Process Monitoring Management System Standard Document

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1. INTRODUCTION

Process Monitoring Management System is a software program used to calculate real time assessment showing the coal power station thermal or equipment performance which is aimed to provide a guide of the thermal performance reflecting the condition and the standard of operation of the power stations.

2. SUPPORTING CLAUSES

2.1 SCOPE

2.1.1 Purpose

This standard describes the requirements for the Process Monitoring Management System that shall give on-line plant performance capability.

2.1.2 Applicability

Applicable to all coal fired Power Stations in Generation.

2.2 NORMATIVE/INFORMATIVE REFERENCES

2.2.1 Normative

[1] ISO 9001 Quality Management Systems.

[2] Maintenance of the Design Base 240-43542447

[3] Manage Operating Envelope 240-45920955

[4] Optimise Operational Asset performance 240-45921037

[5] Manage Asset Excursion 240-45920941

[6] Manage Maintenance Base 240-45920887

2.2.2 Informative

[7] Acceptance tests on stationary Steam Generators for the power station type BS EN 12952-15:2003,

[8] Rules for Steam Turbine thermal acceptance test BS EN 60953-2:1996 (equivalent to IEC 953-2:1990)

[9] ASME PTC 4.1 for Boiler Performance Module

[10] ASME PTC 4.3 for Air Heater

[11] ASME PTC 6 for Steam Turbines performance test codes

2.2.3 Disclosure Classification

Controlled Disclosure: Controlled Disclosure to external parties (either enforced by law, or discretionary).

2.3 ABBREVIATIONS

Abbreviation	Description
DCS	Digital Control System
GUI	Graphical User Interface
IM	Information Management
LDAP	Lightweight Directory Access Protocol
OPC	OpenGL Performance Characteristics
PDS	Plant Data System
S.T.E.P	Station Thermal Efficiency Performance
SQL	Standard Query Language
SSL	Secure Sockets Layer
VPN	Local Area Network
WAN	Wide Area Network
WebDav	Web Distribution Authoring and Versioning
XML	Extensible mark-up Language

2.4 PROCESS FOR MONITORING

Refer to appendix.

2.5 RELATED/SUPPORTING DOCUMENTS

Not applicable.

3. PROCESS MONITORING MANAGEMENT SYSTEM

3.1 REQUIREMENTS

This system shall be available to display information across the entire Eskom LAN/WAN network and shall seamlessly integrate into the Eskom IM structures. The scope of supply shall include:

a. Supply of a system for the plant performance and on-line STEP capability of the power station. This includes supply of all required hardware, interfaces, cabling, licences and software.
b. Information gathering
c. Model development
d. Deployment of the system
e. Setting up of a VPN link to facilitate model tuning and trouble shooting
f. Model deployment
g. Model training
h. System maintenance, monitoring, feedback and ongoing fine tuning
i. Training of Eskom staff to operate and train the system.

The system shall have the capability to calculate plant performance. The system shall include, but is not limited to performance modules for the following areas:

j. Boiler performance
k. Boiler Cleanliness
l. Feed water heater performance
m. Condenser performance
n. Cooling tower performance
o. Air heater performance

p. Controllable parameters
q. Pump performance
r. Steam turbine performance
s. Generator capability

The required parameters are detailed in Appendix A, B, C, D and E. The system shall monitor actual cycle and equipment performance relative to expected values dependents on unit load, ambient conditions and known equipment degradation. The system shall be able to identify thermal performance problems and quantify the losses in power generation and the thermodynamic cycle associated with these problems. The system shall provide a first principle thermodynamic model of the unit that is able to provide detailed heat and mass balances of the power plant cycle. The thermodynamic model must be able to be run" off-line" to be able to model "what if" scenarios.

3.1.1 "What if" Simulation

A "what if" simulation is a system to perform detailed mass and energy balances of the power plant cycles. The model shall show the effect on overall plant performance (generation and heat rate) as well as detailed energy flows to facilitate evaluation of conceptual changes in operating parameters as well as equipment design and efficiency improvements. This needs to be an off-line modelling capability.

The Boiler tool shall offer two different calculation modes: Simple Model and Heat Transfer Model. The Simple Model allows superheat and reheats outlet steam temperatures, superheater outlet steam flow, and desuperheatiing spray flows to be compared to fixed values.

The Heat Transfer Model calculation model shall also model the following: The furnace, convection pass, and air heater(s), steam, production, steam temperatures. Heat transfer and hydraulic response of each economiser, superheater, reheater, air heater, and furnace due to fuel heat input. The model shall allow the impact of changes in fuel, excess air, heat transfer section cleanliness, etc. on steam generation and outlet temperatures to be predicted and passed to the turbine cycle model. Superheater steam flows, steam conditions, and flue gas temperatures are calculated. The model also calculates the attemperation sprays, burner tilt position, flue gas recirculation, or convection pass flue gas distribution required to maintain steam temperature set points.

The Heat Transfer Model shall include a furnace model, convection pressure part models (economizer, reheater, etc.), and an air heater model.

Required inputs to the "What if" model

a. Boiler type (Non-reheat or Single Reheat, Drum or Benson)
b. Actual fuel flow
c. Constituents to be burned in the model
d. Superheater and reheater outlet temperature set points
e. Amounts of combustion air (characterised by excess air, excess oxygen – wet or excess oxygen – dry)
f. Carbon in ash
g. Carbon monoxide

A Steam Turbine tool calculates turbine efficiencies. A Condenser Tool calculates turbine backpressure, the impact of changes in circulating water flow, number of plugged tubes and changes in tube material.

3.2 DATA QUANTITY, QUALITY AND PREPARATION

High quality training data shall be used to train the supplied data models.

3.2.1.1 Data Quantity

The minimum requirements on model training data shall include:

a. Data tags to model a piece of equipment.
b. Sampling frequency to allows meaningful filtering and analysis.

3.2.1.2 Bad Data

The following bad data but not limited to these shall be excluded from model training:

a. Data lockups: constant values signals.
b. Data spikes and out of range signals.
c. Missing data.
d. Incorrect data such as signals fluctuating randomly.
e. Loss of significant digits.

3.2.2 Database

The system database for storing of current and historical data shall be SQL and OPC compatible. The display system database shall store all of the data, associated with the acquired information.

The database editor to be provided shall be of the latest state of the art. The system shall provide a comprehensive database management system and interface for the system administrator to view, optimise, add to, delete and organise configuration data. This database shall be completely open and conforms to all the required Eskom architectural standards.

3.2.3 Display

It shall be possible to view real time data from the system, remotely across the Eskom LAN/WAN. The preferred display mechanism shall be a Web based viewer, but a thick client shall be acceptable. The mechanism for data display shall conform to all Eskom standards and protocols.

Plant information shall be presented on a graphical user interface (GUI), and the facility shall exist to print the display data.

3.3 INTERFACE WITH THE ESKOM LAN/WAN

The display system shall interface with the Eskom LAN/WAN. This allows remote viewing and access to data. Remote access shall be as a site or centralised service available through a browser or thick client. The contents of the service shall be dynamically updated. Password protection shall be incorporated to guard sensitive or proprietary information.

When interfacing with the LAN/WAN, the system shall have to conform to all Eskom information management architectural requirements.

3.4 CONNECTIVITY OF THE SYSTEM

Figure 1 below gives a high level connection diagram of how the display system interfaces with the Eskom IM systems. The Eskom Information Management Architectural requirements are detailed in the Architecture Requirements for RFPs.

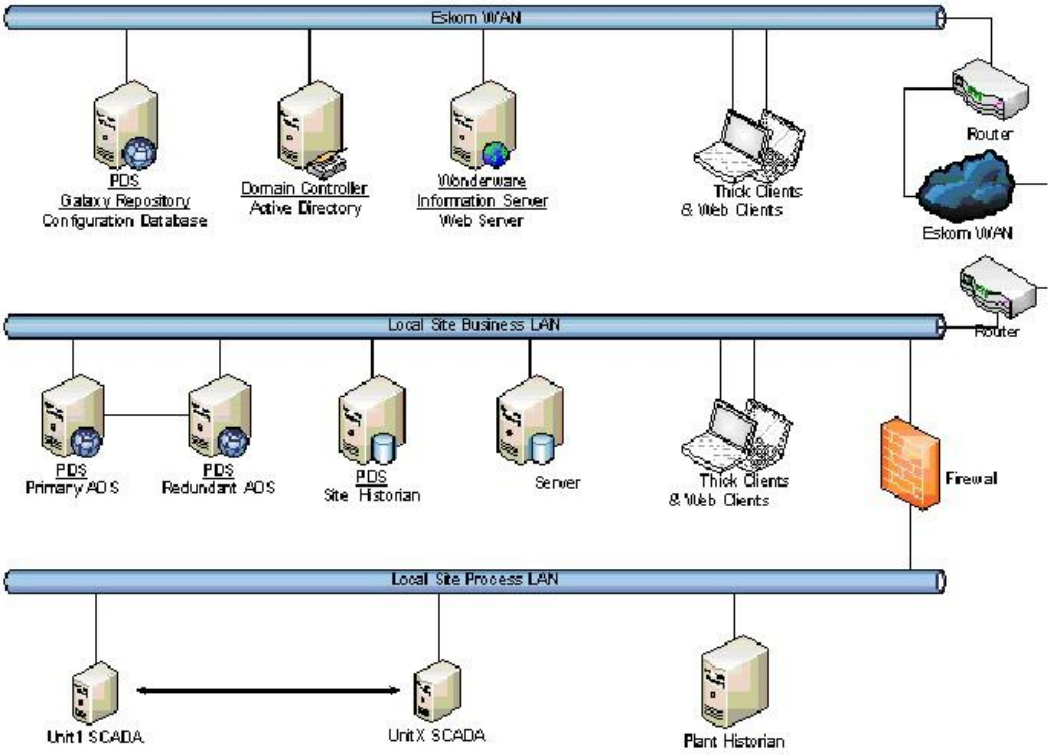

Figure 1: Connectivity of the System

3.5 MONITORING ABILITY

3.5.1 Parameters to be monitored

Appendix A details the plant areas and gives a high level indication of the parameters to be monitored. Appendix B and Appendix C gives an example of how this could be achieved with actual plant tags. This list will vary from plant to plant and is given for information only.

3.5.2 Sources of data

The data source shall be the plant historian. In most cases this shall be the Eskom PDS system.

3.6 COMMUNICATION PROTOCOLS TO THE DCS

Provided the DCS database is open, the display system shall be able to communicate with it. The system shall be OPC and SQL compliant; however, the long term method of communication should be the Generation Driven PDS system, which is based on the Wonderware Archestra platform. The system shall be designed to include all standard, Eskom Corporate architectural review committee approved protocols.

3.7 EXPANDABILITY AND UPGRADEABILITY

To prevent the massive capital outlay of the replacement of the entire system in the future, it is required that the system shall be expandable and upgradable at “component” level. This means that, for instance, it should be possible to upgrade the individual items of hardware and software without having to replace the whole system.

The system shall be designed to be almost infinitely configurable in term of the number of digital and analogue inputs. The system shall also be almost infinitely expandable.

3.8 COMPUTER CAPABILITY

It shall be possible to view the data from the system remotely on a standard Eskom computer, of the latest IT specification.

3.9 STANDARDIZATION

The concept design and, where possible, equipment shall be standardized across all installations of the system.

3.10 SERVICE LIFE

The service life of the system is to be at least 40 years.

3.11 SUPPORTABILITY AND MAINTAINABILITY

Full maintenance and support for the system will be provided by a company based in South Africa.

3.12 TRAINING

A formal training program will be provided to Eskom staff.

4. ACKNOWLEDGEMENTS

This document has been seen and accepted by the Plant Process Engineering S.C.

APPENDIX A: ONLINE PERFORMANCE METHOD

5. MINUIMUM TECHNICAL REQUIREMENTS FOR MODEL BUILDING

5.1 PLANT UNIT TECHNICAL DATA LIST

5.1.1 Steam Turbine

1.1 Valves-Wide-Open Heat Balance

1.2 Part Load Heat Balances

1.3 Steam turbine heat rate correction curves (thermal kit)

1.3.1 SH Pressure

1.3.2 SH Temperature

1.3.3 RH Temperature

1.3.4 Exhaust Pressure

1.4 Exhaust End Details

1.4.1 Number of Exhaust Ends (1, 2, etc.)

1.4.2 Annulus Area per Exhaust End

1.4.3 Last Stage Bucket Length

1.5 Side View Cross Section Drawing

5.1.2 Piping & Instrument Drawing (P&IDS)

2.1 Main Steam

2.2 Reheat Steam

2.3 Extraction Steam & FW Heater Drains

2.4 Feedwater

2.5 Condensate

2.6 Combustion Air

2.7 Flue Gas

2.8 Cooling Water

2.9 Fuel

2.9.1 Fuel Oil

5.1.3 Process Data Source

3.1 PDS Tag List

5.1.4 Boiler

4.1 Contract data sheet
4.2 Predicted Performance Data at Various loads
4.2.1 Throttle Flow
4.2.2 Fuel Flow
4.2.3 Air Heater Air and Gas Temperatures
4.2.4 Excess Air
4.2.5 Steam/Gas Temperatures for Each Boiler Section
4.2.6 Design Fuel
4.3 Mechanical Drawings
4.3.1 Side View
4.3.2 Front View
4.3.3 Plan View
4.4 Detailed Drawings/Description for Convective Sections & Furnace
4.3.1 Tube Size & Material
4.3.2 Tube Pitch & Spacing
4.5 P&ID Showing Steam/Water Flow Paths within Boiler

5.1.5 Condensers

5.1 Side View Cross Section Drawing
5.2 Performance Curves (Pressure vs. Duty, CW Temp)
5.3 Design Data Sheets
5.3.1 Number of Tubes
5.3.2 Number of Passes
5.3.3 Tube BWG or Thickness
5.3.4 Tube OD
5.3.5 Area
5.3.6 Material
5.3.7 CW Flow
5.3.8 Design Duty

5.1.6 Feedwater Heaters

6.1 Side View Cross Section Drawing
6.2 Design Data Sheets
6.2.1 Number of Tubes
6.2.2 Number of Passes
6.2.3 Tube BWG or Thickness

6.2.4 Tube OD

6.2.5 Surface Area

6.2.6 Material

6.2.7 Heat Transfer Coefficients

6.2.8 Duty per Section

5.1.7 Boiler Feed Pump

7.1 Side View Cross Section Drawings

7.2 Efficiency and Head Curves as Function of Flow

7.3 Rated RPM

7.4 Suction and Discharge Inner Pipe Diameters

7.5 Suction & Discharge Legs (height from pump to pressure instrument)

7.6 Drive Motor Efficiency, Voltage and Power Factor

5.1.8 Cooling Tower (As Applicable)

8.1 Side View Cross Section Drawings

8.2 Design Data Sheets

8.3 Performance Curves

8.3.1 Cold Water Temperature vs. Wet Bulb Temp, Flow, Humidity

5.1.9 Generator

9.1 Losses Curve

9.2 Reactive Capability Curves

5.1.10 Controllable Parameter Targets

10.1 Auxiliary (Station Service) Power vs. Load

10.2 SH and RH Spray Flows vs. Load

10.3 Throttle Pressure (sliding pressure operation?) vs. Load

10.4 SH & RH Steam Temperatures vs. Load

10.5 Recent performance test data (if available)

10.6 SH & RH Temp Control points (boiler outlet, turbine inlet, etc.)

10.7 Excess O2 vs. Load or steam flow

5.1.11 General

11.1 Operating Shift Schedule

11.2 Fuel Analysis

11.3 Average Fuel Cost

11.4 Typical Percent Carbon in Ash (Coal Units Only)

8.2 MINIMUM INSTRUMENTATION REQUIREMENTS FOR MODULES BUILDING

5.2.1 Boiler Performance Module

Environment Parameters
Boiler Exit Excess Oxygen
Air Heater Inlet Gas Temperature
Air Heater Exit Gas Temperature
Air Heater Inlet Air Temperature
Air Heater Exit Air Temperature
Fuel Flow
CO, NOx, SO2 (optional)

NOTE: *ASME PTC 4.1 Loss Method*

5.2.2 Boiler Cleanliness Module

Environment Parameters
Fuel Flow
Feedwater Flow
SH & RH Attemperation Flow(s)
Final Feedwater Temperature
Excess Oxygen
Drum Pressure
PSH Steam Outlet
Temperature(s)
SSH Steam Inlet Temperature(s)
SSH Steam Outlet Temperature(s)
CRH Steam Inlet Temperature(s)
HRH Steam Temperature(s)
Burner Elevation Firing Rates
Over-Fire Air Flow (if applicable)
Air Heater Gas Outlet Temperature(s)
Air Heater Air Inlet
Temperature(s)
Air Heater Air Outlet Temperature(s)
Economizer Feedwater Outlet Temperature
Flue Gas Recirculation Rate or Damper Position (if applicable)
Economizer Outlet/Air Heater Gas Inlet Temperature(s)

NOTE: *Availability of boiler temperatures affects the degree to which the cleanliness can be itemized.*

5.2.3 Feedwater Heater Performance Module

”Flange” Extraction Temperature(s)

“Flange” Extraction Pressure(s)

Feedwater Flow

Condensate Flow

Feedwater Heater Inlet Water Temperature(s)

Feedwater Heater Outlet Water Temperature(s)

Feedwater Heater Drain Water Temperature(s)

NOTE: *Depending on the feedwater system’s configuration (bypasses, etc.), the outlet temperature of a heater can be substituted by using the inlet temperature of the “next” heater, if necessary.*

5.2.4 Condenser Performance Module

Environment Parameters

Circulating Water Temperature (s) Entering Condenser

Circulating Water Temperature (s) Exiting Condenser

Condenser Pressure or Temperature (Tsat)

Hotwell Temperature

Circulating Water to Condenser Flow

NOTE: *Circulating water flow is rarely available as a measured parameter. At a minimum, a good estimate of circ water flow under different conditions of operation (# of pumps in operation) is required.*

5.2.5 Cooling Tower Performance Module

Environment Parameters

Circulating Water Cooling Tower Inlet and Outlet Temperatures

Cooling Tower Fan Power

Circulating Water to Cooling Tower Flow

NOTE: *Circulating water flow is rarely available as a measured parameter. At a minimum, a good estimate of circ water flow under different conditions of operation (# of pumps in operation) is required.*

5.2.6 Air Heater Performance Module

AH Air Outlet Temperatures

AH Air-Side Pressure Drop

AH Air Inlet Temperatures

AH Gas-Side Pressure Drop

AH Gas Outlet Temperatures

AH Gas Inlet Temperatures

Economizer Exit Excess Oxygen (optional)

Air Heater Outlet Oxygen (optional)

If Preheater is Used (Steam Coils or Glycol)

Preheater Air Inlet Temperatures

Steam Coil Extraction Temperatures & Pressures

Steam Coil Drain Temperatures

NOTE: *Online monitoring will calculate AH leakage based on difference in O2 levels or System Administrator can insert a fixed value for leakage.*

5.2.7 Controllable Parameters Module

Environment Parameters

Fuel Flow

Economizer Excess Oxygen

Hot Reheat Temperature

Final Feedwater Temperature

Condenser Pressure

Main Steam (Throttle) Temperature

Gross Generation

Main Steam (Throttle) Pressure

Reheat Attemperation Flow(s)

Hotwell Condensate Temperature

Superheat Attemperation Flow(s)

Gas Temperature(s) Entering & Exiting Air Heaters

Feedwater Flow or Main Steam Flow

Circulating Water Inlet Temperature

Net Generation or Station Service

5.2.8 Pump Performance Module

Pump Power (kW) or Current with Design or Estimated Bus Voltage & Power Factor

Pump Speed

Pump Discharge Pressure

Pump Suction Pressure & Temperature

Mechanical Drive Turbine Steam Inlet Pressure & Temperature

Mechanical Drive Turbine Steam Exhaust Pressure & Temperature

Mechanical Drive Turbine Steam Flow

5.2.9 Steam Turbine Performance Module

Feedwater (steam) Flow

Main Steam (throttle) Pressure & Temperature

Cold Reheat Pressure & Temperature

Extraction Pressures & Temp

Hot Reheat Pressure & Temp

Main Steam Flow (Combine Cycle)

Crossover Pressure & Temp

Hot Reheat Flow (Combine Cycle)

Condenser Pressure

Steam Turbine Gross Generation

LP Admission Flow, Pressure & Temperature (Combine Cycle)

5.2.10 Controllable Parameters Diagnostic Module

A specific additional instrument list is developed for each diagnostic depending on unit configuration and diagnostics desired.

