

Zimbabwe National Energy Efficiency Audit (NEEA)



Agriculture sector presentation

SAEC

(SEMCO, SIRDC and others)

by

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Objectives of the study

- ❖ To conduct an extensive study to determine the state of energy efficiency in Zimbabwe.
- The study looked particularly at seven sectors, i.e. Manufacturing, Mining, Transport, Large Buildings, Commercial Services, Agriculture and Housing.
- ❖ Selected entities in each sector were audited and the measure of efficiency was the Energy Intensity associated with the economic or human activity.
- ❖ The Intensities derived from the study will form baselines for energy efficiency and other government policies.

- ❖ Stakeholder identification and engagement
 - emails, phone calls, face-to face meetings, focus group discussions, stakeholder workshop(s)

- ❖ Desktop study
 - Lit. review, what has been done? Where? Why? Results there of!
 - Identification of significant energy users from ZETDC database, international databases e.g. IEA

- ❖ Baseline establishment
 - Historical and current usage patterns
 - Establishment of base load from **baseline equation**

- ❖ Identify Key Energy Drivers for Economic Activities
 - Usual “energy drivers “are the economic activities in terms volumes or tones of output, can be hours of operation, or levels occupancy.

- ❖ Energy matrix assessment
 - Identifies strength, weaknesses and opportunities in organisations w.r.t., policy, management, motivation, information systems, marketing and investment in EE.

- ❖ Perform detailed Energy Audits
 - thorough process, historical data collection, walkthroughs, loggings at various work stations, discussion with management and responsible individuals, process assessment etc

- ❖ Walk through energy audits
 - Data collection, quick survey, identification of energy use patterns, meetings with responsible individuals

- ❖ Identify opportunities for ECM interventions

- ❖ Identify barriers to Energy Management

- ❖ Policy considerations and recommendations

NEEA COVERAGE

Sector	Target number	Audited entities
Agriculture	3	1 x Large Scale Tobacco Farm (D) 1 x Large Pig Farm (D) 1 x Small Scale Poultry Farm (W) 1 x Large scale poultry (W) 1 x Large Scale mixed crop estate (D) 1 x Large scale plantation estate (D)
Commercial Services (Food and catering)	3	1 x Fast Food Outlet (W) 1 x Internet Cafe (W) 2 x Large Scale Shopping Mall(D) 1 x 3 Star Hotel (D) 1 x Large Health Care Service (D)
Buildings	3	1 x Warehouse (D) 1 x Auction Floor (D) 1 x Administration Block (D) 1 x Boarding School (D)
Urban and Rural Residential/ Domestic	15	103 questionnaires, 15 detailed audits (D)
Manufacturing	3	1 x Mineral Processor (D) 1 x Large Chemical Processor (D) 1 x Wire Manufacturer (D) 1 x Large FMCG factory (D) 1 x Drink Manufacturer (D) 1 x Large Maize Miller (W) 1 x Large Fertilizer Blender (W) 1 x Timber Processor (S) 1 x Gas Processor (D) 1 x Sugar Processor (D) 1 x Cement Processor (D)
Mining	3	1 x Nickel Mine (D) 2 x Gold Mines (D) 1 x Platinum Mine (D)
Transport	3	1 x Trucking Organisation (D)? 2 x Long distance buses (D)?

Electricity energy consumption by category

Sector	1998		2013		% change in consumption
	Consumption (GWh)	Sector Contribution	Consumption (GWh)	Sector Contribution	
Mining	1,579.10	17%	1,246	15%	-21%
Industrial	3,951.82	42%	2,044	24%	-48%
Commercial	1,734.23	19%	1,631	20%	-6%
Farming	690.48	7%	491	6%	-29%
Domestic	1,385.00	15%	2,878	35%	108%
<i>Total</i>	<i>9,341</i>	<i>100%</i>	<i>8,290</i>	<i>100%</i>	<i>-11%</i>

Note: Excludes wood, liquid fuels, coal and gas consumption

a) Energy sources used in Agriculture are:

- Electricity to power electrical equipment/machines such as (motors, pumps, welding and general lighting)
- Electricity for space heating (piglets, poultry, nurseries); HDD/CDD
- Coal for firing boilers and for tobacco curing
- Diesel and petrol to power vehicles and equipment (Trackers, combine harvesters, front end loaders and the standby generators)
- Acetylene for welding
- LPG for heating including cooking
- Paraffin for heating; and
- Wood for heating (general heating, tobacco curing)
- Biogas for cooking and general heating
- Water (Municipal, borehole, river, dam) for laundry and ablution and irrigation.

