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SOLAR THERMAL ENERGY
RESEARCH GROUP

The Feasibility of Solar Thermal Process Heat for the Sugarcane Industry in South Africa

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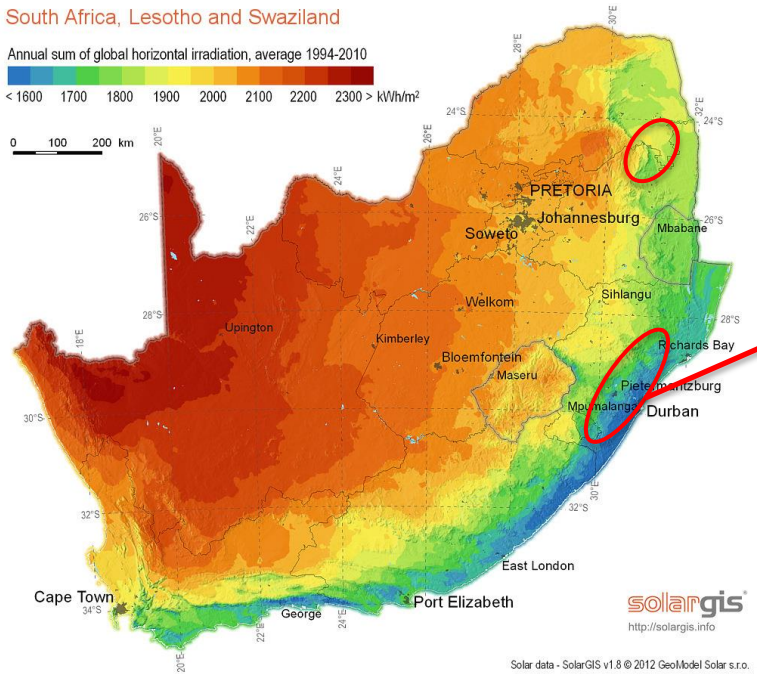
Agenda

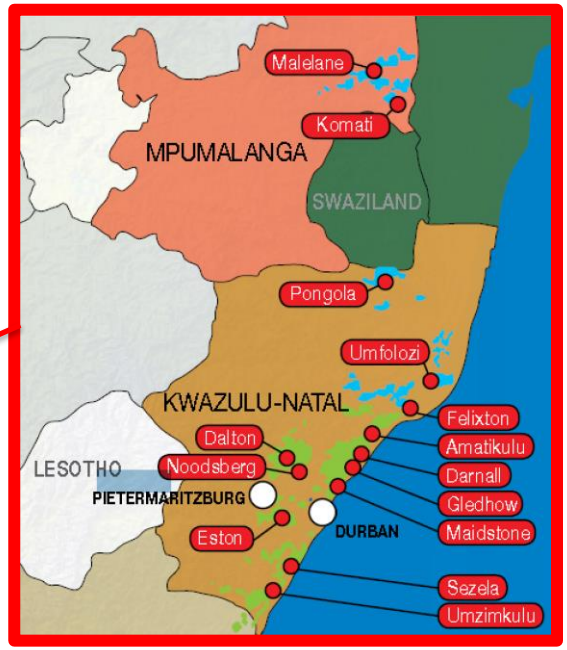
Overview

- Overview of the S.A. Sugar Industry
- Raw Sugar Production
- Drivers of Innovation
- SPH Technology & Low Hanging Fruit
- Potential of SPH Integration
- Expected Results