5.2.11 OpsCenter Module

Procedures, operating instructions, P&IDs for desired systems in electronic format (i.e., AutoCad, Word) or suitable for scanning.

5.2.12 Generator Capability Module

Gross Generation (MW)

Reactive Generation (MVAR) or Power Factor

Hydrogen Pressure (Hydrogen Cooled Generator)

Stator Cooling Systems Status

Field Current

Cold Air Temperature (Air Cooled Generator)

NOTE: *Environment Parameters are Ambient Air Temperature (dry bulb), Barometric Pressure, Ambient Wet Bulb Temperature or Relative Humidity. 7/28/09*

5.3 MODEL PERFORMANCE CONFIGURATION DISPLAY SCREENS

5.3.1 Navigation Display Screen for Generation Heat Rate Management System

The navigation display screen shown below display the plant in an organised manner. The screen content can be organised by plant equipment or system levels and can drill down to levels.

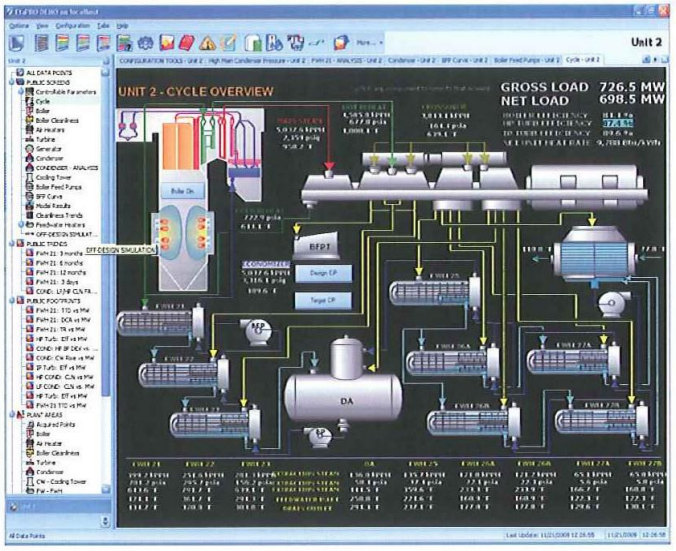

Figure 2: Display Screen for Generation Heat Rate Management System

5.3.2 Air Heater Module

Below is a display screen of the Air Heater Module. The Air Heater calculations are based on ASME PTC 4.3 for Air Heater.

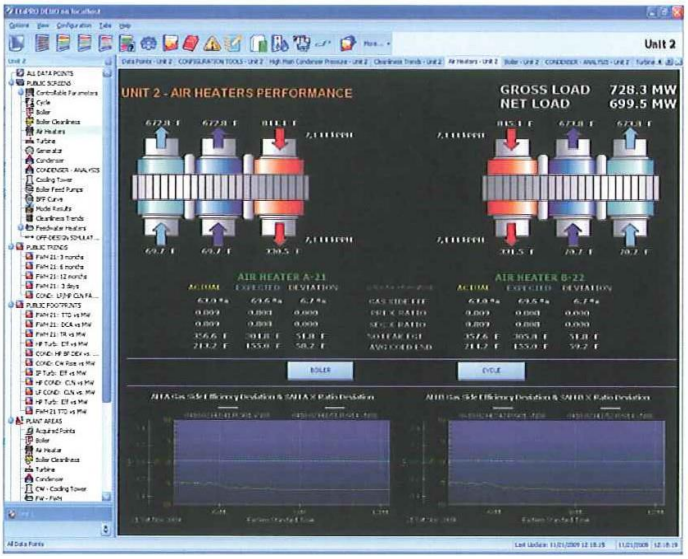

Figure 3: Air Heater Module

5.3.3 Boiler Performance Module

Boiler Performance Module calculate all major heat losses and overall boiler efficiency using technique described in ASME PTC 4.1, Steam Generating Units, and compare them to expected losses. Below is a display screen of the Boiler Performance Module.

Figure 4: Boiler Performance Module

5.3.4 Boiler Cleanliness Module

An effective soot blowing programme keeps the boiler clean and while maintaining optimum heat absorption patterns minimises costs within the boiler for critical steam temperatures and plant efficiency. Boiler Cleanliness Module as shown below.

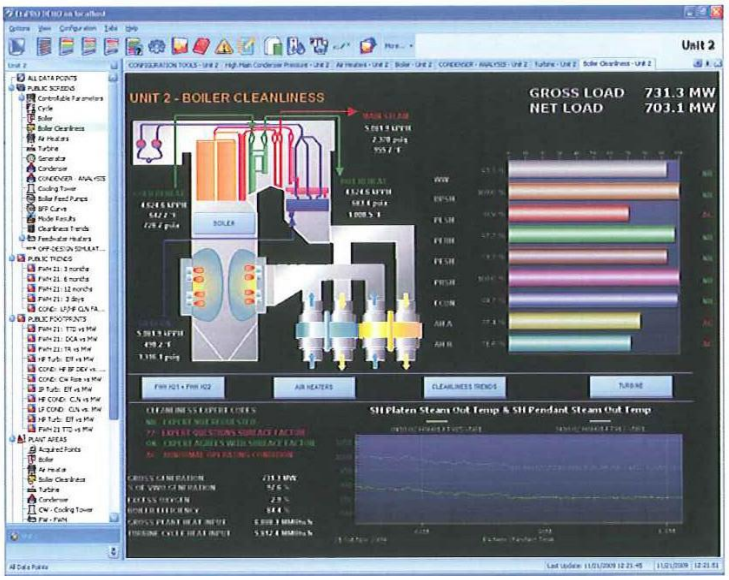

Figure 5: Boiler Performance Module

5.3.5 Feed water Heater Performance Module

Feed water Heater Performance Module constantly monitors terminal temperature difference, drain cooler approach and feed water temperature rise to assure proper heater level as shown below.

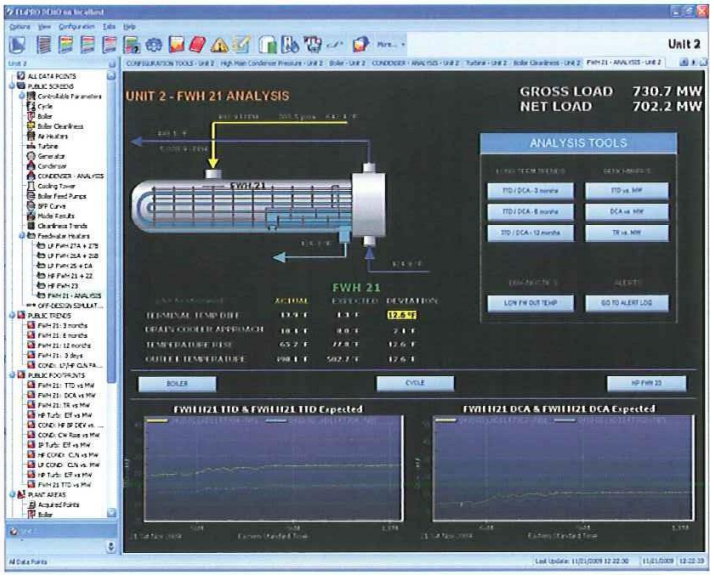

Figure 6: Boiler Performance Module

5.3.6 Steam Turbine Performance Module

The system will monitor actual steam turbine performance that is, section enthalpy drop efficiencies, stage flow factors, corrected stage pressures, turbine cycle heat rate, generator capacity and compare this performance to expected performance at current ambient and operating conditions.

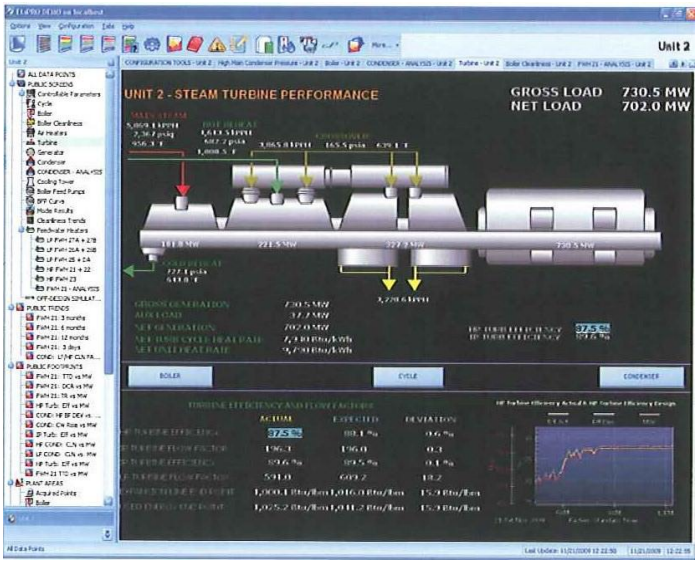

Figure 7: Boiler Performance Module

5.3.7 Condenser Performance Module

The Condenser Performance Module determines hot well sub cooling, circulating water temperature rise, tube cleanliness, heat loading and terminal temperature difference for actual operating conditions.

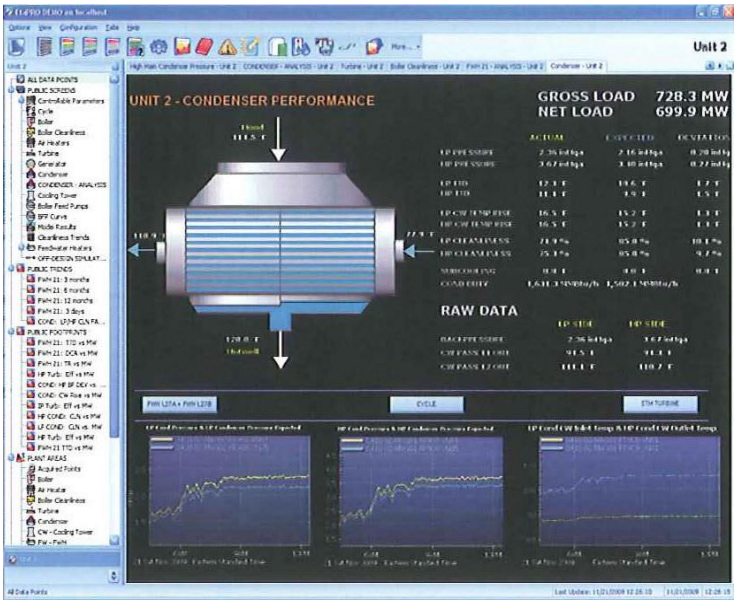

Figure 8: Condenser Performance Module

5.3.8 Cooling Tower Air Cool Condenser (ACC) Performance Module

The Cooling Tower and ACC have an influence on plant efficiency and significant influence on condenser pressure. Cooling Tower and ACC Performance Module monitors key parameters of the cooling tower operation and performance.

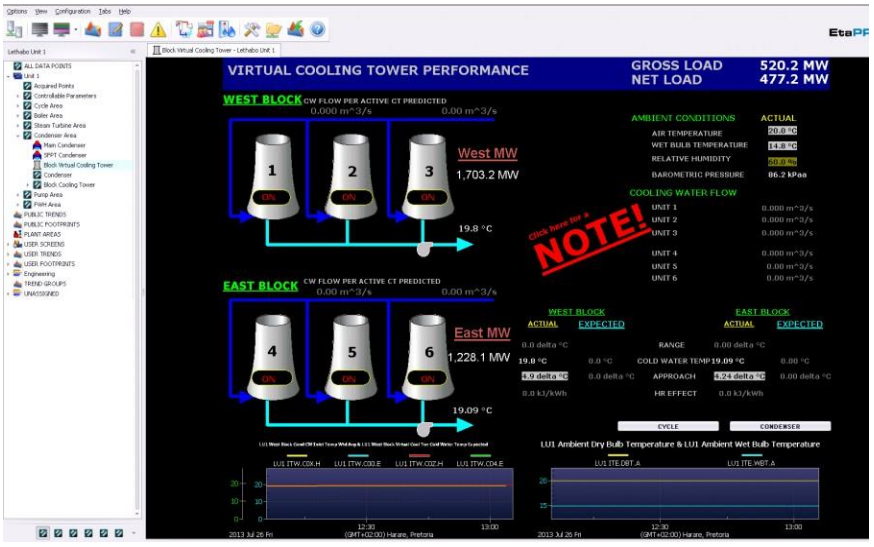

Figure 9: Cooling Tower Performance Module

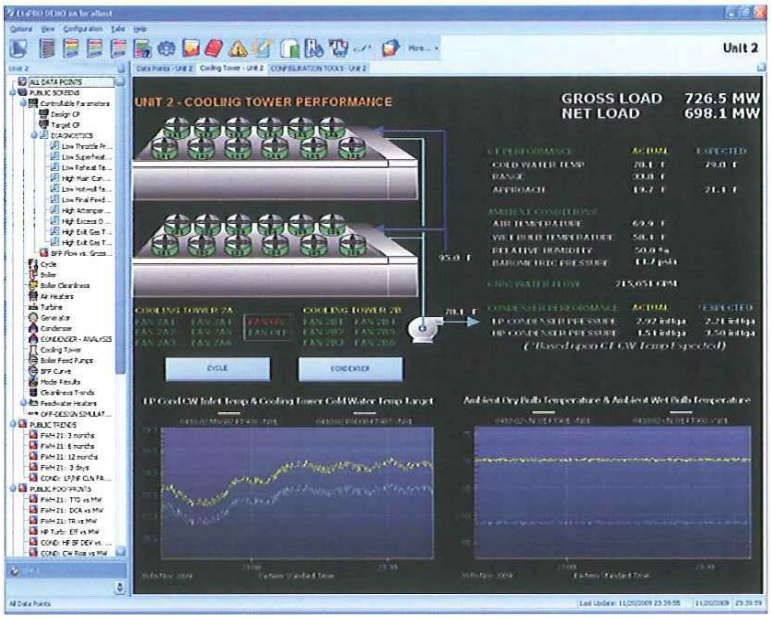

Figure 10: ACC Performance Module

5.3.9 Boiler Feed Pump Performance Module

Boiler Feed Pump Performance Module is a useful tool for determining Boiler Feed Pump Performance due to pump degradation and pump power, flow and head pressure are monitored.

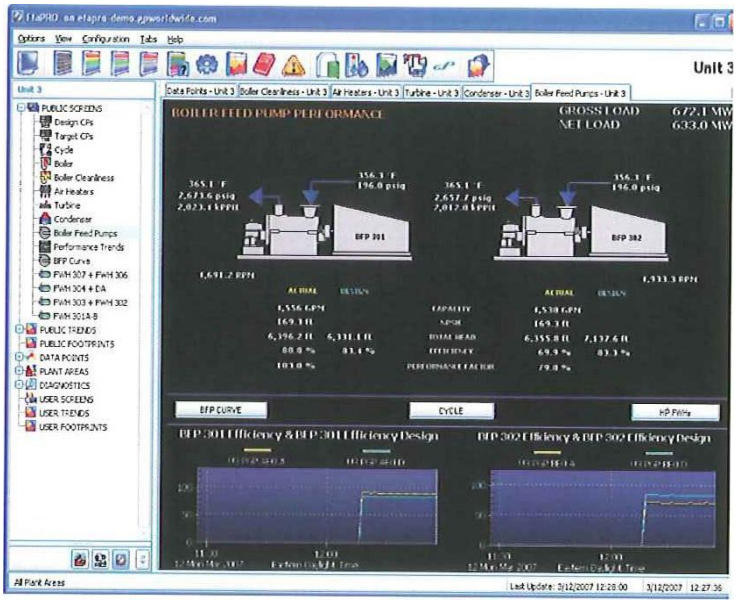

Figure 11: Boiler Feed Pump Module

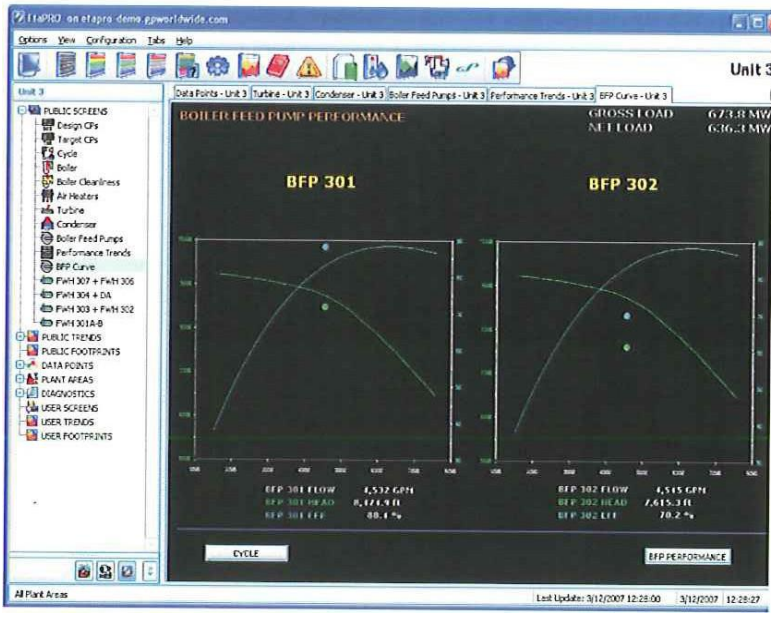

Figure 12: Boiler Feed Pump Curves

5.3.10 Fan Performance Module (to be developed)

Fan Performance Module calculates the key fan performance efficiency. The power, total pressure, flow, vane position and rated speed, forms part of the performance module.

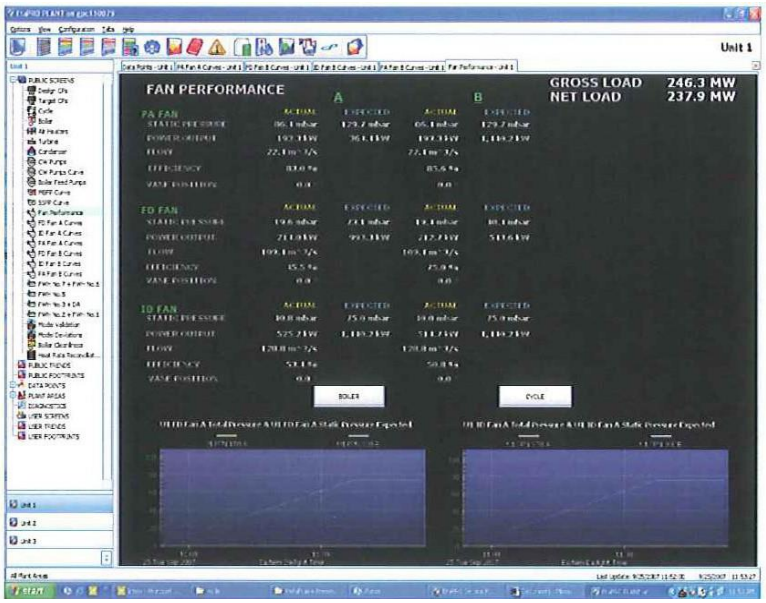

Figure 13: Fan Performance Module

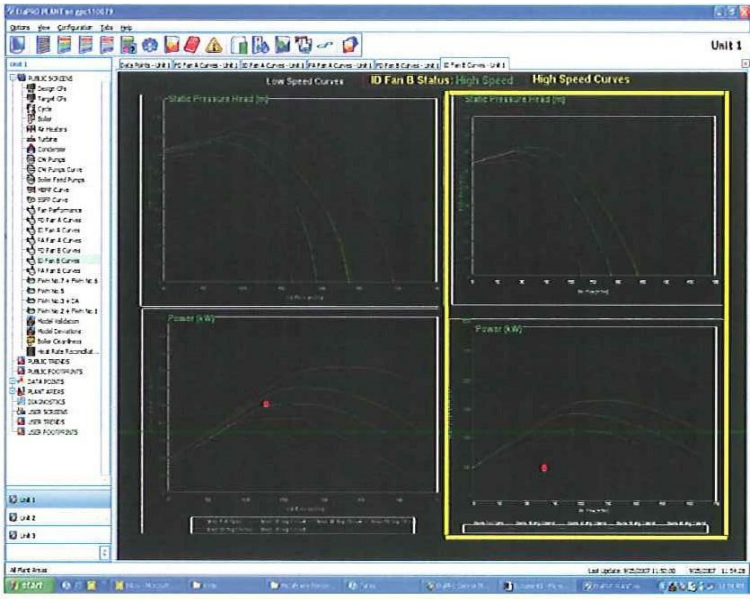

Figure 14: Fan Curves

5.3.11 Mill Performance Module (to be developed)

This model monitors real-time information about the mill performance and capacity. Depending on the instrumentation and coal analyses availability, the following are the minimum parameter measured and calculated;

1. Coal feed rate
2. Primary air flow
3. Fuel/Air ratio
4. Mill motor amps
5. Primary air inlet temperature
6. Mill outlet fuel temperature
7. Tempering air damper position.
8. Bowl differential pressure
9. Classifier differential pressure
10. Mill to furnace differential pressure
11. Relative mill capacity and fineness based on fuel moisture, type and hardness
12. Coal moisture based on mill inlet temperature required to attain mill outlet temperature set point.