Sector findings (Case study 1 - Tobacco)



Sector findings (Case study 1 - Tobacco)

Source Tobacco Research Board (TRB)		
Barn Type	Fuel Source	Ratio
Conventional	Wood	4kg : 1kg
Rocket barn	Wood	2.5kg : 1kg
Modro Electric barn	Electric	To be confirmed
Tunnel barn	Coal	1kg : 1kg

International benchmarks for a number of barns

Barn Type	Zimbabwean Farm	South Africa (British American Tobacco South Africa, 2013)	India (Nayak, 2013)	Zimbabwean Alternative (MUSONI, 2013)
Conventional	4kg : 1kg		8kg:1kg	2.06kg:1
Rocket barn	2.5kg : 1kg			2.06kg:1
Tunnel barn	1kg : 1kg	1.2kg: 1kg		

Sector findings (Case study 1 - Tobacco)



a) Water leakages



a) lagging of steam pipes



Unnecessary day lighting in warehouse₁₀

Sector findings (Case study 2 – Pig production)



Sector findings (Case study 2 – Pig production)

Energy intensity baseline

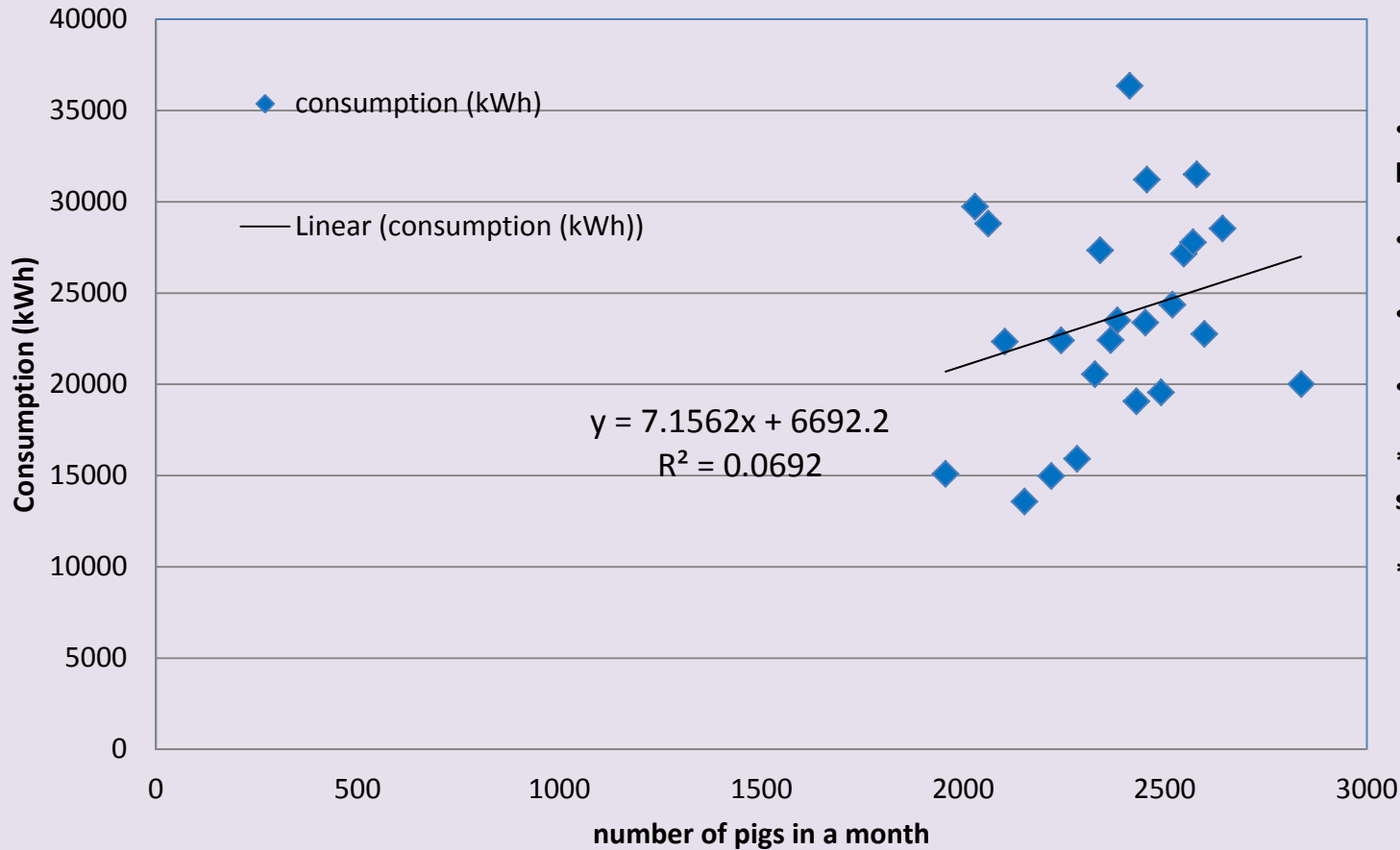
Year	2013	2012	Unit
Total Energy Consumption	1 618 390	1 494 279	MJ
	449 553.0	415 077	MWh
Total number of pigs raised	29 736	27 244	
Energy Intensity	54.4	54.85	MJ/Pig

