

# Services to Technology Providers

Training and Capacity building activities  
of Bagasse Based Plants Operation and Maintenance

Session : Best O&M Practices

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- SOP
- Budget control
- KPI
- Implementation of latest O&M practices
- KRA (key Responsibility Areas)
- Scheduled Outage Planning
- Qualification Process
- HSE Management
- Inventory management
- Peer Review
- CMMS
- Training
- Housekeeping
- Energy Audit

- SOP–Standard Operating Procedure provides written instructions to Plant Operations Staff to perform the Steps of Operations of Power Plant in accordance with the OEM recommendations
- The benefit of SOP is to avoid the human error and perform a safe, reliable and efficient Plant Operation

# Examples of SOP

- The Examples of SOPs
  - Plant Start Up Procedure
  - Plant Shut Down Procedure
  - Emergency Shut Down Procedure
  - Issuing of Work Permit Procedures
  - Electrical Isolation Procedure
  - Boiler Furnace/ Grate/Super Heaters cleaning Procedure
  - Cold and Hot Start Up Procedures

# Considerations for SOP Writing

- OEM Instructions
- Safety of Equipment
- Best Standard Practices

All mentioned considerations are taken into account to write a Standard Operating Procedure–SOP of any operational activity. This ensures Safe, Reliable and Efficient operation

## Steps of SOP Preparation/Implementation

- Two ways of Writing Procedures, Professionals or In house
- In house procedures usually write by Operations Team  
Reviewed by Operations Manager
- Reviewed SOP is approved by Plant Manager or General  
Manager Power
- Training of approved SOP is given to all operations staff  
and the record is maintained
- SOP is reviewed once in a year or after Addition/Deletion  
of any operational equipment
- SOP is always a controlled document available with Plant  
Manager

- Cost of electricity has two main ingredients;
  - Operational Expenses (Opex)
    - Fixed O&M Expenses
    - Variable O&M Expenses
  - Capital Expense (Capex)
    - Short Term Capex (One Year)
    - Long Term Capex (> One Year)

- Operational Expenses (Fixed and Variable O&M)  
Includes the following costs
  - Salary Expenses
  - Consumable (Spares, chemicals etc)
  - EHS Costs
  - License Fee
  - Insurance, Finance and Administrative Cost
  - Outage Cost
  - Hot and Cold Startup Cost
  - Contractors fee



- Capital Expense Includes the following Costs
  - Turbine/Boiler Major Overhauling Expense
  - New Building Construction Cost
  - Installation of New major equipment or ancillaries
  - Installation of New Transformer, Circuit Breakers, modified Control and protection Systems

- Following are the major Power Plant KPI Index's
  - Plant Availability Factor
  - Plant Capacity Factor
  - Plant Load Factor
  - EFOR–Equivalent Forced Outage Rate
  - Plant Net Heat Rate
  - Boiler Efficiency

# Key Performance Indicator–KPI

- Capacity Factor – 98%
- Plant Availability – 99%
- Plant Heat Rate – 14000 BTU/Kw Hour
- Plant Efficiency – 24.5%
- Boiler Efficiency – 85%
- Forced Outages – As per PPA/Contract

## O&M Best Practice To Control

- Frequent unit outages
- Potential risk for cold startup
- Cold startup and cost implications
- Equipment impact on low load operation
- Frequent load cycling
- Load cycling operations
- Load cycling cost impact
- Water chemistry effects on plant assets

# KRA (key Responsibility Areas)

- Following are the “Key Responsibility Areas” of Power Plant
  - Balance of Plant (BOP)
    - Water Treatment Plant
    - Waste Water Treatment Plant
    - Well Pump or Raw Water Intake Plant
    - Cooling Water Treatment Plant
    - Fire Water Storage
    - Fire Pumps
    - Cooling Towers
    - Circulating/Cooling/Service Water Pumps
    - Plant Laboratory
  - Chief Chemist, Plant Chemist & WTP Operators work for BOP