The above results will be displayed on a diagram of the mill and archived in the data historian.

5.3.12 Generator Capability Curve Module

The Generator Capability Curve Module provides an on-line generator reactive capability curve that monitors the generator constantly containing numerical values of the generator hydrogen pressure, reactive load (MVAR) and true power (MW).

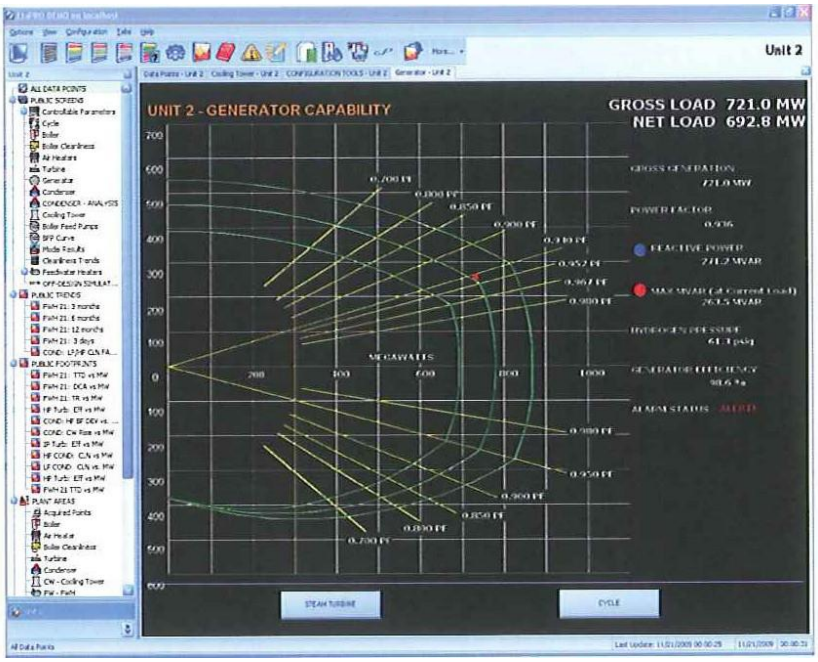

Figure 15: Generator Capability Module

5.3.13 Virtual Plant Modelling

Virtual Plant Modelling enables first principles modelling of power cycle for accurate prediction of thermodynamic and hydraulic performance of conventional fossil fuel power plants. Models built with Virtual Plant are accurate using a large library of plant components such as fossil boilers, steam turbines, condensers, feed water heaters, cooling towers, air cooled condensers and pumps. Below is a display screen of Virtual Plant Modelling.

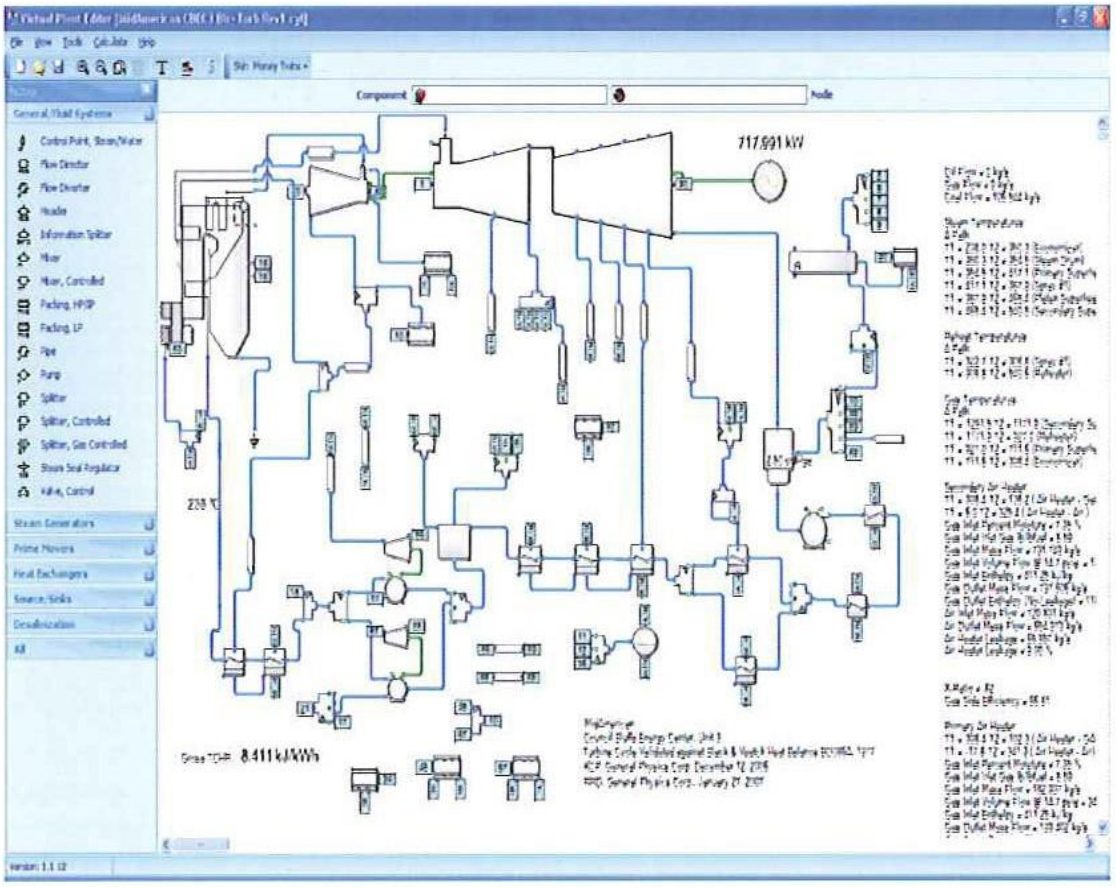

Figure 16: Virtual Plant Model

Limitation of the model in that it does not solve for momentum balances, (pressures up-stream and/or down-stream have to be accurately input) it is a steady state model, it is designed to be used to investigate and quantify cycle wide issues and cannot be used to analyse a single component without having the entire cycle connected and working. It should not be used for the design or sizing of plant equipment.

APPENDIX B: INPUT TAG REQUIREMENTS

Table 1: Minimum Input Tag Requirements for Model Building

NO.	DISCRIPTION	UNITS
1	GENERATOR LOAD	MW
2	Barometric Pressure	kPaa
3	ECON OUTL FW FLOW	kg/s
4	TOTAL FW FLOW	kg/s
5	UNIT TRANSFORMER A	MW
6	UNIT TRANSFORMER B	MW
7	GEN POWER FACTOR LAGGING	NA
8	MVARS (REACTIVE LOAD)	MVAR
9	ECON INLET FLOW 1	kg/s
10	ECON INL FW FLOW 2	kg/s
11	ECON INLET FLOW 3	kg/s
12	TOTAL CIRC WATER FLOW	m^3/s
13	CIRC PUMP A OUTLET WATER FLOW	m^3/s
14	CIRC PUMP B OUTLET WATER FLOW	m^3/s
15	F/OIL NETTO FLOW RAW	kg/s
16	MP OUTL F/OIL FLOW	kg/s
17	RTN PIPE FUEL OIL FLOW	kg/s
18	HP SPRAY WATER TOTAL FLOW	kg/s
19	S/H ATT 1.1 INL SW FLOW	kg/s
20	S/H ATT 1.2 INL SW FLOW	kg/s
21	S/H ATT 2.1 INL SW FLOW	kg/s
22	S/H ATT 2.2 INL SW FLOW	kg/s
23	S/H ATT 2.3 INL SW FLOW	kg/s
24	S/H ATT 2.4 INL SW FLOW	kg/s
25	S/H ATT 3.1 INL SW FLOW	kg/s
26	S/H ATT 3.2 INL SW FLOW	kg/s
27	S/H ATT 3.3 INL SW FLOW	kg/s
28	S/H ATT 3.4 INL SW FLOW	kg/s
29	R/ATT 1 INL SW FLOW	kg/s
30	R/ATT 2 INL SW FLOW	kg/s
31	R/ATT 3 INL SW FLOW	kg/s
32	R/ATT 4 INL SW FLOW	kg/s
33	BLR OUTL TOTAL STEAM FLOW	kg/s
34	BLR OUTL MS 1 STEAM FLOW	kg/s
35	BLR OUTL MS 2 STEAM FLOW	kg/s
36	BLR OUTL MS 3 STEAM FLOW	kg/s
37	BLR OUTL MS 4 STEAM FLOW	kg/s
38	EFP A FW FLOW	kg/s

39	EFP A DISCHARGE FLOW A	kg/s
40	EFP A DISCHARGE FLOW B	kg/s
41	EFP B FW FLOW	kg/s
42	EFP B DISCHARGE FLOW A	kg/s
43	EFP B DISCHARGE FLOW B	kg/s
44	SFP FW FLOW	kg/s
45	SFP DISCHARGE FLOW	kg/s
46	A MAKE UP FLOW (l/s)	NA
47	B MAKE UP FLOW (l/s)	NA
48	CPP MAIN FLOW	m^3/h
49	CPP A FLOW	m^3/h
50	CPP B FLOW	m^3/h
51	CPP C FLOW	m^3/h
52	EFP A SUCTION STRAINER DP	kPa
53	EFP B SUCTION STRAINER DP	kPa
54	SFP SUCTION STRAINER DP	kPa
55	COLD COND PRESS	kPaa
56	HOT COND PRESS	kPaa
57	BFPT COND PRESS	kPaa
58	HP/IP GLAND STEAM MANIFOLD PRESS	kPaa
59	LP GLAND STEAM MANIFOLD PRESS	kPaa
60	ATT 1 R/H STEAM INL PRESS	kPag
61	ATT 2 R/H STEAM INL PRESS	kPag
62	ATT 3 R/H STEAM INL PRESS	kPag
63	ATT 4 R/H STEAM INL PRESS	kPag
64	LH A/H INL AIR PRESS	kPag
65	LH A/H OUTL AIR PRESS	kPag
66	RH A/H INL AIR PRESS	kPag
67	RH A/H OUTL AIR PRESS	kPag
68	LH A/H INL PRI AIR PRESS	kPag
69	LH A/H OUTL PRI AIR PRESS	kPag
70	RH A/H INL PRI AIR PRESS	kPag
71	RH A/H OUTL PRI AIR PRESS	kPag
72	HR/H LEG 1 STEAM PRESS	kPag
73	HR/H LEG 2 STEAM PRESS	kPag
74	HR/H LEG 3 STEAM PRESS	kPag
75	HR/H LEG 4 STEAM PRESS	kPag
76	HR/R COM PIPE STEAM PRESS 4	kPag
77	IP ESV LHT INL STEAM PRESS	kPag
78	IP ESV RHB INL STEAM PRESS	kPag
79	CR/H 1 BLR INL STEAM PRESS	kPag
80	CR/H 2 BLR INL STEAM PRESS	kPag

81	HP EXH RH STEAM PRESS	kPag
82	HP TRB RH EXH NRV PRESS 1	kPag
83	HP TRB RH EXH NRV PRESS 2	kPag
84	HP TRB RH EXH NRV PRESS 3	kPag
85	HP HTR 5A BS INL PRESS	kPag
86	HP HTR 5B BS INL PRESS	kPag
87	HP HTR 6A BS INL PRESS	kPag
88	HP HTR 6B BS INL PRESS	kPag
89	BS/BFPT PRESS	kPag
90	BFPT STEAM BEF LH ESV PRESS	kPag
91	BFPT CR/H STEAM BEF CV PRESS	kPag
92	BFPT CR/H STEAM SUPPLY PRESS	kPag
93	DST STEAM SUPPLY PRESS	kPag
94	LP HTR 1A BS INL PRESS	kPag
95	LP HTR 1B BS INL PRESS	kPag
96	LP HTR 2A BS INL PRESS	kPag
97	LP HTR 2B BS INL PRESS	kPag
98	LP HTR 3 BS INL A PRESS	kPag
99	LP HTR 3 BS INL B PRESS	kPag
100	DST BS INL PRESS	kPag
101	DST SHELL PRESS	kPag
102	EFP A BP SUCT PRESS	kPag
103	EFP B BP SUCT PRESS	kPag
104	SFP BP SUCT PRESS	kPag
105	EXT PUMP B DISCH PRESS	kPag
106	EXT PUMP A DISCH PRESS	kPag
107	AUX STEAM RANGE PRESS	kPag
108	C/RH STEAM PRESS	kPag
109	BFPT EP A DISCH PRESS	kPag
110	BFPT EP B DISCH PRESS	kPag
111	HP TRB AFT GOV INL STEAM PRESS 1	kPag
112	HP TRB AFT GOV INL STEAM PRESS 2	kPag
113	HP TRB AFT GOV INL STEAM PRESS 3	kPag
114	IP GOV V/V RHT OUTL STEAM PRESS	kPag
115	IP GOV V/V LHB OUTL STEAM PRESS	kPag
116	IP STRN RHB OUTL STEAM PRESS	kPag
117	IP STRN RHT OUTL STEAM PRESS	kPag
118	IP STRN LHB OUTL STEAM PRESS	kPag
119	IP STRN LHT OUTL STEAM PRESS	kPag
120	IP EXH RHR STEAM PRESS	kPaa
121	BFPT AFTER LH ESV STEAM PRESS	kPag
122	BFPT AFTER RH ESV STEAM PRESS	kPag

123	BFPT NOZ BOX 2 STEAM PRESS	kPag
124	BFPT NOZ BOX 3 STEAM PRESS	kPag
125	GEN CASING GAS PRESS	kPag
126	HP PMP COMM MANFLT SUCT PRESS	kPag
127	ECON INL FW PRESS	MPag
128	ECON OUTL FW PRESS	MPag
129	ATT 1.1 STEAM OUTL PRESS	MPag
130	ATT 1.1 INL PRESS FOR ENTH	MPag
131	ATT 1.2 STEAM OUTL PRESS	MPag
132	ATT 1.2 INL PRESS FOR ENTH	MPag
133	HP SPRW PRESS	MPag
134	R/ATT COM SW PRESS	MPag
135	LIVE STEAM COM PIPE PRESS 4	MPag
136	LIVE STEAM COM PIPE PRESS 5	MPag
137	LIVE STEAM COM PIPE PRESS 6	MPag
138	LIVE STEAM COM PIPE PRESS 7	MPag
139	HP ESV LHT INL STEAM PRESS	MPag
140	HP ESV RHB INL STEAM PRESS	MPag
141	EFP A DISCH PRESS AFTER NRV	MPag
142	EFP A DISCH PRESS BEF NRV	MPag
143	EFP B DISCH PRESS AFTER NRV	MPag
144	EFP B DISCH PRESS BEF NRV	MPag
145	HP HTRS FW INL PRESS	MPag
146	SFP DISCH PRESS AFTER NRV	MPag
147	SFP DISCH PRESS BEFORE NRV	MPag
148	U1 HP PMP DISCH P BFR FILTER	MPag
149	LH A/H INL F/GAS PRESS	Pag
150	LH A/H OUTL F/GAS PRESS	Pag
151	RH A/H INL F/GAS PRESS	Pag
152	RH A/H OUTL F/GAS PRESS	Pag
153	HP HTR OUTL FW TEMP 1	°C
154	ECON INL FW TEMP 2	°C
155	ECON OUTLET FW TEMP	°C
156	EVAP DIV WALL STEAM TEMP	°C
157	ATT 1.1 STEAM INL TEMP 1	°C
158	ATT 1.1 INL TEMP FOR ENTH	°C
159	ATT 1.1 STEAM INL TEMP 3	°C
160	ATT 1.1 STEAM INL TEMP 4	°C
161	ATT 1.1 STEAM OUTL TEMP 5	°C
162	ATT 1.1 STEAM OUTL TEMP 7	°C
163	ATT 1.2 STEAM INLET TEMP 1	°C
164	ATT 1.2 INL TEMP FOR ENTH	°C

165	ATT 1.2 STEAM INLET TEMP 3	°C
166	ATT 1.2 STEAM INLET TEMP 4	°C
167	ATT 1.2 STEAM OUTLET TEMP 5	°C
168	ATT 1.2 STEAM OUTLET TEMP 7	°C
169	SEP VESS 1 OUTL STEAM TEMP	°C
170	SEP VESS 2 OUTL STEAM TEMP	°C
171	SEP VESS 3 OUTL STEAM TEMP	°C
172	SEP VESS 4 OUTL STEAM TEMP	°C
173	S/H ATT 2.1 STEAM INL TEMP 1	°C
174	S/H ATT 2.1 STEAM INL TEMP	°C
175	S/H ATT 2.1 STEAM OUTL TEMP 3	°C
176	S/H ATT 2.1 STEAM OUTL TEMP	°C
177	S/H ATT 2.2 STEAM INL TEMP 1	°C
178	S/H ATT 2.2 STEAM INL TEMP	°C
179	S/H ATT 2.2 STEAM OUTL TEMP 3	°C
180	S/H ATT 2.2 STEAM OUTL TEMP	°C
181	S/H ATT 2.3 STEAM INL TEMP 1	°C
182	S/H ATT 2.3 STEAM INL TEMP	°C
183	S/H ATT 2.3 STEAM OUTL TEMP 3	°C
184	S/H ATT 2.3 STEAM OUTL TEMP	°C
185	S/H ATT 2.4 STEAM INL TEMP 1	°C
186	S/H ATT 2.4 STEAM INL TEMP	°C
187	S/H ATT 2.4 STEAM OUTL TEMP 3	°C
188	S/H ATT 2.4 STEAM OUTL TEMP	°C
189	S/H ATT 3.1 STEAM INL TEMP 1	°C
190	S/H ATT 3.1 STEAM INL TEMP	°C
191	S/H ATT 3.1 STEAM OUTL TEMP 3	°C
192	S/H ATT 3.1 STEAM OUTL TEMP	°C
193	S/H ATT 3.2 STEAM INL TEMP 1	°C
194	S/H ATT 3.2 STEAM INL TEMP	°C
195	S/H ATT 3.2 STEAM OUTL TEMP 3	°C
196	S/H ATT 3.2 STEAM OUTL TEMP	°C
197	S/H ATT 3.3 STEAM INL TEMP 1	°C
198	S/H ATT 3.3 STEAM INL TEMP	°C
199	S/H ATT 3.3 STEAM OUTL TEMP 3	°C
200	S/H ATT 3.3 STEAM OUTL TEMP	°C
201	S/H ATT 3.4 STEAM INL TEMP 1	°C
202	S/H ATT 3.4 STEAM INL TEMP	°C
203	S/H ATT 3.4 STEAM OUTL TEMP 3	°C
204	S/H ATT 3.4 STEAM OUTL TEMP	°C
205	CIRC PUMP A INL WATER TEMP	°C
206	CIRC PUMP B INL WATER TEMP	°C