Energy intensity benchmarking

Country	Zimbabwe	South Africa SAPPO	Ireland	France
MJ/pig	54.4	30	97.2	61.2
kWh/pig	15.1	8.33	27	17

There's opportunity to improve the energy intensity to the levels of SA

Sector findings (Case study 2 – Pig production)



Challenges

- No energy management practices
- Low capacity utilisation
- lack of access to cash loans
- high cost of stockfeeds
- *expensive protein supplement imports
- *depressed demand

Sector findings (Case study 3 – Large Scale Estate)

- a) Tea plantation and production since 1920s
- b) Coffee plantations and production
- c) Macadamia plantations and processing
- d) Avocado plantations
- e) Banana plantations

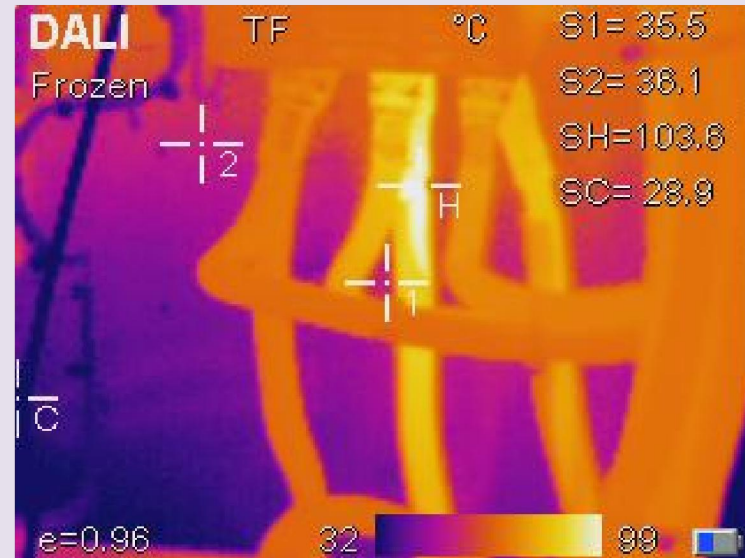
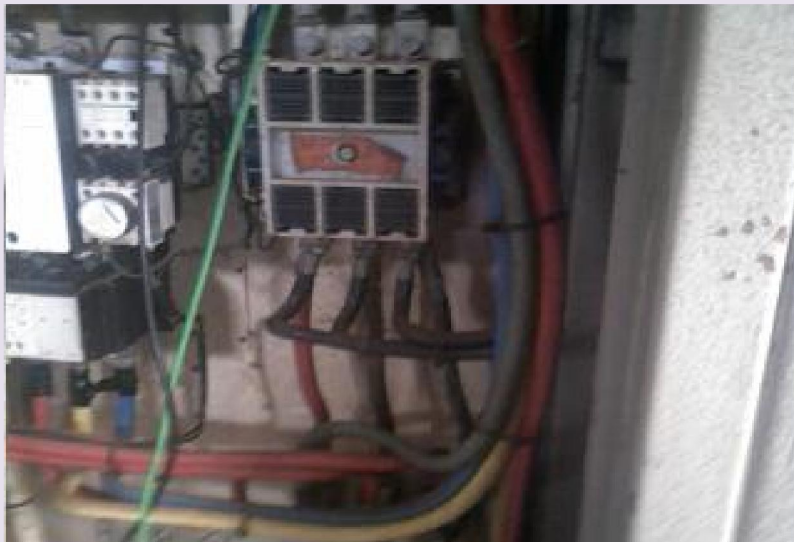


Sector findings (Case study 3 – Large Scale Estate)