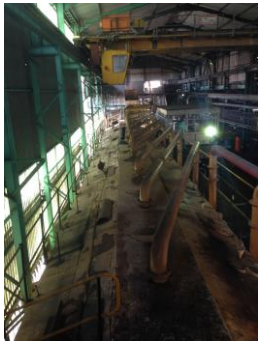
The S.A. Sugar Industry

Location





The S.A. Sugar Industry

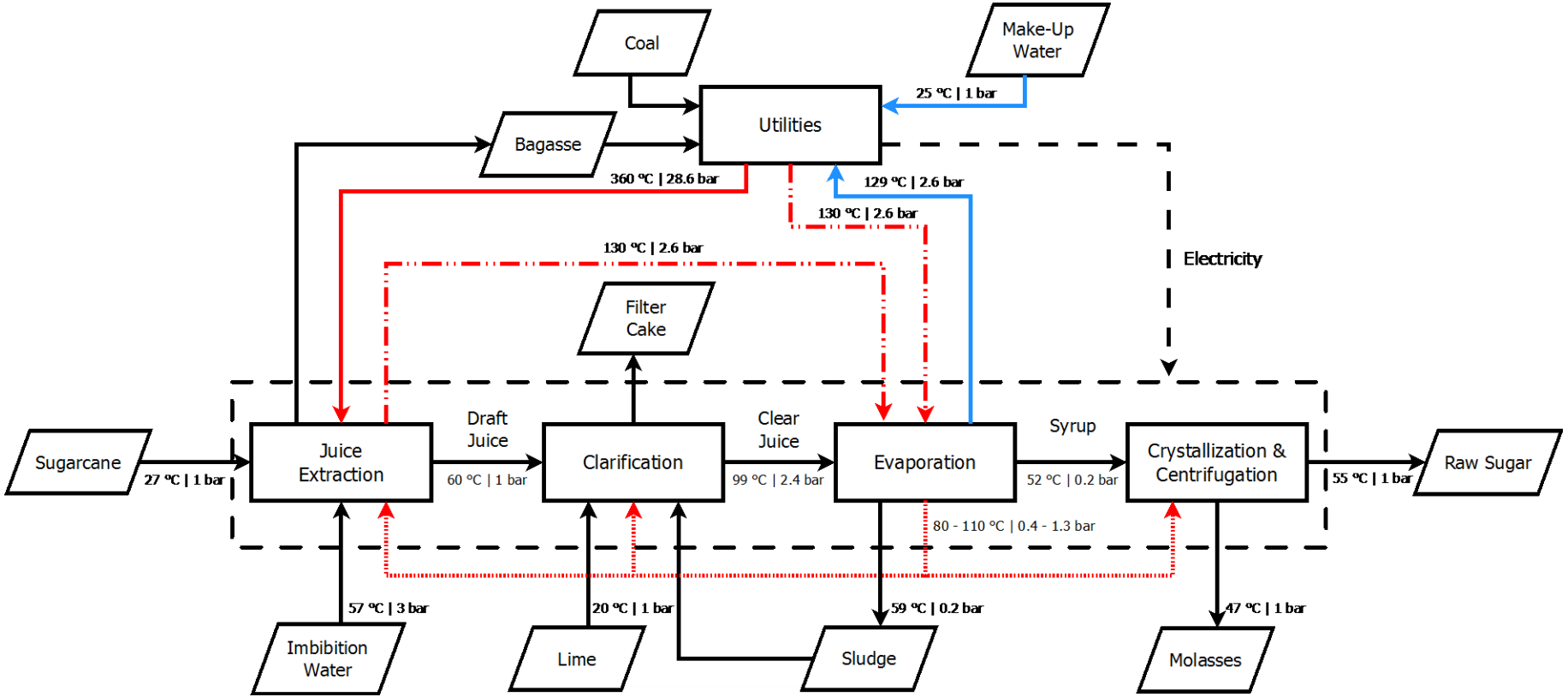


The S.A. Sugar Industry

Overview

Location:	KZN & Mpumalanga	
Production:	> 2m tons/a	(20m tons cane)
Season:	March - December	
Contribution:	R12b per year	
Employment:	79 000 | 12 750	
Sugar Milling:	14 Raw Sugar Factories	
Market:	Highly Regulated Prices	
SMRI:	Profitability, Efficiency & Innovation	

The S.A. Sugar Industry



The S.A. Sugar Industry

Drivers of Innovation

Economic Pressure: Low Prices, Rising Input & Operational Costs

→ Reduce Operational Costs
- Reduce Coal Consumption

→ Explore Alternative Income Streams
- Bagasse By-Products
- Bio-Ethanol
- Electricity Cogeneration

Solar Process Heat Integration

Technology Characteristics

Temperatures:	25 - 450 °C
Pressure:	Up to 40 bar
Integration:	Supply Level / Process Level
Power and gain:	700 W_p/m^2 peak power
Potential Gain:	Up to 1 MWh/m^2 per annum
System size:	No technical limit (Area, Capital)

Flat-Plate Collectors

Evacuated Tube Collectors

Fresnel Collector

Parabolic Trough Collector

Central Tower Receiver

Stationary Concentrating Collector

Solar Process Heat Integration

Potential for the Sugar Industry

Objective: **Identify & Assess Suitable SPH Integration Points**

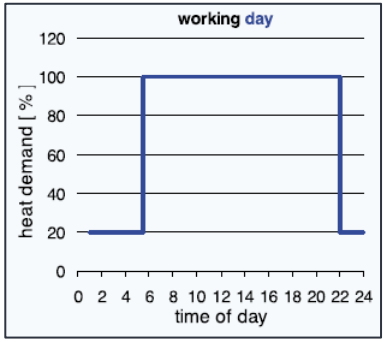
Methodology:

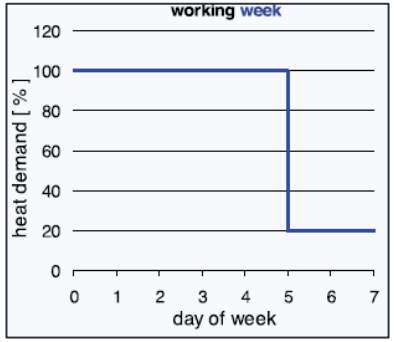
1. Develop a **flow diagram** of a generic sugar mill
2. Analyse the **energy consumption**
3. Identify potential SPH **integration points**
4. Assess & **rank** the integration points
5. Develop **concept designs**
6. Estimate the potential solar **gains**
7. Assess the techno-economic **feasibility**