207	ATT 1 R/H STEAM INL TEMP	°C
208	ATT 1 R/H STEAM OUTL TEMP 1	°C
209	ATT 1 R/H STEAM OUTL TEMP 2	°C
210	ATT 2 R/H STEAM INL TEMP	°C
211	ATT 2 R/H STEAM OUTL TEMP 1	°C
212	ATT 2 R/H STEAM OUTL TEMP 2	°C
213	ATT 3 R/H STEAM INL TEMP	°C
214	ATT 3 R/H STEAM OUTL TEMP 1	°C
215	ATT 3 R/H STEAM OUTL TEMP 2	°C
216	ATT 4 R/H STEAM INL TEMP	°C
217	ATT 4 R/H STEAM OUTL TEMP 1	°C
218	ATT 4 R/H STEAM OUTL TEMP 2	°C
219	LH FD FAN INL AIR TEMP	°C
220	L/H A/H INL AIR TEMP	°C
221	L/H A/H + BYP OUTL AIR TEMP 1	°C
222	RH FD FAN INL AIR TEMP	°C
223	R/H A/H INL AIR TEMP	°C
224	R/H A/H + BYP OUTL AIR TEMP 1	°C
225	LH A/H INL PRI AIR TEMP	°C
226	LH A/H OUTL PRI AIR TEMP	°C
227	RH A/H INL PRI AIR TEMP	°C
228	RH A/H OUTL PRI AIR TEMP	°C
229	LH A/H PLATES GAS TEMP	°C
230	RH A/H PLATES GAS TEMP	°C
231	LH S/H 2 OUTL F/GAS TEMP 1	°C
232	LH R/H 1 OUTL F/GAS TEMP 4	°C
233	LH ECON OUTL F/GAS TEMP 1	°C
234	LH A/H INL F/GAS TEMP	°C
235	LH ID FAN LH INL F/GAS TEMP	°C
236	RH S/H 2 OUTL F/GAS TEMP	°C
237	RH R/H 1 OUTL F/GAS TEMP	°C
238	RH ECON OUTL F/GAS TEMP	°C
239	RH A/H INL F/GAS TEMP	°C
240	RH ID FAN LH INL F/GAS TEMP	°C
241	COM DUCT SEC AIR A TEMP	°C
242	COM DUCT SEC AIR B TEMP	°C
243	COM DUCT SEC AIR C TEMP	°C
244	COM DUCT SEC AIR D TEMP	°C
245	COM DUCT SEC AIR E TEMP	°C
246	COM DUCT SEC AIR F TEMP	°C
247	HP SPRW TEMP	°C
248	BLR OUTL MS 1 STEAM TEMP 1	°C

249	BLR OUTL MS 1 STEAM TEMP 2	°C
250	BLR OUTL MS 1 STEAM TEMP 3	°C
251	BLR OUTL MS 2 STEAM TEMP 1	°C
252	BLR OUTL MS 2 STEAM TEMP 2	°C
253	BLR OUTL MS 2 STEAM TEMP 3	°C
254	BLR OUTL MS 3 STEAM TEMP 1	°C
255	BLR OUTL MS 3 STEAM TEMP 2	°C
256	BLR OUTL MS 3 STEAM TEMP 3	°C
257	BLR OUTL MS 4 STEAM TEMP 1	°C
258	BLR OUTL MS 4 STEAM TEMP 2	°C
259	BLR OUTL MS 4 STEAM TEMP 3	°C
260	LIVE STEAM COM PIPE TEMP 1	°C
261	LIVE STEAM COM PIPE TEMP 2	°C
262	LIVE STEAM COM PIPE TEMP 3	°C
263	HP ESV LHT INL STEAM TEMP	°C
264	HP ESV LHB INL STEAM TEMP	°C
265	HP ESV RHT INL STEAM TEMP	°C
266	HP ESV RHB INL STEAM TEMP	°C
267	HR/H LEG 1 STEAM TEMP 1	°C
268	HR/H LEG 1 STEAM TEMP 2	°C
269	HR/H LEG 1 STEAM TEMP 3	°C
270	HR/H LEG 2 STEAM TEMP 1	°C
271	HR/H LEG 2 STEAM TEMP 2	°C
272	HR/H LEG 2 STEAM TEMP 3	°C
273	HR/H LEG 3 STEAM TEMP 1	°C
274	HR/H LEG 3 STEAM TEMP 2	°C
275	HR/H LEG 3 STEAM TEMP 3	°C
276	HR/H LEG 4 STEAM TEMP 1	°C
277	HR/H LEG 4 STEAM TEMP 2	°C
278	HR/H LEG 4 STEAM TEMP 3	°C
279	HR/H COM PIPE STEAM TEMP	°C
280	IP ESV LHT INL STEAM TEMP	°C
281	IP ESV LHB INL STEAM TEMP	°C
282	IP ESV RHT INL STEAM TEMP	°C
283	IP ESV RHB INL STEAM TEMP	°C
284	CR/H 1 BLR INL STEAM TEMP	°C
285	L/H HP EXH TEMP BEF NRV	°C
286	RH HP EXH TEMP BEF NRV	°C
287	CR/H 2 BLR INL STEAM TEMP	°C
288	HP HTR 5A BS INL TEMP	°C
289	HP HTR 5B BS INL TEMP	°C
290	HP HTR 6A BS INL TEMP	°C

291	HP HTR 6B BS INL TEMP	°C
292	BFPT LH STEAM SUPPLY TEMP	°C
293	BFPT RH STEAM SUPPLY TEMP	°C
294	BFPT CR/H STEAM SUPPLY TEMP	°C
295	LP HTR 3 BS INL A TEMP	°C
296	LP HTR 3 BS INL B TEMP	°C
297	DA BS INL TEMP	°C
298	DST TEMP	°C
299	DST SHELL TEMP	°C
300	DST TEMP	°C
301	DST OUTL/EFP A TEMP	°C
302	EFP A FW INL TEMP	°C
303	DST OUTL/EFP B TEMP	°C
304	EFP B FW INL TEMP	°C
305	DST OUTL/SFP TEMP	°C
306	SFP FW INLET TEMP	°C
307	EFP A FW OUTL TEMP	°C
308	EFP B FW OUTL TEMP	°C
309	HP HTRS FW INL TEMP	°C
310	BFPT FW OUTL TEMP	°C
311	HP HTR 5A FW INL TEMP	°C
312	HP HTR 6A FW INL TEMP	°C
313	HP HTR 6A FW OUTL TEMP	°C
314	HP HTR 5B FW INL TEMP	°C
315	HP HTR 6B FW INL TEMP	°C
316	HP HTR 6B FW OUTL TEMP	°C
317	LP HTRS DRN COOLER INL TEMP	°C
318	LP HTRS COMM INL TEMP	°C
319	LP HTR 2A INL TEMP	°C
320	LP HTR 2B INL TEMP	°C
321	LP HTR 3 INL TEMP	°C
322	LP HTR 3 OUTL TEMP	°C
323	DA INL CNDS TEMP	°C
324	DST TEMP (LP HTR 3 OUTL)	°C
325	AUX STEAM RANGE TEMP	°C
326	AUX STEAM HDR TEMP 1	°C
327	LP 1FRONT EXHAUST TEMP	°C
328	LP 1REAR EXHAUST TEMP	°C
329	LP 1 FRONT EXH TEMP	°C
330	LP1 HOOD TEMP	°C
331	LP 2 FRONT EXHAUST TEMP	°C
332	LP 2 REAR EXHAUST TEMP	°C

333	LP2 HOOD TEMP	°C
334	LP 2 REAR EXH TEMP	°C
335	IP EXH RHF STEAM TEMP	°C
336	IP EXH RHR STEAM TEMP	°C
337	COLD COND HOTWELL TEMP	°C
338	COLD COND STEAM INLET TEMP	°C
339	HOT COND HOTWELL TEMP	°C
340	HOT COND STEAM INLET TEMP	°C
341	HOT COND LH CW INLET TEMP	°C
342	COLD COND LH CW INLET TEMP	°C
343	HOT COND LH CW OUTLET TEMP	°C
344	HOT COND RH CW INL TEMP	°C
345	COLD COND RH CW INL TEMP	°C
346	HOT COND RH CW OUTL TEMP	°C
347	BFPT COND INLET STEAM TEMP	°C
348	BFPT HOTWELL TEMP	°C
349	LP HOOD TEMP FROM MAX SELECTOR OUTPUT	°C
350	HYGROMETER INLET	°C
351	HYGROMETER OUTLET	°C
352	BFPT COND CW OUTLET TEMP	°C
353	HP PMP COMM MANFLT TEMP	°C
354	MILL A FEEDER SPEED	%
355	MILL B FEEDER SPEED	%
356	MILL C FEEDER SPEED	%
357	MILL D FEEDER SPEED	%
358	MILL E FEEDER SPEED	%
359	MILL F FEEDER SPEED	%
360	HP LHT GOV V/V	%
361	HP LHB GOV V/V	%
362	HP RHT GOV V/V	%
363	HP RHB GOV V/V	%
364	IP LHT GOV V/V	%
365	IP LHB GOV V/V	%
366	IP RHT GOV V/V	%
367	IP RHB GOV V/V	%
368	ECONOMISER INLET O2	%
369	CIRC PUMP A MOTOR CURRENT	A
370	CIRC PUMP B MOTOR CURRENT	A
371	EFP A CURRENT	A
372	EFP B CURRENT	A
373	U1 HP PMP A MOTOR CURRENT	A
374	U1 HP PMP B MOTOR CURRENT	A

375	LP HTR 3 LEVEL (mm)	NA
376	HP HTR 5A LEVEL (mm)	NA
377	HP HTR 6A LEVEL (mm)	NA
378	HP HTR 5B LEVEL (mm)	NA
379	HP HTR 6B LEVEL (mm)	NA
380	SFP MAIN PUMP SPEED	RPM
381	EFP A SPEED	RPM
382	EFP B SPEED	RPM
383	FWH 6A DRAIN TEMP	°C
384	FWH 6B DRAIN TEMP	°C
385	FWH 5A DRAIN TEMP	°C
386	FWH 5B DRAIN TEMP	°C
387	FWH 3 DRAIN TEMP	°C
388	FWH 2A DRAIN TEMP	°C
389	FWH 2B DRAIN TEMP	°C
390	FWH 1A DRAIN TEMP	°C
391	FWH 1B DRAIN TEMP	°C
392	DRAIN COOLER DRAIN TEMP	°C
393	SH 1 STEAM OUT TEMP	°C
394	FLUE GAS NOX	ppm
395	FLUE GAS SO2	ppm
396	FLUE GAS CO	ppm
397	MAKEUP FLOW	kg/s

APPENDIX C: WRITE BACK TAG REQUIREMENTS

Table 2: Minimum Write Back Tag Requirements for Model Building

NO.	DESCRIPTION	UNITS
1	Gross Generation	MW
2	Barometric Pressure	kPaa
3	Percent of VWO Gross Load	%
4	Null Value - Zero	NA
5	Aux Load	MW
6	Net Generation	MW
7	Reactive Power	MVAR
8	Coal Flow On-Line 1	kg/s
9	Coal Flow On-Line 2	kg/s
10	Coal Flow On-Line 3	kg/s
11	Coal Flow On-Line 4	kg/s
12	Coal Flow On-Line 5	kg/s
13	Coal Flow On-Line 6	kg/s
14	Fuel Oil Flow	m^3/s
15	Mixed Fuel Flow Set	NA
16	Coal Flow Total	kg/s
17	Reheat Spray Flow	kg/s
18	Superheat Spray Flow 1	kg/s
19	Superheat Spray Flow 2	kg/s
20	Superheat Spray Flow 3	kg/s
21	Superheat Spray Flow Total	kg/s
22	SH Outlet Temperature	°C
23	Main Steam Temp (controlled)	°C
24	Throttle Temperature	°C
25	SH Outlet Pressure	MPaa
26	Main Steam Press (controlled)	MPag
27	Throttle Pressure	MPaa
28	First Stage Pressure	MPaa
29	First Stage Pressure Corrected	MPaa
30	HP Turbine Exhaust Pressure	MPaa
31	Cold RH Stm Press to Boiler	MPaa
32	Hot RH Pressure from Boiler	MPaa
33	Hot RH Pressure into Turbine	MPaa
34	HP Htr 5A Extr Press at Turb	MPaa
35	HP Htr 5B Extr Press at Turb	MPaa
36	Crossover Pressure IP Exhaust	MPaa
37	Crossover Pressure LP Turb inlet	MPaa

38	LP Htr 3 Extr Press at Turb	kPaa
39	LP Htr 2A Extr Press at Turb	kPaa
40	LP Htr 2B Extr Press at Turb	kPaa
41	LP Htr 1A Extr Press at Turb	kPaa
42	LP Htr 1B Extr Press at Turb	kPaa
43	HP Htr 6A Extr Press at FWH	MPaa
44	HP Htr 6B Extr Press at FWH	MPaa
45	HP Htr 5A Extr Press at FWH	MPaa
46	HP Htr 5B Extr Press at FWH	MPaa
47	DA Extr Press at FWH	MPaa
48	LP Htr 3 Extr Press at FWH	kPaa
49	LP Htr 2A Extr Press at FWH	kPaa
50	LP Htr 2B Extr Press at FWH	kPaa
51	LP Htr 1A Extr Press at FWH	kPaa
52	LP Htr 1B Extr Press at FWH	kPaa
53	HP/IP Gland Steam Manifold Press	kPaa
54	LP Gland Steam Manifold Press	kPaa
55	Feed Flow to Boiler	kg/s
56	BFP Suction Flow Total (less recirc)	kg/s
57	HP Htr 5A FW Flow	kg/s
58	HP Htr 5B FW Flow	kg/s
59	HP Htr 6A FW Flow	kg/s
60	HP Htr 6B FW Flow	kg/s
61	Total Main Stm Evaporation	kg/s
62	Above Seat VSLO	kg/s
63	Below Seat VSLO	kg/s
64	Main Stm Flow to Throt Valves	kg/s
65	LP Hotwell Temperature	°C
66	HP Hotwell Temperature	°C
67	Drain Cooler FW Inlet Temperature	°C
68	Drain Cooler FW Outlet Temperature	°C
69	LP Htr 1A FW Inlet Temperature	°C
70	LP Htr 1A FW Outlet Temperature	°C
71	LP Htr 1B FW Inlet Temperature	°C
72	LP Htr 1B FW Outlet Temperature	°C
73	LP Htr 2A FW Inlet Temperature	°C
74	LP Htr 2A FW Outlet Temperature	°C
75	LP Htr 2B FW Inlet Temperature	°C
76	LP Htr 2B FW Outlet Temperature	°C
77	LP Htr 3 FW Inlet Temperature	°C
78	LP Htr 3 FW Outlet Temperature	°C
79	DA Inlet Temperature	°C

80	DA Outlet Temperature	°C
81	RH Spray Source Temperature	°C
82	SH Spray Source Temperature	°C
83	HP Htr 5A FW Inlet Temperature	°C
84	HP Htr 5A FW Outlet Temperature	°C
85	HP Htr 5B FW Inlet Temperature	°C
86	HP Htr 5B FW Outlet Temperature	°C
87	HP Htr 6A FW Inlet Temperature	°C
88	HP Htr 6A FW Outlet Temperature	°C
89	HP Htr 6B FW Inlet Temperature	°C
90	HP Htr 6B FW Outlet Temperature	°C
91	Feedwater to Boiler Temperature	°C
92	CW Flow - LP Cond Expected	m^3/s
93	CW Flow - HP Cond Expected	m^3/s
94	CT Circ Water Flow Expected	m^3/s
95	LP Cond Pressure	kPaa
96	HP Cond Pressure	kPaa
97	Cond Pressure Avg	kPaa
98	Generator Hydrogen Pressure	MPag
99	Deaerator Shell Pressure	MPag
100	BFP Discharge Pressure	MPag
101	Reheat Spray Pressure	MPag
102	Superheat Spray Pressure	MPag
103	FWH DC Water Inlet Pressure	MPag
104	LP Htr 1A Water Inlet Pressure	MPag
105	LP Htr 1B Water Inlet Pressure	MPag
106	LP Htr 2A Water Inlet Pressure	MPag
107	LP Htr 2B Water Inlet Pressure	MPag
108	LP Htr 3 Water Inlet Pressure	MPag
109	HP Htr 5A Water Inlet Pressure	MPag
110	HP Htr 5B Water Inlet Pressure	MPag
111	HP Htr 6A Water Inlet Pressure	MPag
112	HP Htr 6B Water Inlet Pressure	MPag
113	Feedwater to Boiler Pressure	MPag
114	LH A/H Pri Air dP	kPa
115	RH A/H Pri Air dP	kPa
116	LH A/H Sec Air dP	kPa
117	RH A/H Sec Air dP	kPa
118	LH A/H Flue Gas dP	kPa
119	RH A/H Flue Gas dP	kPa
120	LH A/H Sec Flue Gas dP	kPa
121	RH A/H Sec Flue Gas dP	kPa

122	Ambient Dry Bulb Temperature	°C
123	HP Turbine Exhaust Temperature	°C
124	Cold RH Stm Temp to Boiler	°C
125	Hot RH Temp from Boiler	°C
126	Hot RH Temp (controlled)	°C
127	Hot RH Temp into Turbine	°C
128	HP Htr 6A Extraction Temp	°C
129	HP Htr 6A Drain Out Temp	°C
130	HP Htr 6B Extraction Temp	°C
131	HP Htr 6B Drain Out Temp	°C
132	HP Htr 5A Extraction Temp	°C
133	HP Htr 5A Drain Out Temp	°C
134	HP Htr 5B Extraction Temp	°C
135	HP Htr 5B Drain Out Temp	°C
136	DA Extraction Temp	°C
137	Crossover Temp IP Exhaust	°C
138	Crossover Temp LP Turb inlet	°C
139	LP Htr 3 Extraction Temp	°C
140	LP Htr 3 Drain Out Temp	°C
141	LP Htr 2A Extraction Temp	°C
142	LP Htr 2A Drain Out Temp	°C
143	LP Htr 2B Extraction Temp	°C
144	LP Htr 2B Drain Out Temp	°C
145	LP Htr 1A Extraction Temp	°C
146	LP Htr 1A Drain Out Temp	°C
147	LP Htr 1B Extraction Temp	°C
148	LP Htr 1B Drain Out Temp	°C
149	FWH DC Drain Out Temp	°C
150	LP Turbine 1 Exhaust Temperature	°C
151	LP Turbine 2 Exhaust Temperature	°C
152	LH A/H Pri Air Inlet Temperature	°C
153	RH A/H Pri Air Inlet Temperature	°C
154	LH A/H Sec Air Inlet Temperature	°C
155	RH A/H Sec Air Inlet Temperature	°C
156	LH A/H Pri Air Outlet Temperature	°C
157	RH A/H Pri Air Outlet Temperature	°C
158	LH A/H Sec Air Outlet Temperature	°C
159	RH A/H Sec Air Outlet Temperature	°C
160	LH A/H Gas Inlet Temperature	°C
161	RH A/H Gas Inlet Temperature	°C
162	LH A/H Gas Outlet Temp (No Alarm)	°C
163	RH A/H Gas Outlet Temp (No Alarm)	°C