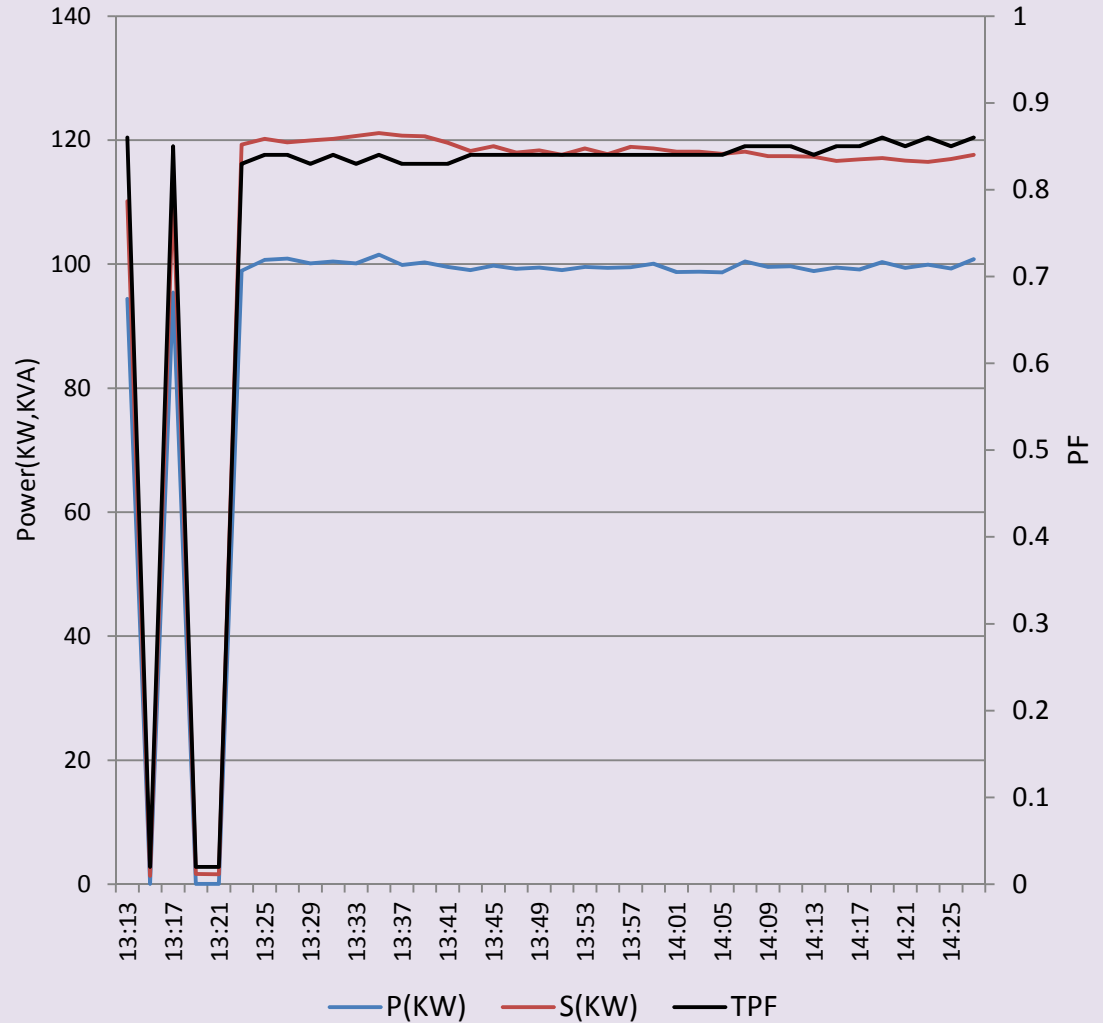
Significant energy usage at large scale estates

- Water pumping from dams to elevated earth dams
- water pumping direct for irrigation
- Electricity use in tea, coffee and macadamia processing factories
- Diesel for GenSets used during power outages
- Wood for boilers that generate steam for industrial process heat
- Coal for boilers
- Electricity use in farm compounds

