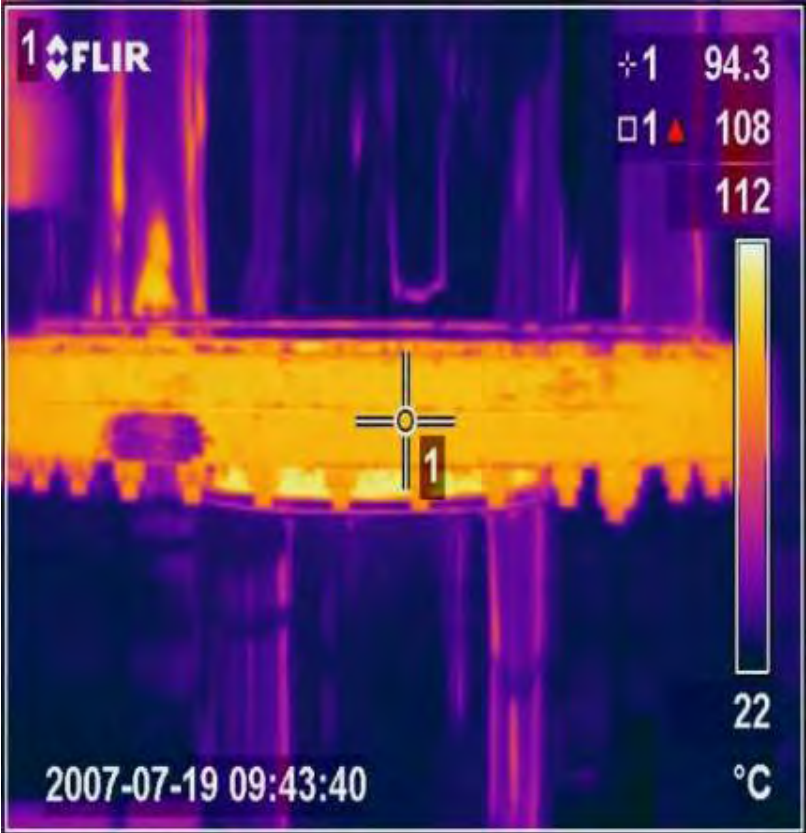
Faulty steam trap operation in which steam leaks through – on the left

Images courtesy of ICON Tecnologia

Thermal Imaging Impact of Unlagged Mixed Juice Heater End Plate



Thermal Imaging Impact of Unlagged Flanges



Thermal Imaging Evaporating Vessel & Piping



Thermal Imaging Impact of Unlagged Piping



Conclusion

- Energy reporting is an integral part of an energy conservation programme
- Ideally EMIS should be part of existing LIMS/CaneLab reporting system
- Technical know how is required to determine:
 - What are the Energy Sensitive Steps?
 - What are the best Measurement Points?
 - What type of Measuring Equipment to use?
- Infra Red Imaging is a powerful tool to identify heat losses
- Need for an Energy Manager?



Booker Tate



Thank you