164	LP Cond CW Inlet Temp	°C
165	HP Cond CW Inlet Temp	°C
166	LP Cond CW Outlet Temp	°C
167	HP Cond CW Outlet Temp	°C
168	Ambient Wet Bulb Temperature	°C
169	Specific Humidity	kg/kgdryair
170	Ambient Relative Humidity	%
171	Flue Gas NOx	ppm
172	Flue Gas SO2	ppm
173	Flue Gas CO	ppm
174	Excess Oxygen Actual	%
175	Heat Input from Coal On-Line 1	MJ/h
176	Heat Input from Coal On-Line 2	MJ/h
177	Heat Input from Coal On-Line 3	MJ/h
178	Heat Input from Coal On-Line 4	MJ/h
179	Heat Input from Coal On-Line 5	MJ/h
180	Heat Input from Coal On-Line 6	MJ/h
181	Heat Input from Coal Total	MJ/h
182	Heat Input from Fuel Oil	MJ/h
183	Fuel Oil Mass Flow	kg/h
184	Gross Unit Heat Input (Fuel Flow)	MJ/h
185	% Total Heat Input from Coal	%
186	First Stage Enthalpy	kJ/kg
187	First Stage Temperature	°C
188	IP Cooling Steam Flow	kg/s
189	N1 Inner Lkg	kg/s
190	N1 Outer Lkg to LP 2 Htr	kg/s
191	N1 Outer Lkg to SSR	kg/s
192	N3 to Lkg LP 2 Htr	kg/s
193	N1 + N3 to Lkg LP 2A/B Htr	kg/s
194	N3 Lkg to SSR	kg/s
195	LO to LP Turbine Seals	kg/s
196	SSR LP Steam to GSC	kg/s
197	SFP Status (1=ON 0=OFF)	NA
198	SFPT Extraction Flow	kg/s
199	HP Htr 6A Extraction Flow	kg/s
200	HP Htr 6B Extraction Flow	kg/s
201	Cold RH to Boiler Flow (boiler in)	kg/s
202	Hot Reheat From Boiler Flow	kg/s
203	LH A/H Pri Leakage	%
204	RH A/H Pri Leakage	%
205	LH A/H Sec Leakage	%

206	RH A/H Sec Leakage	%
207	AH Leakage Weighted Avg	%
208	LH A/H Leakage Weighted Avg	%
209	RH A/H Leakage Weighted Avg	%
210	AH Gas In Temp Design	°C
211	AH Gas In Temp Target	°C
212	AH No Leak EGT at Ref Design	°C
213	LH A/H Air Inlet Temp Weighted Avg	°C
214	RH A/H Air Inlet Temp Weighted Avg	°C
215	LH A/H Air Outlet Temp Weighted Avg	°C
216	RH A/H Air Outlet Temp Weighted Avg	°C
217	AH Air Inlet Temp Weighted Avg	°C
218	PAH X-Ratio Design	NA
219	PAH X-Ratio Expected	NA
220	PAH X-Ratio Target	NA
221	SAH X-Ratio Design	NA
222	SAH X-Ratio Expected	NA
223	SAH X-Ratio Target	NA
224	AH X-Ratio Avg Design	NA
225	AH X-Ratio Avg Expected	NA
226	AH X-Ratio Avg Target	NA
227	AH Gas Side Efficiency Design	%
228	AH Gas Side Efficiency Expected	%
229	AH Gas Side Efficiency Target	%
230	LH A/H EGT Design	°C
231	LH A/H EGT Target	°C
232	RH A/H EGT Design	°C
233	RH A/H EGT Target	°C
234	AH Air Inlet Temp Reference	°C
235	LH A/H Gas Outlet Temp (Equip Alarm)	°C
236	RH A/H Gas Outlet Temp (Equip Alarm)	°C
237	LH A/H No Leak EGT Actual	°C
238	RH A/H No Leak EGT Actual	°C
239	LH A/H NL EGT Actual Ref	°C
240	RH A/H NL EGT Actual Ref	°C
241	LH A/H No Leak EGT Design	°C
242	LH A/H No Leak EGT Target	°C
243	RH A/H No Leak EGT Design	°C
244	RH A/H No Leak EGT Target	°C
245	AH Air Outlet Temp Weighted Avg	°C
246	AH Gas Inlet Temp Weighted Avg	°C
247	AH Gas Outlet Temp Weighted Avg	°C

248	AH No Leak EGT Actual Wtd Avg	°C
249	AH No Leak EGT Actual Ref Wtd Avg	°C
250	AH No Leak EGT Design Wtd Avg	°C
251	AH No Leak EGT Target Wtd Avg	°C
252	AH EGT Target Wtd Avg	°C
253	Excess Oxygen Design	%
254	Excess Oxygen Target	%
255	Excess Oxygen Deviation	%
256	Incomplete Combustion Actual	%
257	Incomplete Combustion Design	%
258	Incomplete Combustion Target	%
259	CO Design	ppm
260	CO Target	ppm
261	Excess Air Actual	%
262	Air to Fuel Ratio Actual	kg/kg fuel
263	Wt of Comb Prods In Dry Air Actual	kg/kg fuel
264	Wt of Comb Prods In Wet Air Actual	kg/kg fuel
265	Radiation Loss Actual	%
266	Dry Gas Loss Actual	%
267	Fuel Moisture Loss Actual	%
268	Air Moisture Loss Actual	%
269	Hydrogen Loss Actual	%
270	Carbon In Ash Loss Actual	%
271	Carbon Monoxide Loss Actual	%
272	NOx Loss Actual	%
273	Solids Loss Actual	%
274	Boiler Unaccounted Losses Actual	%
275	Boiler Efficiency Actual	%
276	Turbine Cycle Heat Input	MJ/h
277	Net Turbine Cycle Heat Rate Actual	kJ/kWh
278	Gross Unit Heat Input (TCHI/BlrEff)	MJ/h
279	Net Unit Heat Rate Actual (GPHI)	kJ/kWh
280	Gross Unit Heat Rate Actual (GPHI)	kJ/kWh
281	Fuel Use (TCHI/BlrEff)	kg/s
282	Flue Gas Flow (TCHI/BlrEff)	kg/s
283	Flue Gas SO2 - Mass Basis	kg/kWh
284	Flue Gas NOx - Mass Basis	kg/kWh
285	Flue Gas SO2 Design - Mass Basis	kg/kWh
286	Flue Gas SO2 Design - Concentration	ppm
287	Flue Gas SO2 Target - Mass Basis	kg/kWh
288	Flue Gas SO2 Target - Concentration	ppm
289	Flue Gas NOx Design - Mass Basis	kg/kWh

290	Flue Gas NOx Design - Concentration	ppm
291	Flue Gas NOx Target - Mass Basis	kg/kWh
292	Flue Gas NOx Target - Concentration	ppm
293	Flue Gas Enthalpy At Reference	kJ/kg
294	Excess Air Expected	%
295	Air to Fuel Ratio Expected	kg/kg fuel
296	Wt of Comb Prods In Dry Air Expected	kg/kg fuel
297	Wt of Comb Prods In Wet Air Expected	kg/kg fuel
298	Radiation Loss Expected	%
299	Dry Gas Loss Expected	%
300	Fuel Moisture Loss Expected	%
301	Air Moisture Loss Expected	%
302	Hydrogen Loss Expected	%
303	Carbon In Ash Loss Expected	%
304	Carbon Monoxide Loss Expected	%
305	NOx Loss Expected	%
306	Solids Loss Expected	%
307	Boiler Unaccounted Losses Expected	%
308	Boiler Efficiency Expected	%
309	Excess Air Deviation	%
310	Air to Fuel Ratio Deviation	kg/kg fuel
311	Wt of Comb Prods In Dry Air Deviation	kg/kg fuel
312	Wt of Comb Prods In Wet Air Deviation	kg/kg fuel
313	Radiation Loss Deviation	%
314	Dry Gas Loss Deviation	%
315	Fuel Moisture Loss Deviation	%
316	Air Moisture Loss Deviation	%
317	Hydrogen Loss Deviation	%
318	Carbon In Ash Loss Deviation	%
319	Carbon Monoxide Loss Deviation	%
320	NOx Loss Deviation	%
321	Solids Loss Deviation	%
322	Boiler Unaccounted Losses Deviation	%
323	Boiler Efficiency Deviation	%
324	Turbine Cycle Heat Input Design	MJ/h
325	Net Turbine Cycle Heat Rate Design	kJ/kWh
326	Boiler Efficiency Design	%
327	Boiler Efficiency Target	%
328	Air Flow Calculated	kg/s
329	Generator Loss	MW
330	Generator Power Factor	NA
331	Reactive Power Maximum	MVAR

332	Generator Power Alarm Trigger	NA
333	Generator Power Alarm Label	NA
334	Generator Efficiency	%
335	Condenser Duty Total (from TCHR)	MJ/h
336	Cond Duty (Each Shell)(from TCHR)	MJ/h
337	Cooling Tower Range	delta °C
338	LP Condenser CW Temp Rise	delta °C
339	HP Condenser CW Temp Rise	delta °C
340	Circ Water Flow Calculated	m^3/h
341	Cold Water Temp Des 45000 m^3/h	°C
342	Cold Water Temp Des 54000 m^3/h	°C
343	Cooling Tower Cold Water Temp Design	°C
344	Cold Water Temp Tar 45000 m^3/h	°C
345	Cold Water Temp Tar 54000 m^3/h	°C
346	Cooling Tower Cold Water Temp Target	°C
347	HP Condenser CW In Temp Design	°C
348	HP Condenser CW In Temp Target	°C
349	Circ Water Flow Predicted	m^3/h
350	Circ Water Flow Adjusted	m^3/h
351	Cooling Tower Capability	%
352	Cold Water Temp Deviation	delta °C
353	CT Approach Actual	delta °C
354	CT Approach Predicted	delta °C
355	CT Approach Deviation	delta °C
356	CW In LP Cond Temp Corr (<65F)	NA
357	CW In LP Cond Temp Corr (>65F)	NA
358	CW In HP Cond Temp Corr (<65F)	NA
359	CW In HP Cond Temp Corr (>65F)	NA
360	CW Flow (Each Shell) Design	m^3/h
361	CW Flow (Each Shell) Target	m^3/h
362	Condenser Duty Total Design	MJ/h
363	Cond Duty (Each Shell) Design	MJ/h
364	CW Temp Rise (Each Shell) Design	delta °C
365	LP Condenser TTD Design	delta °C
366	HP Condenser TTD Design	delta °C
367	LP Condenser TTD CT-Des	delta °C
368	HP Condenser TTD CT-Des	delta °C
369	LP Condenser Pressure Design	kPaa
370	HP Condenser Pressure Design	kPaa
371	LP Condenser Pressure CT-Des	kPaa
372	HP Condenser Pressure CT-Des	kPaa
373	CW Temp Rise (Each Shell) Expected	delta °C

374	LP Cond CW Temp Rise Deviation	delta °C
375	HP Cond CW Temp Rise Deviation	delta °C
376	LP Condenser Cleanliness Actual	%
377	HP Condenser Cleanliness Actual	%
378	LP Condenser Cleanliness Design	%
379	HP Condenser Cleanliness Design	%
380	LP Condenser Cleanliness Target	%
381	HP Condenser Cleanliness Target	%
382	LP Condenser Cleanliness Deviation	%
383	HP Condenser Cleanliness Deviation	%
384	LP Condenser TTD Expected	delta °C
385	HP Condenser TTD Expected	delta °C
386	LP Condenser Pressure Expected	kPaa
387	HP Condenser Pressure Expected	kPaa
388	Condenser Pressure Expected Avg	kPaa
389	LP Condenser Pressure Deviation	kPa
390	HP Condenser Pressure Deviation	kPa
391	LP Condenser TTD Actual	delta °C
392	HP Condenser TTD Actual	delta °C
393	LP Condenser TTD Deviation	delta °C
394	HP Condenser TTD Deviation	delta °C
395	LP Cond Press Actual HR Corr Gross	%
396	HP Cond Press Actual HR Corr Gross	%
397	Cond Press(both) Actual HR Corr Gross	%
398	LP Cond Press Design HR Corr Gross	%
399	HP Cond Press Design HR Corr Gross	%
400	LP Cond Press CT-Des HR Corr Gross	%
401	HP Cond Press CT-Des HR Corr Gross	%
402	LP Cond Press Design HR Corr Net	%
403	HP Cond Press Design HR Corr Net	%
404	Cond Press Design HR Corr Net	%
405	LP Cond Press CT-Des HR Corr Net	%
406	HP Cond Press CT-Des HR Corr Net	%
407	Cond Press CT-Des HR Corr Net	%
408	Cooling Tower Cold Water Temp Des HRCorr	%
409	LP Condenser Press Design Cost	$/h
410	HP Condenser Press Design Cost	$/h
411	Cooling Tower Cold Water Temp Des Cost	$/h
412	LP Condenser Pressure Target Initial	kPaa
413	HP Condenser Pressure Target Initial	kPaa
414	LP Condenser Pressure CT-Tar Initial	kPaa
415	HP Condenser Pressure CT-Tar Initial	kPaa

416	LP Cond BP Target HR Corr Gross Init	%
417	HP Cond BP Target HR Corr Gross Init	%
418	Cond(both)BP Target HR Corr Gross Init	%
419	LP Cond BP CT-Tar HR Corr Gross Init	%
420	HP Cond BP CT-Tar HR Corr Gross Init	%
421	Cond(both)BP CT-Tar HRCorr Gross Init	%
422	Excess Oxygen Actual Safety Limited	%
423	Excess Oxygen Design HR Corr	%
424	Excess Oxygen Design Cost	$/h
425	Excess Oxygen Target HR Corr	%
426	Excess Oxygen Target Cost	$/h
427	Incomplete Combustion Design HR Corr	%
428	Incomplete Combustion Design Cost	$/h
429	Incomplete Combustion Target HR Corr	%
430	Incomplete Combustion Target Cost	$/h
431	LH A/H Temperature Head	delta °C
432	RH A/H Temperature Head	delta °C
433	LH A/H Avg Cold End Temp Actual	°C
434	RH A/H Avg Cold End Temp Actual	°C
435	LH A/H Pri X-Ratio Actual	NA
436	RH A/H Pri X-Ratio Actual	NA
437	LH A/H Sec X-Ratio Actual	NA
438	RH A/H Sec X-Ratio Actual	NA
439	LH A/H X-Ratio Actual	NA
440	RH A/H X-Ratio Actual	NA
441	LH A/H No Leak Gas Temp Drop	delta °C
442	RH A/H No Leak Gas Temp Drop	delta °C
443	LH A/H Gas Side Efficiency Actual	%
444	RH A/H Gas Side Efficiency Actual	%
445	LH A/H NL EGT Exp (Act Gas In)	°C
446	RH A/H NL EGT Exp (Act Gas In)	°C
447	LH A/H NL EGT Exp (Des Gas In)	°C
448	RH A/H NL EGT Exp (Des Gas In)	°C
449	AH Avg Cold End Temp Design	°C
450	LH A/H Pri X-Ratio Deviation	NA
451	RH A/H Pri X-Ratio Deviation	NA
452	LH A/H Sec X-Ratio Deviation	NA
453	RH A/H Sec X-Ratio Deviation	NA
454	LH A/H Avg Cold End Temp Deviation	delta °C
455	RH A/H Avg Cold End Temp Deviation	delta °C
456	LH A/H Gas Side Efficiency Deviation	%
457	RH A/H Gas Side Efficiency Deviation	%

458	LH A/H No Leak EGT Deviation	delta °C
459	RH A/H No Leak EGT Deviation	delta °C
460	LH A/H Pri Air DP Exp	kPa
461	RH A/H Pri Air DP Exp	kPa
462	LH A/H Sec Air DP Exp	kPa
463	RH A/H Sec Air DP Exp	kPa
464	LH A/H Pri Air DP Dev	kPa
465	RH A/H Pri Air DP Dev	kPa
466	LH A/H Sec Air DP Dev	kPa
467	RH A/H Sec Air DP Dev	kPa
468	LH A/H Flue Gas DP Exp	kPa
469	RH A/H Flue Gas DP Exp	kPa
470	LH A/H Flue Gas DP Dev	kPa
471	RH A/H Flue Gas DP Dev	kPa
472	LH A/H EGT HR Corr Design	%
473	LH A/H EGT Design Cost	$/h
474	LH A/H EGT HR Corr Target	%
475	LH A/H EGT Target Cost	$/h
476	RH A/H EGT HR Corr Design	%
477	RH A/H EGT Design Cost	$/h
478	RH A/H EGT HR Corr Target	%
479	RH A/H EGT Target Cost	$/h
480	LP Hotwell Temperature Design	°C
481	HP Hotwell Temperature Design	°C
482	LP Hotwell Temperature Target	°C
483	HP Hotwell Temperature Target	°C
484	LP Hotwell Subcooling Actual	delta °C
485	HP Hotwell Subcooling Actual	delta °C
486	LP Hotwell Subcooling Design	delta °C
487	HP Hotwell Subcooling Design	delta °C
488	LP Hotwell Subcooling Target	delta °C
489	LP Hotwell Subcooling Deviation	delta °C
490	HP Hotwell Subcooling Target	delta °C
491	HP Hotwell Subcooling Deviation	delta °C
492	Hotwell (each) Temp HR Corr for 5°F	%
493	LP Hotwell Temp Limited by Design Value	°C
494	HP Hotwell Temp Limited by Design Value	°C
495	LP Hotwell Temp Limited by Target Value	°C
496	HP Hotwell Temp Limited by Target Value	°C
497	LP Hotwell HR Corr Design	%
498	HP Hotwell HR Corr Design	%
499	LP Hotwell HR Corr Target	%

500	HP Hotwell HR Corr Target	%
501	LP Hotwell Design Cost	$/h
502	HP Hotwell Design Cost	$/h
503	LP Hotwell Target Cost	$/h
504	HP Hotwell Target Cost	$/h
505	Makeup Flow Actual	kg/s
506	Makeup Flow Design	kg/s
507	Makeup Flow Target	kg/s
508	Chng Makeup Flow From Des As % Thr Flow	%
509	Chng Makeup Flow From Tar As % Thr Flow	%
510	HR Corr. For 1% Makeup Flow Design	%
511	HR Corr. For 1% Makeup Flow Target	%
512	Makeup Flow Design HR Corr	%
513	Makeup Flow Target HR Corr	%
514	Makeup Flow Design Cost	$/h
515	Makeup Flow Target Cost	$/h
516	Feedwater Temperature Design	°C
517	Feedwater Temperature Target	°C
518	FW Temp HR Corr for 5°F	%
519	FW Temp HR Corr Design	%
520	FW Temp HR Corr Target	%
521	FW Temp Design Cost	$/h
522	FW Temp Target Cost	$/h
523	Throttle Press Ltd by Safety Value	MPag
524	Throttle Pressure Design	MPag
525	Throttle Pressure Target	MPag
526	Thr Press % Deviation from Design	%
527	Thr Press % Deviation from Target	%
528	Throttle Pressure HR Corr Design	%
529	Throttle Pressure HR Corr Target	%
530	Throttle Pressure Design Cost	$/h
531	Throttle Pressure Target Cost	$/h
532	SH Temp Limited by Safety Value	°C
533	SH Temperature Design	°C
534	SH Temperature Target	°C
535	SH Temp Deviation from Design	delta °C
536	SH Temp Deviation from Target	delta °C
537	SH Temperature HR Corr Design	%
538	SH Temperature HR Corr Target	%
539	SH Temperature Design Cost	$/h
540	SH Temperature Target Cost	$/h
541	RH Temp Limited by Safety Value	°C