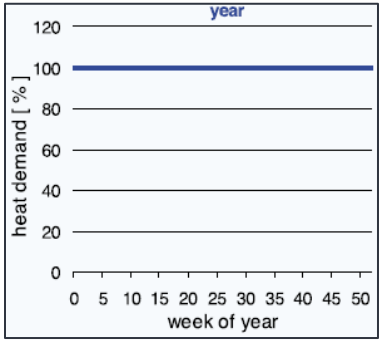
Solar Process Heat Integration

Low Hanging Fruits

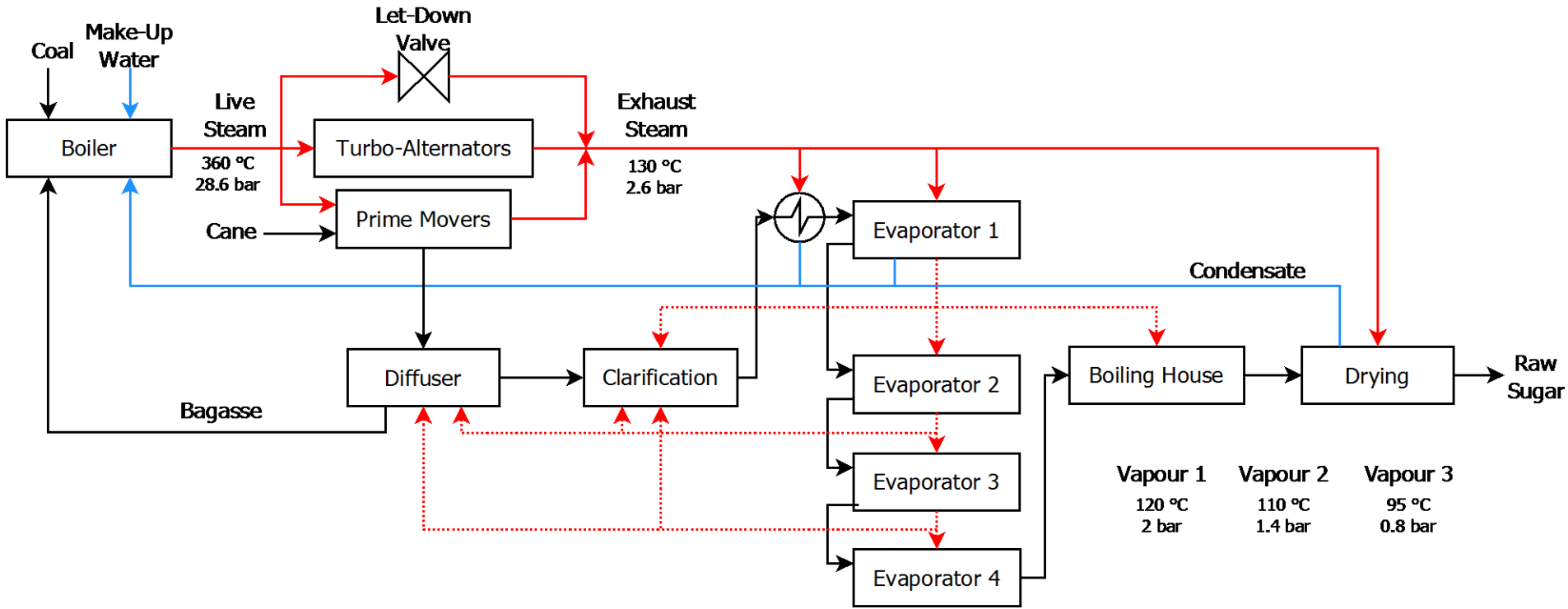
- Low Process (Return) Temperature
- High Temperature Lift
- High & Constant Heat Demand
- Demand Concurs with High Irradiance







Solar Process Heat Integration



Solar Process Heat Integration

Entry Barriers

- Low Cost of Energy: Bagasse
- Heat Distribution: Exhaust, Vapour
- Seasonality: March – December
- Relatively Low Irradiation: 2000 kWh/m^2
- Area Requirements: Limited Area

Solar Process Heat Integration

Potential Integration Points

Heat Sink	Fuel / Heat Source	Process Temperature	Temperature Lift	Mean Load
Live Steam Injection	Bagasse & Coal	360 °C	N/A	90 MW
Feed Water Pre-Heating	**Bagasse & Coal**	**129 °C**	**230 °C**	**75 MW**
Make-Up Water Pre-Heating	Bagasse & Coal	25 °C	335 °C	N/A
Evaporation	Exhaust Steam	114 °C	7 °C	58 MW
Clear Juice HEX	**Exhaust Steam**	**100 °C**	**14 °C**	**4 MW**
Sugar Drying	**Exhaust Steam**	**25 °C**	**55 °C**	**0,6 MW**
Bagasse Drying	**Bagasse & Coal**	**72 °C**	**N/A**	**N/A**

Thank You

ACKNOWLEDGEMENTS:

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