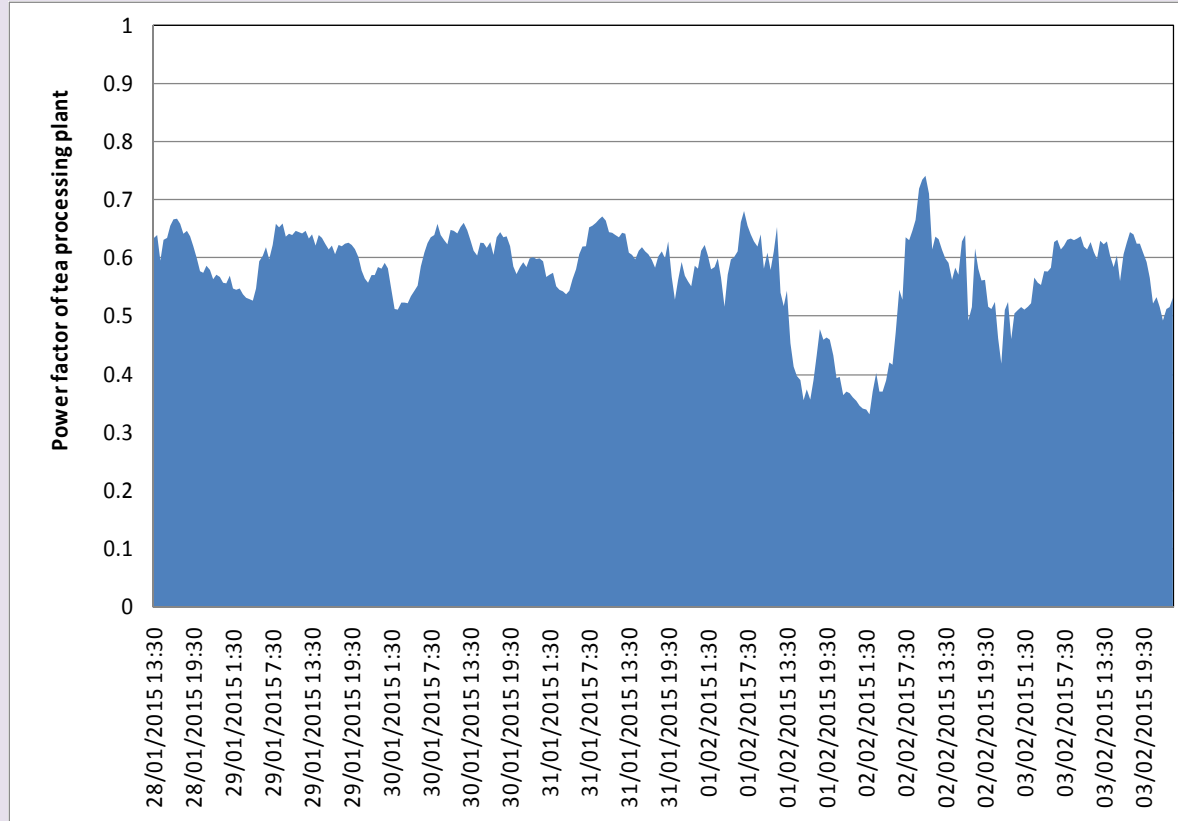
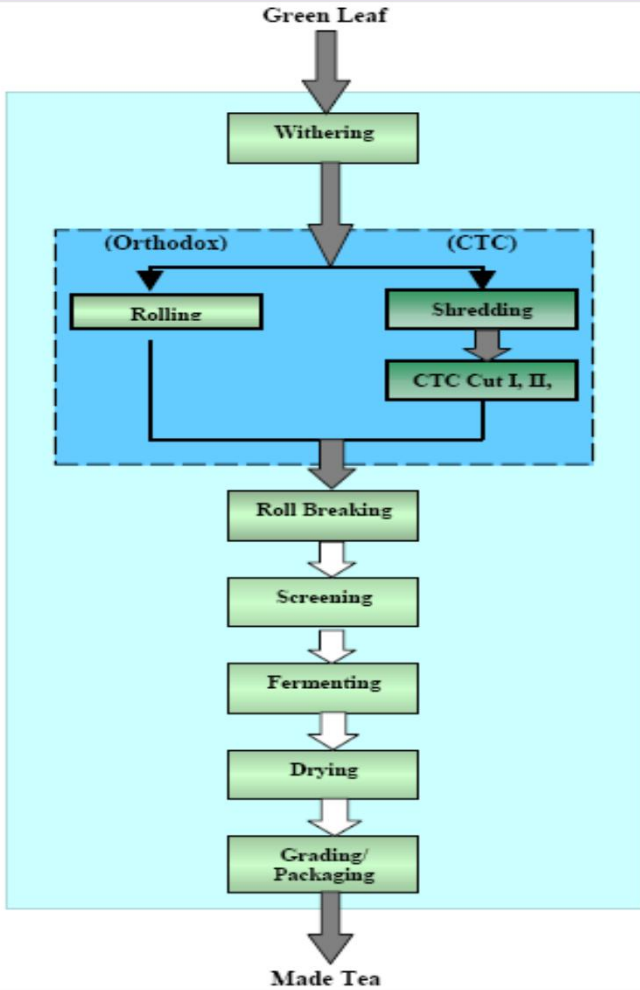
Sector findings (Case study 3 – Large Scale Estate)



Sector findings (Case study 3 – Large Scale Estate)