542	RH Temperature Design	°C
543	RH Temperature Target	°C
544	RH Temp Deviation from Design	delta °C
545	RH Temp Deviation from Target	delta °C
546	RH Temperature HR Corr Design	%
547	RH Temperature HR Corr Target	%
548	RH Temperature Design Cost	$/h
549	RH Temperature Target Cost	$/h
550	SH Spray Flow Design	kg/s
551	SH Spray Flow Target	kg/s
552	RH Spray Flow Design	kg/s
553	RH Spray Flow Target	kg/s
554	RH Spray Flow Design HR Corr	%
555	RH Spray Flow Target HR Corr	%
556	RH Spray Flow Design Cost	$/h
557	RH Spray Flow Target Cost	$/h
558	Aux Power Load Design	MW
559	Aux Power Load Target	MW
560	Aux Power Design HR Corr	%
561	Aux Power Target HR Corr	%
562	Aux Power Design Cost	$/h
563	Aux Power Target Cost	$/h
564	LP Cond Pressure Design HR Effect	kJ/kWh
565	HP Cond Pressure Design HR Effect	kJ/kWh
566	CT Cold Water Temp Design HR Effect	kJ/kWh
567	Excess Oxygen Design HR Effect	kJ/kWh
568	Excess Oxygen Target HR Effect	kJ/kWh
569	Incomplete Comb Design HR Effect	kJ/kWh
570	Incomplete Comb Target HR Effect	kJ/kWh
571	LH A/H EGT Design HR Effect	kJ/kWh
572	LH A/H EGT Target HR Effect	kJ/kWh
573	RH A/H EGT Design HR Effect	kJ/kWh
574	RH A/H EGT Target HR Effect	kJ/kWh
575	Hotwell A Temp Design HR Effect	kJ/kWh
576	Hotwell A Temp Target HR Effect	kJ/kWh
577	Hotwell B Temp Design HR Effect	kJ/kWh
578	Hotwell B Temp Target HR Effect	kJ/kWh
579	Makeup Flow Design HR Effect	kJ/kWh
580	Makeup Flow Target HR Effect	kJ/kWh
581	FW Temp Design HR Effect	kJ/kWh
582	FW Temp Target HR Effect	kJ/kWh
583	Throttle Pressure Design HR Effect	kJ/kWh

584	Throttle Pressure Target HR Effect	kJ/kWh
585	SH Steam Temp Design HR Effect	kJ/kWh
586	SH Steam Temp Target HR Effect	kJ/kWh
587	RH Steam Temp Design HR Effect	kJ/kWh
588	RH Steam Temp Target HR Effect	kJ/kWh
589	RH Spray Flow Design HR Effect	kJ/kWh
590	RH Spray Flow Target HR Effect	kJ/kWh
591	Aux Power Design HR Effect	kJ/kWh
592	Aux Power Target HR Effect	kJ/kWh
593	Net TCHR Corr. to Act Conds Design	kJ/kWh
594	Net Unit Heat Rate Design	kJ/kWh
595	Net Unit Heat Rate Dev from Design	kJ/kWh
596	Total Target HR Corr w/o Cond Press	%
597	Condenser Duty Total Target	MJ/h
598	Cond Duty (Each Shell) Target	MJ/h
599	CW Temp Rise (Each Shell) Target	delta °C
600	LP Condenser TTD Target	delta °C
601	HP Condenser TTD Target	delta °C
602	LP Condenser TTD CT-Tar	delta °C
603	HP Condenser TTD CT-Tar	delta °C
604	LP Condenser Pressure Target	kPaa
605	HP Condenser Pressure Target	kPaa
606	LP Condenser Pressure CT-Tar	kPaa
607	HP Condenser Pressure CT-Tar	kPaa
608	LP Cond BP Target HR Corr Gross Final	%
609	HP Cond BP Target HR Corr Gross Final	%
610	LP Cond BP CT-Tar HR Corr Gross Final	%
611	HP Cond BP CT-Tar HR Corr Gross Final	%
612	LP Cond Press Target HR Corr Net Final	%
613	HP Cond Press Target HR Corr Net Final	%
614	Cond Press Target HR Corr Net Final	%
615	LP Cond Press CT-Tar HRCorr Net Final	%
616	HP Cond Press CT-Tar HRCorr Net Final	%
617	Cond Press CT-Tar HRCorr Net Final	%
618	Cooling Tower Cold Water Temp Tar HRCorr	%
619	LP Condenser Press Target Cost	$/h
620	HP Condenser Press Target Cost	$/h
621	Cooling Tower Cold Water Temp Tar Cost	$/h
622	LP Cond Pressure Target HR Effect	kJ/kWh
623	HP Cond Pressure Target HR Effect	kJ/kWh
624	CT Cold Water Temp Target HR Effect	kJ/kWh
625	Total Oper Design HR Corr	%

626	Total Oper Target HR Corr	%
627	Total Oper Design HR Effect	kJ/kWh
628	Total Oper Target HR Effect	kJ/kWh
629	Net Unit Heat Rate Target	kJ/kWh
630	Heat Rate Ratio - Actual/Design	NA
631	Heat Rate Ratio - Actual/Target	NA
632	Off-Design Total Annual Cost	R
633	Off-Target Total Annual Cost	R
634	Reheat Bowl Flow	kg/s
635	HP Htr 5A Drain In Flow	kg/s
636	HP Htr 5A Extraction Flow	kg/s
637	HP Htr 5B Drain In Flow	kg/s
638	HP Htr 5B Extraction Flow	kg/s
639	DA FW Outlet Flow (less recirc)	kg/s
640	DA Drain In Flow	kg/s
641	DA Drain In Temp	°C
642	DA Extraction Flow	kg/s
643	DA FW Inlet Flow	kg/s
644	LP Htr 3 FW Flow	kg/s
645	LP Htr 3 Extraction Flow	kg/s
646	LP Htr 2A FW Flow	kg/s
647	LP Htr 2A Extraction Flow	kg/s
648	LP Htr 2B FW Flow	kg/s
649	LP Htr 2B Extraction Flow	kg/s
650	LP Htr 2 Extraction Flow Total	kg/s
651	LP Htr 1A FW Flow	kg/s
652	LP Htr 1A Extraction Flow	kg/s
653	LP Htr 1B FW Flow	kg/s
654	LP Htr 1B Extraction Flow	kg/s
655	LP Htr 1 Extraction Flow Total	kg/s
656	Drain Cooler FW Flow	kg/s
657	Drain Cooler Drain In Flow	kg/s
658	Drain Cooler Drain In Temp	°C
659	HP Turbine Efficiency Actual	%
660	IP Turbine 1 Efficiency Actual	%
661	IP Turbine 2 Efficiency Actual	%
662	Crossover Flow	kg/s
663	LP Turbine Exhaust Flow	kg/s
664	IP Turbine Inlet Flow Factor	NA
665	IP Turbine Inlet Flow Factor Expected	NA
666	IP Turbine In Flow Factor Dev from Exp	NA
667	LP Turbine Inlet Flow Factor	NA

668	LP Turbine Inlet Flow Factor Expected	NA
669	LP Turbine In Flow Factor Dev from Exp	NA
670	Used Energy End Point Expected (62 GL)	kJ/kg
671	Cycle HB Check (62GL)	%
672	Expansion Line End Point (62 GL)	kJ/kg
673	HP Turbine Power Output	MW
674	IP Turbine Power Output	MW
675	LP Turbine Power Output	MW
676	Used Energy End Point (HB)	kJ/kg
677	Expansion Line End Point (HB)	kJ/kg
678	Cycle HB Check	%
679	HP Turbine Pressure Ratio	NA
680	IP Turbine Pressure Ratio	NA
681	HP Turbine Efficiency Design	%
682	IP Turbine Efficiency Design	%
683	HP Turbine Efficiency Dev from Design	%
684	HP Turbine Efficiency HR Corr	%
685	HP Turbine Efficiency HR Effect	kJ/kWh
686	IP Turb 1 Efficiency Dev from Design	%
687	IP Turb 2 Efficiency Dev from Design	%
688	IP Turbine Efficiency HR Corr	%
689	IP Turbine Efficiency HR Effect	kJ/kWh
690	Steam Turbine Total Efficiency HR Corr	%
691	Steam Turbine Total Eff HR Effect	kJ/kWh
692	Expansion Line End Point Deviation	kJ/kg
693	Used Energy End Point Deviation	kJ/kg
694	HP Htr 6A TTD	delta °C
695	HP Htr 6A DCA	delta °C
696	HP Htr 6A Temp Rise	delta °C
697	HP Htr 6A TTD Expected	delta °C
698	HP Htr 6A DCA Expected	delta °C
699	HP Htr 6A Temp Rise Expected	delta °C
700	HP Htr 6A Extr Flow Expected	kg/s
701	HP Htr 6A Outlet Temp Expected	°C
702	HP Htr 6A TTD Deviation	delta °C
703	FWH HP Htr 6A TTD HR Corr	%
704	HP Htr 6A TTD HR Effect	kJ/kWh
705	HP Htr 6A DCA Deviation	delta °C
706	HP Htr 6A Temp Rise Deviation	delta °C
707	HP Htr 6A Extr Flow Deviation	kg/s
708	HP Htr 6A Outlet Temp Deviation	delta °C
709	HP Htr 6B TTD	delta °C

710	HP Htr 6B DCA	delta °C
711	HP Htr 6B Temp Rise	delta °C
712	HP Htr 6B TTD Expected	delta °C
713	HP Htr 6B DCA Expected	delta °C
714	HP Htr 6B Temp Rise Expected	delta °C
715	HP Htr 6B Extr Flow Expected	kg/s
716	HP Htr 6B Outlet Temp Expected	°C
717	HP Htr 6B TTD Deviation	delta °C
718	FWH HP Htr 6B TTD HR Corr	%
719	HP Htr 6B TTD HR Effect	kJ/kWh
720	HP Htr 6B DCA Deviation	delta °C
721	HP Htr 6B Temp Rise Deviation	delta °C
722	HP Htr 6B Extr Flow Deviation	kg/s
723	HP Htr 6B Outlet Temp Deviation	delta °C
724	HP Htr 5A TTD	delta °C
725	HP Htr 5A DCA	delta °C
726	HP Htr 5A Temp Rise	delta °C
727	HP Htr 5A TTD Expected	delta °C
728	HP Htr 5A DCA Expected	delta °C
729	HP Htr 5A Temp Rise Expected	delta °C
730	HP Htr 5A Extr Flow Expected	kg/s
731	HP Htr 5A Outlet Temp Expected	°C
732	HP Htr 5A TTD Deviation	delta °C
733	FWH HP Htr 5A TTD HR Corr	%
734	HP Htr 5A TTD HR Effect	kJ/kWh
735	HP Htr 5A DCA Deviation	delta °C
736	HP Htr 5A Temp Rise Deviation	delta °C
737	HP Htr 5A Extr Flow Deviation	kg/s
738	HP Htr 5A Outlet Temp Deviation	delta °C
739	HP Htr 5B TTD	delta °C
740	HP Htr 5B DCA	delta °C
741	HP Htr 5B Temp Rise	delta °C
742	HP Htr 5B TTD Expected	delta °C
743	HP Htr 5B DCA Expected	delta °C
744	HP Htr 5B Temp Rise Expected	delta °C
745	HP Htr 5B Extr Flow Expected	kg/s
746	HP Htr 5B Outlet Temp Expected	°C
747	HP Htr 5B TTD Deviation	delta °C
748	FWH HP Htr 5B TTD HR Corr	%
749	HP Htr 5B TTD HR Effect	kJ/kWh
750	HP Htr 5B DCA Deviation	delta °C
751	HP Htr 5B Temp Rise Deviation	delta °C

752	HP Htr 5B Extr Flow Deviation	kg/s
753	HP Htr 5B Outlet Temp Deviation	delta °C
754	DA TTD	delta °C
755	LP Htr 3 TTD	delta °C
756	LP Htr 3 Temp Rise	delta °C
757	LP Htr 3 TTD Expected	delta °C
758	LP Htr 3 Temp Rise Expected	delta °C
759	LP Htr 3 Extr Flow Expected	kg/s
760	LP Htr 3 Outlet Temp Expected	°C
761	LP Htr 3 TTD Deviation	delta °C
762	FWH LP Htr 3 TTD HR Corr	%
763	LP Htr 3 TTD HR Effect	kJ/kWh
764	LP Htr 3 Temp Rise Deviation	delta °C
765	LP Htr 3 Extr Flow Deviation	kg/s
766	LP Htr 3 Outlet Temp Deviation	delta °C
767	LP Htr 2A TTD	delta °C
768	LP Htr 2A Temp Rise	delta °C
769	LP Htr 2A TTD Expected	delta °C
770	LP Htr 2A Temp Rise Expected	delta °C
771	LP Htr 2A Extr Flow Expected	kg/s
772	LP Htr 2A Outlet Temp Expected	°C
773	LP Htr 2A TTD Deviation	delta °C
774	FWH LP Htr 2A TTD HR Corr	%
775	LP Htr 2A TTD HR Effect	kJ/kWh
776	LP Htr 2A Temp Rise Deviation	delta °C
777	LP Htr 2A Extr Flow Deviation	kg/s
778	LP Htr 2A Outlet Temp Deviation	delta °C
779	LP Htr 2B TTD	delta °C
780	LP Htr 2B Temp Rise	delta °C
781	LP Htr 2B TTD Expected	delta °C
782	LP Htr 2B Temp Rise Expected	delta °C
783	LP Htr 2B Extr Flow Expected	kg/s
784	LP Htr 2B Outlet Temp Expected	°C
785	LP Htr 2B TTD Deviation	delta °C
786	FWH LP Htr 2B TTD HR Corr	%
787	LP Htr 2B TTD HR Effect	kJ/kWh
788	LP Htr 2B Temp Rise Deviation	delta °C
789	LP Htr 2B Extr Flow Deviation	kg/s
790	LP Htr 2B Outlet Temp Deviation	delta °C
791	LP Htr 1A TTD	delta °C
792	LP Htr 1A Temp Rise	delta °C
793	LP Htr 1A TTD Expected	delta °C

794	LP Htr 1A Temp Rise Expected	delta °C
795	LP Htr 1A Extr Flow Expected	kg/s
796	LP Htr 1A Outlet Temp Expected	°C
797	LP Htr 1A TTD Deviation	delta °C
798	FWH LP Htr 1A TTD HR Corr	%
799	LP Htr 1A TTD HR Effect	kJ/kWh
800	LP Htr 1A Temp Rise Deviation	delta °C
801	LP Htr 1A Extr Flow Deviation	kg/s
802	LP Htr 1A Outlet Temp Deviation	delta °C
803	LP Htr 1B TTD	delta °C
804	LP Htr 1B Temp Rise	delta °C
805	LP Htr 1B TTD Expected	delta °C
806	LP Htr 1B Temp Rise Expected	delta °C
807	LP Htr 1B Extr Flow Expected	kg/s
808	LP Htr 1B Outlet Temp Expected	°C
809	LP Htr 1B TTD Deviation	delta °C
810	FWH LP Htr 1B TTD HR Corr	%
811	LP Htr 1B TTD HR Effect	kJ/kWh
812	LP Htr 1B Temp Rise Deviation	delta °C
813	LP Htr 1B Extr Flow Deviation	kg/s
814	LP Htr 1B Outlet Temp Deviation	delta °C
815	Drain Cooler DCA	delta °C
816	Drain Cooler Temp Rise	delta °C
817	Drain Cooler DCA Expected	delta °C
818	Drain Cooler Temp Rise Expected	delta °C
819	Drain Cooler Outlet Temp Expected	°C
820	Drain Cooler DCA Deviation	delta °C
821	Drain Cooler Temp Rise Deviation	delta °C
822	Drain Cooler Outlet Temp Deviation	delta °C
823	FWH Total TTD HR Corr	%
824	FWH Total TTD HR Effect	kJ/kWh
825	Unaccounted Loss Design HR Effect	kJ/kWh
826	Crew Number	NA
827	Shift Number	NA
828	SFP Speed	RPM
829	SFP Suction Pressure	MPag
830	SFP Discharge Pressure	MPag
831	SFP Suction Temperature	°C
832	SFP Mass Flow	kg/s
833	SFP Volume Flow	m^3/s
834	SFP Discharge Temperature	°C
835	SFP Suction Head	m

836	SFP Discharge Head	m
837	SFP NPSH	m
838	SFP Total Head	m
839	SFP Efficiency Design	%
840	SFP Capacity at Rated RPM	m^3/s
841	SFP Head at Rated RPM Design	m
842	SFP Head at Live RPM Design	m
843	SFP Head at Rated RPM Actual	m
844	SFP Capacity at Head Design	m^3/s
845	SFP Performance Factor	%
846	SFP Efficiency from Head Design	%
847	SFP Efficiency	%
848	SFP Fluid Power	kW
849	SFP Turb Extr Press	MPaa
850	SFP Turb Extr Temp	°C
851	SFP Turb Extr Flow	kg/s
852	SFP Steam Rate	kg/kWh
853	SFP Steam Rate Design	kg/kWh
854	SFP Cond Duty Des	MJ/h
855	SFP Turb Exh Press	kPaa
856	SFP Extr Steam Avail Energy	kJ/kg
857	SFP Turb Available Power	kW
858	SFP Turb/Pump Set Eff	%
859	SFP Cond Hotwell Temp	°C
860	SFP Cond CW In Temp	°C
861	SFP Cond CW Out Temp	°C
862	SFP Cond Duty	MJ/h
863	SFP Cond CW Temp Rise	delta °C
864	SFP CW Tmp Corr (<18.33 C)	NA
865	SFP CW Tmp Corr (>18.33 C)	NA
866	SFP CW Flow Target	m^3/h
867	SFP CW Temp Rise Exp	delta °C
868	SFP Cond CW Temp Rise Dev	delta °C
869	SFP Cond Cleanliness	%
870	SFP Cond Cleanliness Des	%
871	SFP Cond Cleanliness Tar	%
872	SFP Cond Cleanliness Dev	%
873	SFP Cond TTD Exp	delta °C
874	SFP Cond Press Exp	kPaa
875	SFP Cond Press Dev	kPa
876	SFP Cond TTD	delta °C
877	SFP Cond TTD Dev	delta °C

878	SFP Hotwell Temp Des	°C
879	SFP Hotwell Temp Tar	°C
880	SFP Hotwell Subcool	delta °C
881	SFP Hotwell Subcool Tar	delta °C
882	SFP Hotwell Subcool Dev	delta °C
883	EFP A Speed	RPM
884	EFP A Suction Pressure	MPag
885	EFP A Discharge Pressure	MPag
886	EFP A Suction Temperature	°C
887	EFP A Mass Flow	kg/s
888	EFP A Volume Flow	m^3/s
889	EFP A Discharge Temperature	°C
890	EFP A Suction Head	m
891	EFP A Discharge Head	m
892	EFP A NPSH	m
893	EFP A Total Head	m
894	EFP A Efficiency Design	%
895	EFP A Capacity at Rated RPM	m^3/s
896	EFP A Head at Rated RPM Design	m
897	EFP A Head at Live RPM Design	m
898	EFP A Head at Rated RPM Actual	m
899	EFP A Capacity at Head Design	m^3/s
900	EFP A Performance Factor	%
901	EFP A Efficiency from Head Design	%
902	EFP A Efficiency	%
903	EFP B Speed	RPM
904	EFP B Suction Pressure	MPag
905	EFP B Discharge Pressure	MPag
906	EFP B Suction Temperature	°C
907	EFP B Mass Flow	kg/s
908	EFP B Volume Flow	m^3/s
909	EFP B Discharge Temperature	°C
910	EFP B Suction Head	m
911	EFP B Discharge Head	m
912	EFP B NPSH	m
913	EFP B Total Head	m
914	EFP B Efficiency Design	%
915	EFP B Capacity at Rated RPM	m^3/s
916	EFP B Head at Rated RPM Design	m
917	EFP B Head at Live RPM Design	m
918	EFP B Head at Rated RPM Actual	m
919	EFP B Capacity at Head Design	m^3/s

