



## Energy Management Guideline for Gas Engine Co-Generation Systems

### 1. Introduction

This guideline provides a structured approach to optimize energy efficiency in gas engine co-generation systems, covering operation, maintenance, and performance monitoring to achieve SREDA's benchmark of **68-70% overall efficiency**.

### 2. Operational Management

| Parameter             | Measurement Method                     | Frequency  | Target Value  | Corrective Action  |
|-----------------------|--|------------|---|--|
| Electrical Efficiency | (Electrical Output/Fuel Input)×100     | Daily      | ≥38%  | Adjust <b>air-fuel ratio (As per Technical manual)</b> ; clean/replace spark plugs ( <b>gap ≤0.8mm</b> ).  |
| Load Factor           | (Actual Load/Rated Capacity)×100       | Continuous | 70-85%  | Balance generators to maintain <b>70–85% load</b> ; avoid <b>less than 40% load</b> .  |
| Heat Recovery Rate    | (Recovered Heat/Electrical Output)×100 | Daily      | ≥30%  | Clean heat exchangers (target <b>ΔP ≤0.5 bar</b> ); insulate pipes to reduce losses.   |
| Exhaust Gas Temp.     | Thermocouple measurement               | Weekly     | <b>Normal</b> : 400–480°C.<br><b>Warning</b> : 480–500°C<br><b>Critical</b> :>500°C | Check <b>O<sub>2</sub> (As per Technical manual)</b> and <b>CO (&lt;100 ppm)</b> ; reduce load if <b>Temp is Greater than 500°C</b> .                  |
| Lube Oil Pressure     | Pressure gauge                         | Daily      | 3-5 bar (per engine specs)  | Replace oil/filter if pressure <b>less than 3 bar</b> ; use appropriate SAE/API grade of oil suggested for Bangladesh weather in the technical manual. |

### 3. Maintenance Schedule

| Activity                         | Frequency                                    | Tools Required                    | Corrective Action  |
|----------------------------------|--|-----------------------------------|--|
| <b>Spark Plug Inspection</b>     | Every 2,000 hours                            | Gap tool, torque wrench           | Set gap to $\leq 0.8\text{mm}$ ; clean carbon deposits.  |
| <b>Air Filter Cleaning</b>       | Weekly                                       | Pressure gauge                    | Replace if $\Delta P$ greater than <b>0.2 bar</b> ; wash with mild detergent..                                       |
| <b>Heat Exchanger Cleaning</b>   | Quarterly                                    | Chemical cleaning kit             | Restore original heat transfer rate by using descaling agents (e.g., <b>5% citric acid</b> ).                        |
| <b>Lube Oil Change</b>           | Every 1,000 hours/ As per maintenance manual | Oil analysis kit/ dipstick        | Check if viscosity is within specification. If not, drain oil at <b>80°C</b> ; refill with appropriate grade of oil. |
| <b>Valve Clearance Check</b>     | Every 4,000 hours                            | Feeler gauge                      | Set intake to <b>0.3mm</b> , exhaust to <b>0.5mm</b> (Check specs with manufacturer's manual).                       |
| <b>Exhaust System Inspection</b> | Monthly                                      | Boroscope                         | Repair leaks; replace cracked gaskets.   |
| <b>System Integration</b>        | Monthly                                      | Process flow diagrams, SCADA logs | Verify sensors; update SCADA flow diagrams monthly.  |

### 4. Performance Monitoring & Troubleshooting

#### Key Metrics to Track Daily:

- Specific Fuel Consumption** ( $\text{Nm}^3/\text{kWh}$ ) → Compare against SREDA's benchmark of  $0.25 \text{ Nm}^3/\text{kWh}$  for 40% efficiency
- Heat Recovery Utilization** → Ensure  $\geq 85\%$  of recovered heat is productively used
- Start-Stop Cycles** → Limit to less than 5 start-stop cycles/day to reduce thermal stress