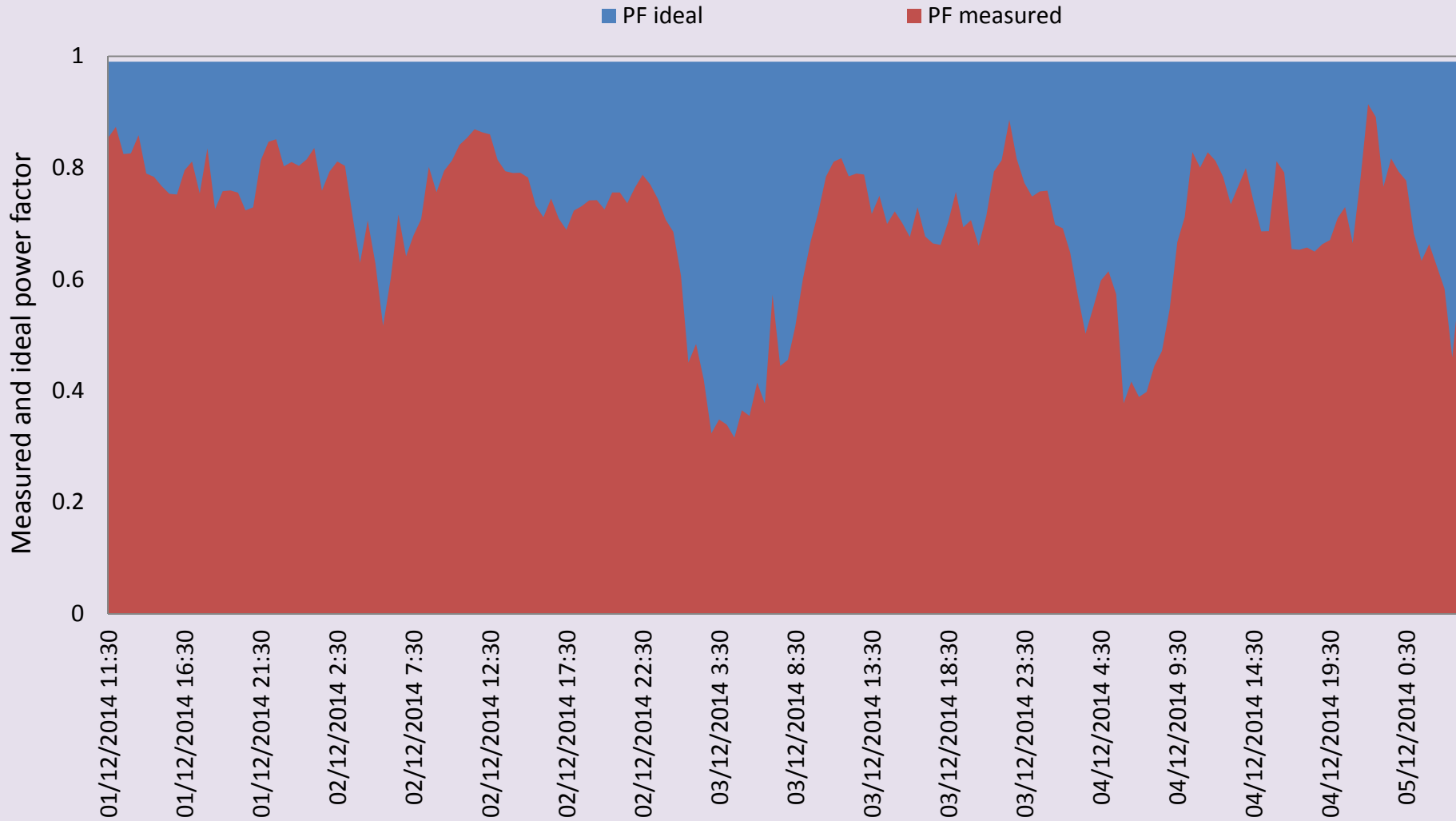


Sector findings (Case study 3 – Large Scale Estate)



The tea processing plant had an average power factor of 0.57

Agriculture sector findings, cntd



Measured and ideal Power Factors at a poultry processing farm

Sector findings (Case study 4 – Large poultry farm)