920	EFP B Performance Factor	%
921	EFP B Efficiency from Head Design	%
922	EFP B Efficiency	%
923	Economizer Wtr Out Temp Tar	°C
924	SH 1 Stm Out Temp Tar	°C
925	Economizer Water In Press	MPag
926	Economizer Water Out Press	MPag
927	Div Wall Water In Press	MPag
928	Div Wall Water Out Press	MPag
929	SH Chamber Walls Water In Press	MPag
930	SH Chamber Walls Water Out Press	MPag
931	SH 1 Steam In Press	MPag
932	SH 1 Steam Out Press	MPag
933	SH 2 Steam In Press	MPag
934	SH 2 Steam Out Press	MPag
935	SH 3 Steam In Press	MPag
936	SH 3 Steam Out Press	MPag
937	SH 4 Steam In Press	MPag
938	SH 4 Steam Out Press	MPag
939	RH 1 Steam In Press	MPag
940	RH 1 Steam Out Press	MPag
941	RH 2 Steam In Press	MPag
942	RH 2 Steam Out Press	MPag
943	Economizer Water In Temp	°C
944	Economizer Water Out Temp	°C
945	Div Wall Water In Temp	°C
946	Div Wall Water Out Temp	°C
947	SH Chamber Walls Water In Temp	°C
948	SH Chamber Walls Water Out Temp	°C
949	SH 1 Steam In Temp	°C
950	SH 2 Steam Out Temp	°C
951	SH 1 Steam Out Temp	°C
952	SH 2 Steam In Temp	°C
953	SH 3 Steam In Temp	°C
954	SH 3 Steam Out Temp	°C
955	SH 4 Steam In Temp	°C
956	SH 4 Steam Out Temp	°C
957	RH 1 Steam In Temp	°C
958	RH 1 Steam Out Temp	°C
959	RH 2 Steam In Temp	°C
960	RH 2 Steam Out Temp	°C
961	Boiler Cleanliness Model Convergence	NA

962	Flue Gas Flow to SH 1	kg/s
963	Flue Gas Flow to SH 3	kg/s
964	Flue Gas Flow to SH 4	kg/s
965	Flue Gas Flow to RH 2	kg/s
966	Flue Gas Flow to SH 2	kg/s
967	Flue Gas Flow to RH 1	kg/s
968	Flue Gas Flow to Economizer	kg/s
969	LH A/H Gas Inlet Flow	kg/s
970	RH A/H Gas Inlet Flow	kg/s
971	Economizer Gas In Temp	°C
972	RH 1 Gas In Temp	°C
973	SH 2 Gas In Temp	°C
974	RH 2 Gas In Temp	°C
975	SH 4 Gas In Temp	°C
976	SH 3 Gas In Temp	°C
977	SH 1 Gas In Temp	°C
978	SH Chamber Walls Gas In Temp	°C
979	Div Wall Gas In Temp	°C
980	Economizer Heat Trans Duty	MJ/h
981	RH 1 Heat Trans Duty	MJ/h
982	SH 2 Heat Trans Duty	MJ/h
983	RH 2 Heat Trans Duty	MJ/h
984	SH 4 Heat Trans Duty	MJ/h
985	SH 3 Heat Trans Duty	MJ/h
986	SH 1 Heat Trans Duty	MJ/h
987	SH Chamber Walls Heat Trans Duty	MJ/h
988	Div Wall Heat Trans Duty	MJ/h
989	LH A/H Heat Trans Duty	MJ/h
990	LH A/H Heat Trans Coef	W/m^2K
991	RH A/H Heat Trans Duty	MJ/h
992	RH A/H Heat Trans Coef	W/m^2K
993	Economizer Heat Trans Coef	W/m^2K
994	RH 1 Heat Trans Coef	W/m^2K
995	SH 2 Heat Trans Coef	W/m^2K
996	RH 2 Heat Trans Coef	W/m^2K
997	SH 4 Heat Trans Coef	W/m^2K
998	SH 3 Heat Trans Coef	W/m^2K
999	SH 1 Heat Trans Coef	W/m^2K
1000	SH Chamber Walls Heat Trans Coef	W/m^2K
1001	Div Wall Heat Trans Coef	W/m^2K
1002	LH A/H Base HTC	W/m^2K
1003	RH A/H Base HTC	W/m^2K

1004	LH A/H Cleanliness	%
1005	RH A/H Cleanliness	%
1006	Economizer Cleanliness	%
1007	RH 1 Cleanliness	%
1008	SH 2 Cleanliness	%
1009	RH 2 Cleanliness	%
1010	SH 4 Cleanliness	%
1011	SH 3 Cleanliness	%
1012	SH 1 Cleanliness	%
1013	SH Chamber Walls Cleanliness	%
1014	Div Wall Cleanliness	%
1015	Water Wall Cleanliness	%
1016	HP Turbine Exhaust Temp Tar	°C
1017	Fuel to FW Flow Ratio Act	NA
1018	Fuel to FW Flow Ratio Tar	NA
1019	LH A/H Air Out Temp Tar	°C
1020	LH A/H Expert	NA
1021	RH A/H Air Out Temp Tar	°C
1022	RH A/H Expert	NA
1023	Economizer Expert	NA
1024	RH 1 Expert	NA
1025	SH 2 Expert	NA
1026	RH 2 Expert	NA
1027	SH 4 Expert	NA
1028	SH 3 Expert	NA
1029	SH 1 Expert	NA
1030	SH Chamber Walls Expert	NA
1031	Div Wall Expert	NA
1032	Water Walls Expert	NA
1033	Adiabatic Flame Temp	°C
1034	PSI - WW Fouling Coef	NA
1035	Clean Furnace Exit Gas Temp	°C
1036	HP HTR 6A Status	NA
1037	HP HTR 6B Status	NA
1038	HP HTR 5A Status	NA
1039	HP HTR 5B Status	NA
1040	LP HTR 3 Status	NA
1041	LP HTR 2A Status	NA
1042	LP HTR 2B Status	NA
1043	LP HTR 1A Status	NA
1044	LP HTR 1B Status	NA
1045	Mill A Status (1=ON, 0=OFF)	NA

1046	Mill B Status (1=ON, 0=OFF)	NA
1047	Mill C Status (1=ON, 0=OFF)	NA
1048	Mill D Status (1=ON, 0=OFF)	NA
1049	Mill E Status (1=ON, 0=OFF)	NA
1050	Mill F Status (1=ON, 0=OFF)	NA
1051	Model 1 Number of Iterations	NA
1052	Model 2 Number of Iterations	NA
1053	Model 3 Number of Iterations	NA
1054	Model 4 Number of Iterations	NA
1055	Model 5 Number of Iterations	NA
1056	Model 6 Number of Iterations	NA
1057	Model 1 Throttle Pressure	MPaa
1058	Model 1 Main Steam Temp	°C
1059	Model 1 SH Spray Flow	kg/s
1060	Model 1 Blowdown Flow	kg/s
1061	Model 1 LP Condenser Pressure	kPaa
1062	Model 1 HP Condenser Pressure	kPaa
1063	Model 1 Condenser Pressure Avg	kPaa
1064	Model 1 Barometric Pressure	kPaa
1065	Model 1 Ambient Dry Bulb Temperature	°C
1066	Model 1 Relative Humidity	%
1067	Model 1 Main Steam Flow	kg/s
1068	Model 1 Feedwater Flow	kg/s
1069	Model 1 Gross Generation	MW
1070	Model 1 First Stage Pressure	MPaa
1071	Model 2 Main Steam Flow	kg/s
1072	Model 2 Feedwater Flow	kg/s
1073	Model 2 Gross Generation	MW
1074	Model 2 First Stage Pressure	MPaa
1075	Model 3 Main Steam Flow	kg/s
1076	Model 3 Feedwater Flow	kg/s
1077	Model 3 Gross Generation	MW
1078	Model 3 First Stage Pressure	MPaa
1079	Model 1 Hotwell Temperature	°C
1080	Model 1 LP HTR 1A FW Outlet Temperature	°C
1081	Model 1 LP HTR 1B FW Outlet Temperature	°C
1082	Model 1 LP HTR 2A FW Outlet Temperature	°C
1083	Model 1 LP HTR 2B FW Outlet Temperature	°C
1084	Model 1 LP HTR 3 FW Outlet Temperature	°C
1085	Model 1 DA Outlet Temperature	°C
1086	Model 1 HP HTR 5 FW Inlet Temperature	°C
1087	Model 1 HP HTR 5A FW Outlet Temperature	°C

1088	Model 1 HP HTR 5B FW Outlet Temperature	°C
1089	Model 1 HP HTR 6A FW Outlet Temperature	°C
1090	Model 1 HP HTR 6B FW Outlet Temperature	°C
1091	Model 1 DC Drain Temperature	°C
1092	Model 1 LP HTR 1A Drain Temperature	°C
1093	Model 1 LP HTR 1B Drain Temperature	°C
1094	Model 1 LP HTR 2A Drain Temperature	°C
1095	Model 1 LP HTR 2B Drain Temperature	°C
1096	Model 1 LP HTR 3 Drain Temperature	°C
1097	Model 1 HP HTR 5A Drain Temperature	°C
1098	Model 1 HP HTR 5B Drain Temperature	°C
1099	Model 1 HP HTR 6A Drain Temperature	°C
1100	Model 1 HP HTR 6B Drain Temperature	°C
1101	Model 1 HP Turbine Exhaust Pressure	MPaa
1102	Model 1 HP HTR 6 Extr Press at Turb	MPaa
1103	Model 1 Hot RH Pressure	MPaa
1104	Model 1 HP HTR 5 Extr Press at Turb	MPaa
1105	Model 1 DA Extr Press	MPaa
1106	Model 1 Crossover Pressure IP Exhaust	MPaa
1107	Model 1 LP HTR 3 Extr Press at Turb	kPaa
1108	Model 1 LP HTR 2 Extr Press at Turb	kPaa
1109	Model 1 LP HTR 1 Extr Press at Turb	kPaa
1110	Model 2 Hotwell Temperature	°C
1111	Model 2 LP HTR 1A FW Outlet Temperature	°C
1112	Model 2 LP HTR 1B FW Outlet Temperature	°C
1113	Model 2 LP HTR 2A FW Outlet Temperature	°C
1114	Model 2 LP HTR 2B FW Outlet Temperature	°C
1115	Model 2 LP HTR 3 FW Outlet Temperature	°C
1116	Model 2 DA Outlet Temperature	°C
1117	Model 2 HP HTR 5A FW Outlet Temperature	°C
1118	Model 2 HP HTR 5B FW Outlet Temperature	°C
1119	Model 2 HP HTR 6A FW Outlet Temperature	°C
1120	Model 2 HP HTR 6B FW Outlet Temperature	°C
1121	Model 2 HP Turbine Exhaust Pressure	kPaa
1122	Model 2 HP HTR 6 Extr Press at Turb	kPaa
1123	Model 2 HP HTR 5 Extr Press at Turb	kPaa
1124	Model 2 LP HTR 3 Extr Press at Turb	kPaa
1125	Model 2 Crossover Pressure IP Exhaust	kPaa
1126	Model 2 LP HTR 2 Extr Press at Turb	kPaa
1127	Model 2 LP HTR 1 Extr Press at Turb	kPaa
1128	Model 3 Hotwell Temperature	°C
1129	Model 3 LP HTR 1A FW Outlet Temperature	°C

1130	Model 3 LP HTR 1B FW Outlet Temperature	°C
1131	Model 3 LP HTR 2A FW Outlet Temperature	°C
1132	Model 3 LP HTR 2B FW Outlet Temperature	°C
1133	Model 3 DA Outlet Temperature	°C
1134	Model 3 LP HTR 3 FW Outlet Temperature	°C
1135	Model 3 HP HTR 5A FW Outlet Temperature	°C
1136	Model 3 HP HTR 5B FW Outlet Temperature	°C
1137	Model 3 HP HTR 6A FW Outlet Temperature	°C
1138	Model 3 HP HTR 6B FW Outlet Temperature	°C
1139	Model 3 HP Turbine Exhaust Pressure	kPaa
1140	Model 3 HP HTR 6 Extr Press at Turb	kPaa
1141	Model 3 HP HTR 5 Extr Press at Turb	kPaa
1142	Model 3 HP HTR 3 Extr Press at Turb	kPaa
1143	Model 3 Crossover Pressure IP Exhaust	kPaa
1144	Model 3 LP HTR 2 Extr Press at Turb	kPaa
1145	Model 3 LP HTR 1 Extr Press at Turb	kPaa
1146	Model 1 Feedwater Flow Ratio	NA
1147	Model 1 Gross Generation Ratio	NA
1148	Model 1 First Stage Pressure Ratio	NA
1149	Model 2 Feedwater Flow Ratio	NA
1150	Model 2 Gross Generation Ratio	NA
1151	Model 2 First Stage Pressure Ratio	NA
1152	Model 3 Feedwater Flow Ratio	NA
1153	Model 3 Gross Generation Ratio	NA
1154	Model 3 First Stage Pressure Ratio	NA
1155	M1 HP Hotwell Temperature Ratio	NA
1156	M1 LP HTR 1A FW Outlet Temperature Ratio	NA
1157	M1 LP HTR 1B FW Outlet Temperature Ratio	NA
1158	M1 LP HTR 2A FW Outlet Temperature Ratio	NA
1159	M1 LP HTR 2B FW Outlet Temperature Ratio	NA
1160	M1 LP HTR 3 FW Outlet Temperature Ratio	NA
1161	M1 DA Outlet Temperature Ratio	NA
1162	M1 HP HTR 5 FW Inlet Temperature Ratio	NA
1163	M1 HP HTR 5A FW Outlet Temperature Ratio	NA
1164	M1 HP HTR 5B FW Outlet Temperature Ratio	NA
1165	M1 HP HTR 6A FW Outlet Temperature Ratio	NA
1166	M1 HP HTR 6B FW Outlet Temperature Ratio	NA
1167	M1 DC Drain Temperature Ratio	NA
1168	M1 LP HTR 1A Drain Temperature Ratio	NA
1169	M1 LP HTR 1B Drain Temperature Ratio	NA
1170	M1 LP HTR 2A Drain Temperature Ratio	NA
1171	M1 LP HTR 2B Drain Temperature Ratio	NA

1172	M1 LP HTR 3 Drain Temperature Ratio	NA
1173	M1 HP HTR 5A Drain Temperature Ratio	NA
1174	M1 HP HTR 5B Drain Temperature Ratio	NA
1175	M1 HP HTR 6A Drain Temperature Ratio	NA
1176	M1 HP HTR 6B Drain Temperature Ratio	NA
1177	M1 Main Steam Flow Ratio	NA
1178	M1 Throttle Pressure Ratio	NA
1179	M1 HP Turbine Exhaust Pressure Ratio	NA
1180	M1 HP HTR 6 Extr Press at Turb Ratio	NA
1181	M1 Hot RH Pressure Ratio	NA
1182	M1 HP HTR 5 Extr Press at Turb Ratio	NA
1183	M1 DA Extr Pressure Ratio	NA
1184	M1 Crossover Pressure IP Exhaust Ratio	NA
1185	M1 LP HTR 3 Extr Press at Turb Ratio	NA
1186	M1 LP HTR 2 Extr Press at Turb Ratio	NA
1187	M1 LP HTR 1 Extr Press at Turb Ratio	NA
1188	M1 LP Condenser Pressure Ratio	NA
1189	M1 HP Condenser Pressure Ratio	NA
1190	M1 Condenser Pressure Ratio	NA
1191	Model 1 Gross Turbine Cycle Heat Rate	kJ/kWh
1192	Model 1 HP Turbine Efficiency	%
1193	Model 2 Gross Turbine Cycle Heat Rate	kJ/kWh
1194	Model 3 Gross Turbine Cycle Heat Rate	kJ/kWh
1195	Model 4 Main Steam Flow	kg/s
1196	Model 4 Gross Generation	MW
1197	Model 4 Gross Turbine Cycle Heat Rate	kJ/kWh
1198	Model 4 First Stage Pressure	MPaa
1199	Model 5 Main Steam Flow	kg/s
1200	Model 5 Gross Generation	MW
1201	Model 5 Gross Turbine Cycle Heat Rate	kJ/kWh
1202	Model 5 Coal Flow	kg/s
1203	Model 6 Gross Generation	MW
1204	Model 6 LP Section Generation	MW
1205	Model 6 HP Section Generation	MW
1206	Blr Radiation Heat Loss Actual	MJ/h
1207	Blr Dry Gas Heat Loss Actual	MJ/h
1208	Blr Fuel Moisture Heat Loss Actual	MJ/h
1209	Blr Air Moisture Heat Loss Actual	MJ/h
1210	Blr Hydrogen Heat Loss Actual	MJ/h
1211	Blr Carbon In Ash Heat Loss Actual	MJ/h
1212	Blr Unaccounted Heat Loss Actual	MJ/h
1213	Theoretical Air Flow Calculated (Stoich)	kg/s

1214	Mixed Fuel Carbon %	%
1215	Mixed Fuel Hydrogen %	%
1216	Mixed Fuel Moisture %	%
1217	Mixed Fuel Ash %	%
1218	Mixed Fuel Sulfur %	%
1219	Mixed Fuel Nitrogen %	%
1220	Mixed Fuel Oxygen %	%
1221	Mixed Fuel HHV	kJ/kg
1222	Boiler Efficiency Actual - Loss Method	%
1223	Boiler Efficiency Deviation (I/O Method)	%
1224	Boiler Efficiency Corrected	%
1225	Boiler Efficiency Corrected Design	%
1226	Boiler Efficiency Corrected Deviation	%
1227	L/H AH LMTD	°C
1228	R/H AH LMTD	°C
1229	Tramp Air Estimate (%)	%
1230	LH A/H Air Temp Rise	delta °C
1231	LH A/H Air Side Efficiency Actual	%
1232	AH Air Side Efficiency Design	%
1233	LH A/H Air Side Efficiency Deviation	%
1234	RH A/H Air Temp Rise	delta °C
1235	RH A/H Air Side Efficiency Actual	%
1236	RH A/H Air Side Efficiency Deviation	%
1237	AH Air Avg Specific Heat	kJ/kg-K
1238	AH Gas In Enthalpy	kJ/kg
1239	AH Gas Out Enthalpy	kJ/kg
1240	AH Flue Gas Avg Specific Heat	kJ/kg-K
1241	Generator MVA	MVA
1242	Aux Load as % of Gross	%
1243	Throttle Enthalpy	kJ/kg
1244	HP Htr 6A Extr Enthalpy	kJ/kg
1245	HP Htr 6B Extr Enthalpy	kJ/kg
1246	HP Htr 5A Extr Enthalpy	kJ/kg
1247	HP Htr 5B Extr Enthalpy	kJ/kg
1248	DA Extr Enthalpy	kJ/kg
1249	XO Extr Enthalpy	kJ/kg
1250	LP Htr 3 Extr Enthalpy	kJ/kg
1251	LP Htr 2A Extr Enthalpy	kJ/kg
1252	LP Htr 2B Extr Enthalpy	kJ/kg
1253	LP Htr 1A Extr Enthalpy	kJ/kg
1254	LP Htr 1B Extr Enthalpy	kJ/kg
1255	Total Heat in Throttle Steam	MJ/h

1256	Total Heat in HP 6A Extr Steam	MJ/h
1257	Total Heat in HP 6B Extr Steam	MJ/h
1258	Total Heat in SFP Extr Steam	MJ/h
1259	Total Heat in HP 5A Extr Steam	MJ/h
1260	Total Heat in HP 5B Extr Steam	MJ/h
1261	Total Heat in DA Extr Steam	MJ/h
1262	Total Heat in LP 3 Extr Steam	MJ/h
1263	Total Heat in LP 2A Extr Steam	MJ/h
1264	Total Heat in LP 2B Extr Steam	MJ/h
1265	Total Heat in LP 1A Extr Steam	MJ/h
1266	Total Heat in LP 1B Extr Steam	MJ/h
1267	Total Heat in LP Exhaust Steam	MJ/h
1268	Total Heat to Turbine Glands	MJ/h
1269	Generation Energy in Steam	MJ/h
1270	LP Exhaust Steam Quality	%
1271	Throttle Flow Corrected	kg/s
1272	HP HTR 6A Extr Press Corrected	kPaa
1273	HP HTR 6B Extr Press Corrected	kPaa
1274	HP HTR 5A Extr Press Corrected	kPaa
1275	DA Extr Press Corrected	kPaa
1276	LP HTR 3 Extr Press Corrected	kPaa
1277	LP HTR 2A Extr Press Corrected	kPaa
1278	LP HTR 2B Extr Press Corrected	kPaa
1279	LP HTR 1A Extr Press Corrected	kPaa
1280	LP HTR 1B Extr Press Corrected	kPaa
1281	Net Turbine Cycle Heat Rate Actual	kJ/kWh
1282	Condenser Saturation Temp	°C
1283	Condenser ITD Actual	delta °C
1284	CW Inlet Specific Heat	kJ/kg-K
1285	CW Inlet Specific Gravity	NA
1286	Makeup Water Enthalpy	kJ/kg
1287	Condenser CW Avg Tube Velocity	m/s
1288	Condenser LMTD	°C
1289	Condenser HT Coefficient Actual	W/m^2K
1290	Condenser LMTD Design	°C
1291	Condenser HT Coefficient Design	W/m^2K
1292	Circ Water Flow Ratio (Des/Act)	NA
1293	HP 6A Htr Saturation Temp	°C
1294	HP 6B Htr Saturation Temp	°C
1295	HP 5A Htr Saturation Temp	°C
1296	DA Saturation Temp	°C
1297	LP 3 Htr Saturation Temp	°C