# KRA (key Responsibility Areas) Conti...

- Boiler
  - Boiler Fuel Handling System
  - Boiler Feed Water Pumps
  - Main Boiler Operations
  - Boiler Ash Handling System
- Turbine and Utilities
  - Steam Turbine & Generator
  - Condensate Water System
  - Condenser
  - Gland Steam System
  - Compressed Air System
- Manager Operations, Shift Engineers, CRO, TO, Boiler & Utility Operators work in this area

Manager E&I, Team Leader E&I, DCS Engineer, Electrical & Instrument Engineer, E&I Technicians work in this area and looking after the following;

- Maintenance Planning, spare parts & inventory management
- MV Switchgear
- LV Switchgear
- Transformers/Protections/Switchyard
- DCS Relay Room
- PLC Systems
- Plant Lighting System
- VFDs System
- AC/DC UPS System
- AC Generator & Excitation System
- Turbine Speed & Load Control System
- Plant Instrumentation System
- Electric Motors

Manager Maintenance, Team Leader Maintenance, Mechanical Engineer, Mechanical Supervisor, Welder, Fabricator, Technicians work in this area and perform the following tasks,

- Maintenance Planning, spare parts & inventory management
- Steam Turbine/Compressors/Pumps and other rotary equipment Maintenance
- Boiler/Pressure vessel Maintenance
- Fuel/Lube Oil/Cooling Water/Main Steam & Condensate System Maintenance
- Workshop activities
- Welding & fabrication activities
- Any other mechanical maintenance activity



# Scheduled Outage Planning

- List down Preventative and Corrective shutdown activities
- Make a separate list of E&I, Mechanical and Operations activities
- Arrange spare parts and consumables
- Estimate the required Manpower and Man hours
- Assign time required against each activity
- Plan the first activity that is required to finish to perform another activity
- Plan to perform maximum possible parallel activities

# Qualification Process

- Preparation of Qualification book of each area like Boiler, Turbine, WTP, Utilities, Fuel System
- Include the questions containing the basics of system knowledge, OEM recommendations and best practices
- Include the questions about the system safety
- Assign a “mentor”, a trained individual to each person is being qualified

EHS Manager, Safety Officer, Firefighting staff work in this department and looking after the following activities;

- Safety Audits
- Safety Signboard Management
- Safety Trainings and drills
- Firefighting equipment Audits and Drills
- Safety rules implementation like work permits and PPEs
- 5S implementation and housekeeping evaluation

Store Inventory consists of;

- Strategic/Operational Spares
- Consumables
- Strategic/Safety Spares
  - The spares are recommended by the OEM and the no of items in inventory are also given. It includes both Mechanical and Electrical parts
- Consumable
  - Items like contact cleaner, bushes, seals, belts, cotton rags, ambry papers, paint, EHS PPEs, chemicals, Lubricants etc

- Peer Review is a process when a colleague of equal skills and capabilities perform a review of any operation or maintenance activity of another colleague.
- This is more effective if a company owns plant at two different locations and the team of one plant comes to other plant for “Peer Review”

- CMMS stands for Computerized Maintenance Management System, it has following features;
  - Work Request Module
  - Work Order Module
  - Preventive Maintenance Module
  - Equipment List
  - Spare Parts List
  - Maintenance Record
  - Store inventory record

Training Need Analysis or TNA is performed to assess the requirement of training for an individual. Following are the types skills that are reviewed to recommend a training;

- Functional Skill (Core Operations & Maintenance)
- Human Skills
- Communication Skills

Plant Housekeeping is a key element to avoid unsafe conditions and also aesthetics of plant is directly dependent on proper housekeeping. To ensure good housekeeping, the areas are assigned to individuals and monthly audit is performed of each area to ensure effective implementation.



- Energy in Power Plant is used in following forms;
  - Heat Energy in form of Combustion
  - Heat Energy in form of Steam
  - Electrical Energy for Auxiliaries and lighting load
  - Cooling of Buildings
  - Water Extraction
- In an Energy Audit, the usage of energy in all mentioned forms are evaluated and any loss of energy is identified which in return save the energy and increase the profitability of Company

# Thank You for Your Kind Attention

OMS a Unique Company specialized in Operating  
Biomass Power Plants based on Bagasse and Non  
Conventional Biomass Fuels.