☐ 39 fowl runs. Total capacity of 220 000 birds

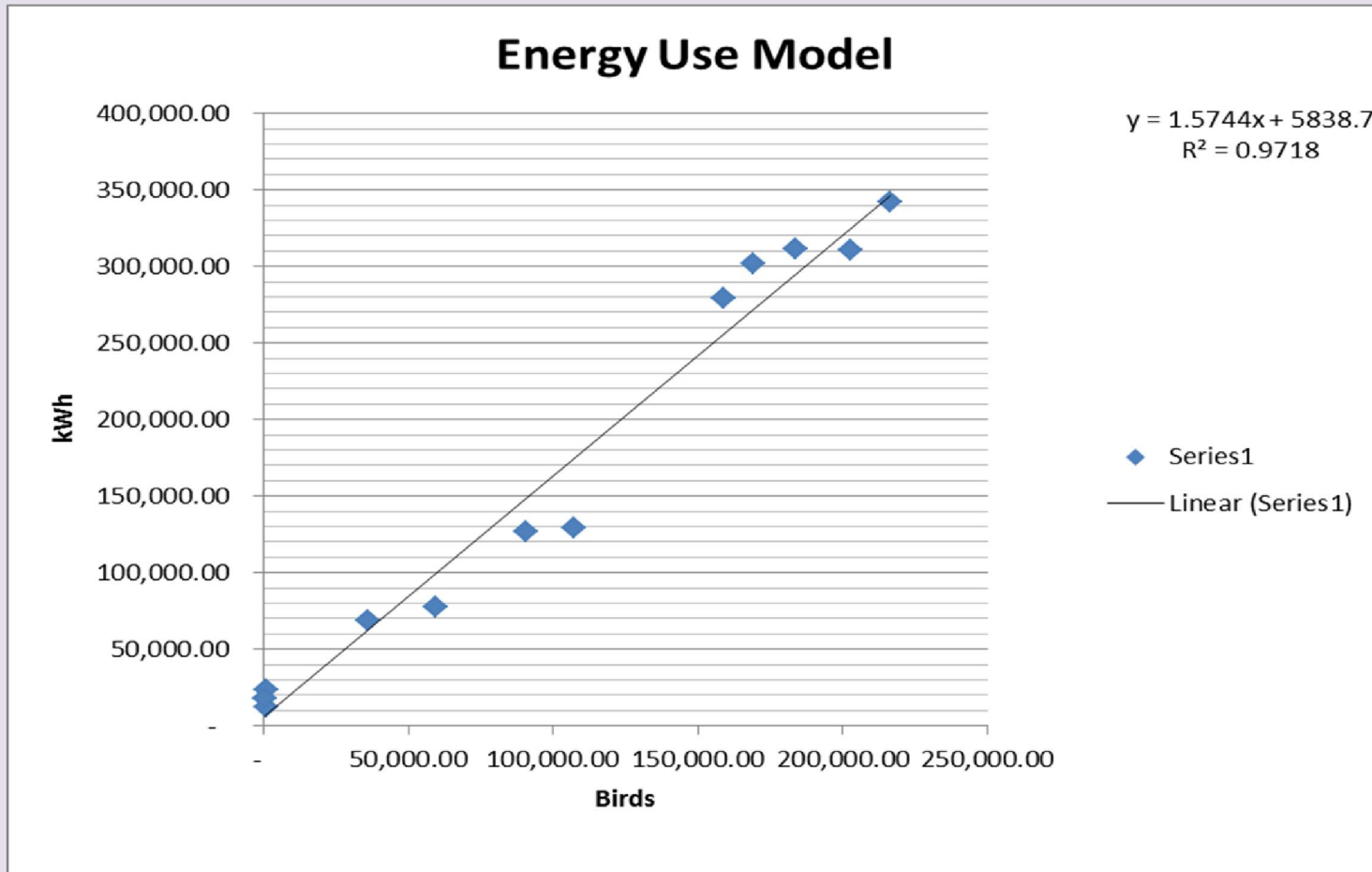
The significant energy users on the estate are:

- 2 160 x 100 W incandescent Philips lights bulbs.
- 8 x 240W HPSV perimeter fencing lights.
- 4 x 2.5 kW borehole pumps.
- 78 x 3.5 kW stoker fan motors used for heating and ventilation.
- 78 x 2.5 kW blower fans used to light the coal heater.
- 2 x 2 kW Thermotec Geysers.
- 2 x 107 kW Desktop Computers among others