1298	LP 2A Htr Saturation Temp	°C
1299	LP 2B Htr Saturation Temp	°C
1300	LP 1A Htr Saturation Temp	°C
1301	LP 1B Htr Saturation Temp	°C
1302	HP 6A Htr Drain Enthalpy	kJ/kg
1303	HP 6A Htr FW In Enthalpy	kJ/kg
1304	HP 6A Htr FW Out Enthalpy	kJ/kg
1305	HP 6B Htr Drain Enthalpy	kJ/kg
1306	HP 6B Htr FW In Enthalpy	kJ/kg
1307	HP 6B Htr FW Out Enthalpy	kJ/kg
1308	HP 5A Htr Drain Enthalpy	kJ/kg
1309	HP 5A Htr FW In Enthalpy	kJ/kg
1310	HP 5A Htr FW Out Enthalpy	kJ/kg
1311	HP 5B Htr Drain Enthalpy	kJ/kg
1312	HP 5B Htr FW In Enthalpy	kJ/kg
1313	HP 5B Htr FW Out Enthalpy	kJ/kg
1314	DA Condensate In Enthalpy	kJ/kg
1315	DA Condensate Out Enthalpy	kJ/kg
1316	LP 3 Htr Drain Enthalpy	kJ/kg
1317	LP 3 Htr FW In Enthalpy	kJ/kg
1318	LP 3 Htr FW Out Enthalpy	kJ/kg
1319	LP 2A Htr Drain Enthalpy	kJ/kg
1320	LP 2A Htr FW In Enthalpy	kJ/kg
1321	LP 2A Htr FW Out Enthalpy	kJ/kg
1322	LP 2B Htr Drain Enthalpy	kJ/kg
1323	LP 2B Htr FW In Enthalpy	kJ/kg
1324	LP 2B Htr FW Out Enthalpy	kJ/kg
1325	LP 1A Htr Drain Enthalpy	kJ/kg
1326	LP 1A Htr FW In Enthalpy	kJ/kg
1327	LP 1A Htr FW Out Enthalpy	kJ/kg
1328	LP 1B Htr Drain Enthalpy	kJ/kg
1329	LP 1B Htr FW In Enthalpy	kJ/kg
1330	LP 1B Htr FW Out Enthalpy	kJ/kg
1331	Total Heat in SFPT Extr Steam	MJ/h
1332	Total Heat in SFPT Exhaust Steam	MJ/h
1333	SFP Turbine Efficiency Actual	%
1334	SFP Turbine Efficiency Design	%
1335	SFP Turbine Efficiency Deviation	%
1336	SFP Turbine Input Power	kW
1337	Deviation from Expected Gross Generation	MW
1338	SFP Enthalpy Rise	kJ/kg
1339	EFP A Enthalpy Rise	kJ/kg

1340	EFP B Enthalpy Rise	kJ/kg
1341	SFP Head at Rated RPM Deviation	%
1342	EFP A Head at Rated RPM Deviation	%
1343	EFP B Head at Rated RPM Deviation	%
1344	Unit Efficiency Actual	%
1345	Flue Gas Vol N2 %	%
1346	Flue Gas Vol O2 %	%
1347	Flue Gas Vol CO2 %	%
1348	Flue Gas Vol CO %	%
1349	Flue Gas Vol H2O %	%
1350	Test Point - Write Via SDK	NA
1351	Test Point - Log Point Write Via SQL	NA
1352	Generator Power Factor (for VP Model)	%
1353	Boiler Reheat Press Drop	kPag
1354	Boiler Reheat Press Drop	MPaa
1355	Boiler Reheat Press Drop (feeding VP Model)	%
1356	IP Turbine Avg Efficiency Actual	%
1357	IP Turb Avg Efficiency Dev from Design	%

APPENDIX D: SIGNAL RANGE FOR PARAMETERS TO BE MONITORED

Table 3: Steam Drum Boiler

Model Measurement Description		Signal							
		Steam Drum Boiler							
		Grootvlei	Matla	Komati	Lethabo	Arnot	Hendrina	Kendal	Camden
Boiler Cleanliness									
1	Fuel flow	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
2	Feedwater flow	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
3	S/H Attemperation flow (if orifice plate is installed)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
4	R/H Attemperation flow (if orifice plate is installed)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
5	Final feedwater temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
6	Economizer outlet temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
7	Drum pressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
8	Furnace pressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
9	Furnace temperatures	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
10	PSH steam outlet temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
11	SSH steam inlet temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
12	CRH steam inlet temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
13	HRH steam temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
14	Burner elevation firing rates (coal feeder or oil/gas flows)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
15	Burner tilt position (if applicable)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
16	Air heater gas inlet temperature(s)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
17	Air heater gas outlet temperature(s)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
18	Relaive humidity (if measured)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
19	Air heater air inlet temperature(s)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC

20	Air heater air outlet temperature(s)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
21	Excess 02	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
22	C0 (Optional)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
Air Heater									
23	Air Heater Inlet Gas Temperature;	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
24	Air Heater Exit Gas Temperature;	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
25	Air Heater Inlet Air Temperature;	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
26	Air Heater Outlet Air Temperature;	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
27	Economiser Exit Excess O2 and	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
28	Air Heater Outlet O2 (if available)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
FD/ID Fans									
29	Fan Power (amps or kW)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
30	Fan Speed	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
31	Fan Discharge Pressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
32	Fan Discharge Temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
33	Fan Suction Pressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
34	Fan Suction Temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
35	Inlet Vane Position	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
Steam Turbine									
36	Gross Generation	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
37	Condenser Backpressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
38	HP Turbine Inlet Temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
39	HP Turbine Inlet Pressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
40	Cold Reheat Steam Temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
41	Cold Reheat Steam Pressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
42	Hot Reheat Steam Temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC

43	Hot Reheat Steam Pressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
44	Desuperheating Flows (If orifices are installed)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
45	First Stage Pressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
46	LP Bowl Pressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
47	Crossover Temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
48	Feedwater Flow	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
49	Final Feedwater Temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
50	Final Feedwater Pressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
51	Feedwater Temperature into Each Heater	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
52	Feedwater Pressure into Each Heater	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
53	Drains Temperature from Each Heater (If possible)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
Condenser									
57	Circulating Water Temperature(s) Entering Condenser	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
58	Circulating Water Temperature(s) Exiting Condenser	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
59	Condenser Pressure or Condenser Temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
60	Hotwell Temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
61	Ambient Temperature (for cooling towers only)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
62	Ambient Relative Humidity (for cooling towers only)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
Feedwater Heater									
63	Feedwater Heater “Flange” Extraction Pressure(s)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
64	Feedwater Heater Inlet Water Temperature(s)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
65	Feedwater Heater Outlet Water Temperature(s)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
66	Feedwater Heater Drain Temperature(s)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
67	Feedwater Heater Level(s) (Optional)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
Deaerator									
68	Deaerator inlet temperatures	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC

69	Deaerator outlet temperatures	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
Generator									
70	Gross generation (MW)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
71	Reactive generation (MVAR)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
72	H2 pressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
73	Stator cooling system status	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
74	Field current	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
75	H2 purity	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
76	Power factor	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
Pumps									
77	Pump Power (amps or kW)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
78	Pump Speed	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
79	Pump Discharge Pressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
80	Pump Discharge Temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
81	Pump Suction Pressure	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
82	Pump Suction Temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
Cooling Tower									
83	Ambient Wet Bulb Temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
84	Ambient Dry Bulb Temperature	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
85	Relative Humidity	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
86	Warm Water/Cold Water Temperatures (wet towers)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
87	Warm Water/Cold air Temperatures (dry towers)	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC
88	Cooling Tower Cell Fan Speed	OPC	OPC	OPC	OPC	OPC	OPC	OPC	OPC

Table 4: Once-Through Boiler

Model Measurement Description		Signal				
		Once-Through Boiler				
		Matimba	**Majuba**	**Kriel**	**Tutuka**	**Duvha**
Boiler Cleanliness						
1	Fuel flow	OPC	OPC	OPC	OPC	OPC
2	Feedwater flow	OPC	OPC	OPC	OPC	OPC
3	S/H Attemperation flow (if orifice plate is installed)	OPC	OPC	OPC	OPC	OPC
4	R/H Attemperation flow (if orifice plate is installed)	OPC	OPC	OPC	OPC	OPC
5	Final feedwater temperature	OPC	OPC	OPC	OPC	OPC
6	Economizer outlet temperature	OPC	OPC	OPC	OPC	OPC
7	Drum pressure	N/A	N/A	N/A	N/A	N/A
8	Furnace pressure	OPC	OPC	OPC	OPC	OPC
9	Furnace temperatures	OPC	OPC	OPC	OPC	OPC
10	PSH steam outlet temperature	OPC	OPC	OPC	OPC	OPC
11	SSH steam inlet temperature	OPC	OPC	OPC	OPC	OPC
12	CRH steam inlet temperature	OPC	OPC	OPC	OPC	OPC
13	HRH steam temperature	OPC	OPC	OPC	OPC	OPC
14	Burner elevation firing rates (coal feeder or oil/gas flows)	OPC	OPC	OPC	OPC	OPC
15	Burner tilt position (if applicable)	OPC	OPC	OPC	OPC	OPC
16	Air heater gas inlet temperature(s)	OPC	OPC	OPC	OPC	OPC
17	Air heater gas outlet temperature(s)	OPC	OPC	OPC	OPC	OPC
18	Relaive humidity (if measured)	N/A	N/A	N/A	N/A	N/A
19	Air heater air inlet temperature(s)	OPC	OPC	OPC	OPC	OPC
20	Air heater air outlet temperature(s)	OPC	OPC	OPC	OPC	OPC

21	Excess 02	OPC	OPC	OPC	OPC	OPC
22	C0 (Optional)	OPC	OPC	OPC	OPC	OPC
Air Heater						
23	Air Heater Inlet Gas Temperature;	OPC	OPC	OPC	OPC	OPC
24	Air Heater Exit Gas Temperature;	OPC	OPC	OPC	OPC	OPC
25	Air Heater Inlet Air Temperature;	OPC	OPC	OPC	OPC	OPC
26	Air Heater Outlet Air Temperature;	OPC	OPC	OPC	OPC	OPC
27	Economiser Exit Excess O2 and	OPC	OPC	OPC	OPC	OPC
28	Air Heater Outlet O2 (if available)	OPC	OPC	OPC	OPC	OPC
FD/ID Fans						
29	Fan Power (amps or kW)	OPC	OPC	OPC	OPC	OPC
30	Fan Speed	OPC	OPC	OPC	OPC	OPC
31	Fan Discharge Pressure	OPC	OPC	OPC	OPC	OPC
32	Fan Discharge Temperature	OPC	OPC	OPC	OPC	OPC
33	Fan Suction Pressure	OPC	OPC	OPC	OPC	OPC
34	Fan Suction Temperature	OPC	OPC	OPC	OPC	OPC
35	Inlet Vane Position	OPC	OPC	OPC	OPC	OPC
Steam Turbine						
36	Gross Generation	OPC	OPC	OPC	OPC	OPC
37	Condenser Backpressure	OPC	OPC	OPC	OPC	OPC
38	HP Turbine Inlet Temperature	OPC	OPC	OPC	OPC	OPC
39	HP Turbine Inlet Pressure	OPC	OPC	OPC	OPC	OPC
40	Cold Reheat Steam Temperature	OPC	OPC	OPC	OPC	OPC
41	Cold Reheat Steam Pressure	OPC	OPC	OPC	OPC	OPC
42	Hot Reheat Steam Temperature	OPC	OPC	OPC	OPC	OPC
43	Hot Reheat Steam Pressure	OPC	OPC	OPC	OPC	OPC

44	Desuperheating Flows (If orifices are installed)	OPC	OPC	OPC	OPC	OPC
45	First Stage Pressure	OPC	OPC	OPC	OPC	OPC
46	LP Bowl Pressure	OPC	OPC	OPC	OPC	OPC
47	Crossover Temperature	OPC	OPC	OPC	OPC	OPC
48	Feedwater Flow	OPC	OPC	OPC	OPC	OPC
49	Final Feedwater Temperature	OPC	OPC	OPC	OPC	OPC
50	Final Feedwater Pressure	OPC	OPC	OPC	OPC	OPC
51	Feedwater Temperature into Each Heater	OPC	OPC	OPC	OPC	OPC
52	Feedwater Pressure into Each Heater	OPC	OPC	OPC	OPC	OPC
53	Drains Temperature from Each Heater (If possible)	OPC	OPC	OPC	OPC	OPC
Condenser						
57	Circulating Water Temperature(s) Entering Condenser	OPC	OPC	OPC	OPC	OPC
58	Circulating Water Temperature(s) Exiting Condenser	OPC	OPC	OPC	OPC	OPC
59	Condenser Pressure or Condenser Temperature	OPC	OPC	OPC	OPC	OPC
60	Hotwell Temperature	OPC	OPC	OPC	OPC	OPC
61	Ambient Temperature (for cooling towers only)	OPC	OPC	OPC	OPC	OPC
62	Ambient Relative Humidity (for cooling towers only)	OPC	OPC	OPC	OPC	OPC
Feedwater Heater						
63	Feedwater Heater “Flange” Extraction Pressure(s)	OPC	OPC	OPC	OPC	OPC
64	Feedwater Heater Inlet Water Temperature(s)	OPC	OPC	OPC	OPC	OPC
65	Feedwater Heater Outlet Water Temperature(s)	OPC	OPC	OPC	OPC	OPC
66	Feedwater Heater Drain Temperature(s)	OPC	OPC	OPC	OPC	OPC
67	Feedwater Heater Level(s) (Optional)	OPC	OPC	OPC	OPC	OPC
Deaerator						
68	Deaerator inlet temperatures	OPC	OPC	OPC	OPC	OPC
69	Deaerator outlet temperatures	OPC	OPC	OPC	OPC	OPC

Generator						
70	Gross generation (MW)	OPC	OPC	OPC	OPC	OPC
71	Reactive generation (MVAR)	OPC	OPC	OPC	OPC	OPC
72	H2 pressure	OPC	OPC	OPC	OPC	OPC
73	Stator cooling system status	OPC	OPC	OPC	OPC	OPC
74	Field current	OPC	OPC	OPC	OPC	OPC
75	H2 purity	OPC	OPC	OPC	OPC	OPC
76	Power factor	OPC	OPC	OPC	OPC	OPC
Pumps						
77	Pump Power (amps or kW)	OPC	OPC	OPC	OPC	OPC
78	Pump Speed	OPC	OPC	OPC	OPC	OPC
79	Pump Discharge Pressure	OPC	OPC	OPC	OPC	OPC
80	Pump Discharge Temperature	OPC	OPC	OPC	OPC	OPC
81	Pump Suction Pressure	OPC	OPC	OPC	OPC	OPC
82	Pump Suction Temperature	OPC	OPC	OPC	OPC	OPC
Cooling Tower						
83	Ambient Wet Bulb Temperature	OPC	OPC	OPC	OPC	OPC
84	Ambient Dry Bulb Temperature	OPC	OPC	OPC	OPC	OPC
85	Relative Humidity	OPC	OPC	OPC	OPC	OPC
86	Warm Water/Cold Water Temperatures (wet towers)	OPC	OPC	OPC	OPC	OPC
87	Warm Water/Cold air Temperatures (dry towers)	OPC	OPC	OPC	OPC	OPC
88	Cooling Tower Cell Fan Speed	OPC	OPC	OPC	OPC	OPC

APPENDIX E: POWER STATION CONFIGURATION

Table 5: Coal 2

Production Unit		Coal 2						
Power Station		**Duvha**	**Lethabo**	**Matimba**	**Tutuka**	**Kendal**	**Majuba**	**Matla**
Plant Systems								
1	**BOILER**							
1.1	Number of Units	6	6	6	6	6	6	6
1.2	Boiler configuration	Once Through	Drum	Once Through	Once Through	Drum	Once Through	Drum
1.3	Boiler firing type	Front and Rear Wall Fired	Front and Rear Wall Fired	Corner Fired	Front and Rear Wall Fired	Corner Fired	Front and Rear Wall Fired	Front and Rear Wall Fired
1.4	Number of superheaters	4	4	4	4	5	3	3
1.5	Number of reheaters	2	3 Banks of Prime and 1 Secondary Reheater	2	2	2	2	2
2	**MILLS**							
2.1	Number of mills per boiler	6	6	4	6	5	6	6
2.2	Type of mill	Babcock Vertical Spindle (U1 to U4)	Tube	Tube	Tube	Tube	Tube	Vertical Spindle
		Loech Vertical Spindle		*5th mill decommissioned in Dec 1996				
3	**Cooling Tower**							
3.1	Type of cooling tower	Wet Cooled	Wet Cooled	Air Cooled Condenser	Wet Cooled	Dry Cooled Tower	Air Cooled Condenser (U1 to U3)	Wet Cooled
							Wet Cooled (U4 to U6)	
4	**FLY ASH PLANT**							
4.1	ESP or Bag Filer	ESP (U1 to U3)	ESP	ESP	ESP	ESP	ESP	ESP
		Bag (U4 to U6)						
4	**TURBINE**							
4.1	Size of turbine MW	600	618	665	609	686	657 (U1 to U3)	600
							713 (U4 to U6)	

Table 6: Coal 3

Production Unit		Coal 3					
Power Station		**Arnot**	**Grootvlei**	**Camden**	**Komati**	**Hendrina**	**Kriel**
Plant Systems							
1	**BOILER**						
1.1	Number of Units	6	6	8	9	7	6
1.2	Boiler configuration	Drum	Drum	Drum	Drum	Drum	Once Through
1.3	Boiler firing type	Corner Fired	Front and Rear Wall Fired	Front	Rear Wall Fired	Front and Rear Wall Fired	Front and Rear Wall Fired
1.4	Number of superheaters	5	2	4	4 (U1 to U5), 3 (U6 to U9)	3 (U1), 4 (U2 to U7)	3
1.5	Number of reheaters	3	0	0	0	0	2
2	**MILLS**						
2.1	Number of mills per boiler	3 Tube (U1)	6	5	3 Vertical Spindle (U1 to U3, U8, U9)	6	6
2.2	Type of mill	6 Vertical Spindle (U2-U6)	Vertical Spindle	Vertical Spindle	3 Tube (U4 to U7)	Vertical Spindle	Vertical Spindle
							On Mill on Standby
3	**Cooling Tower**						
3.1	Type of cooling tower	Wet Cooled	Wet Cooled (U1 to U4)	Wet cooled	Wet Cooled	Wet Cooled	Wet Cooled
			Direct Cooled (U5)				
4	**FLY ASH PLANT**						
4.1	ESP or Bag Filer	Bag	Bag (U1, U5, U6)	Bag	ESP	Bag	ESP
			ESP (U2 to U4)				
4	**TURBINE**						
4.1	Size of turbine MW	400 (U1 to U4 and U6)	200	200	100 (U1 to U5)	200	500
		350 (U5)			100 (U6 to U9)		