Energy intensity comparison

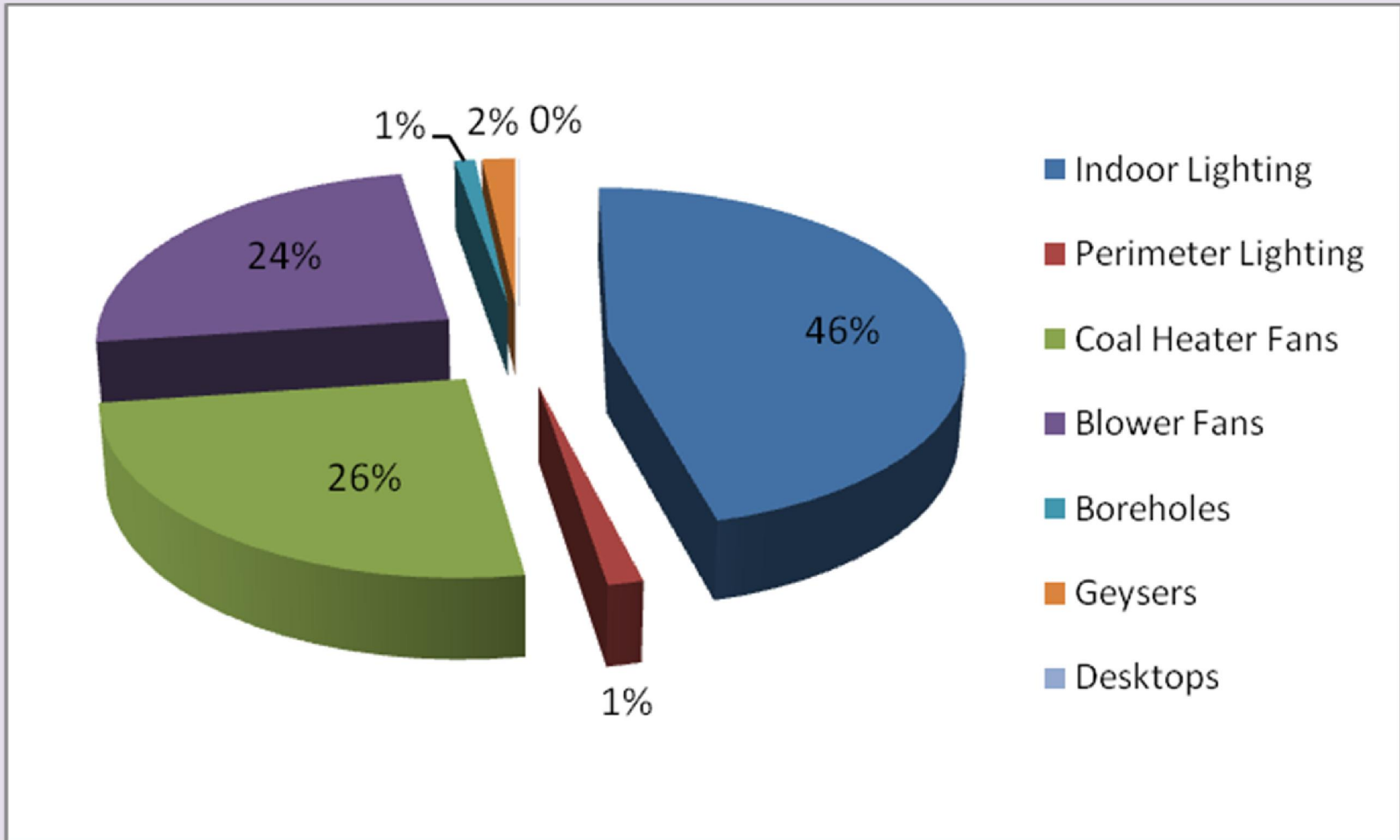
Parameter	Entity Intensity	Astral Poultry RSA 2013 Annual Report
Intensity kWh/bird	1.632	1.376

Sector findings (Case study 4 – Large poultry farm)



➤ Good correlation between energy consumption and poultry production

Sector findings (Case study 4 – Large poultry farm)



➤ Potential savings from indoor lighting retrofit with LEDs

General Sector findings (Issues and Causes)

- High energy intensities even in organisations with suppressed output
- Poor data records
 - production figures and farm output are kept in different depts
 - lack of sub-metering: energy data for subsectors not available
 - wood usage data is unavailable. Had to rely on estimates
 - Diesel and petrol data for various sectors (water pumping, generators and vehicles is inseparable)
- Oversized and undersized water pumps
- Excessive water leakages in irrigation piping systems
- Direct On-line starting of electric motors
- Air leakages in compressed air systems
- Steam leakages in boiler rooms
- Inefficient lighting systems e.g. incandescent light bulbs, Na vapour lamps, lights ON during daylight etc
- Lack of EM policies and strategies

The ECMs for Agriculture / What can be done

i) Water pumping systems

- Mending leaks on water pumps (gland packing)
- Mending leaks on water pipes
- Replace oversized pumps with optimally sized pumps
- Trimming impellers of oversized pumps and
- Install VSDs and soft starters on large pump motors.

ii) Compressed air system

- Mending leaks in pipes.
- Blanking

The ECMs for Agriculture are:

iii) Refrigeration

- Retrofitting Fibre Reinforced Plastic (FRP) fan blades
- Improve insulation of pipes
- Calibration and upgrading of temperature controls
- Maintaining specified refrigerant charge and
- Cleaning of heat transfer surfaces of evaporators and condensers.

iv) Others

- Improve lagging of steam pipes for tobacco bans
- Install economisers in boiler exhaust system to preheat water
- Replace/repair missing and damaged insulation
- Mending steam leaks in pipes and
- Install adequate instrumentation for monitoring/controlling boilers.
- Use biogas for heating in place of wood fuel (for small scale farms)

Agriculture sector observations and conclusion

- There are no energy policies at farming institutions
- There are no energy management strategies in agriculture
- There's a lack of energy efficiency culture in agriculture institutions
- Information and record keeping on energy use is poor and at worst non-existent
- There are no dedicated personnel responsible for energy management even at national scale
- There is lack of integration between production and energy consumption in the majority of institutions

Energy conservation policies and measures
are urgently required in agriculture