

## Fast Start Flexibility©

### Description

#### Power Industry Market Demands Shift in Operations

Changes in the power generation market are transforming power plant operations. With higher fuel costs and increased market capacity, plants are seeking ways to maximize revenue potential during peak conditions and reduce operating costs due to National Grid Company regulations for off-peak periods.

#### New Power Market Expands Operational Range and Flexibility

To meet the National Grid Company demands and requirements of a changing power market, GT-APS has developed an enhancement designed to expand the operating profile of GE LM series gas turbine for improving poor fuel consumption levels. Through Advanced Fuel Scheduling and Start Sequencing on firing power plant, a proprietary method of controlling fuel distribution, GT-APS **Fast Start Flexibility©** enhancement broaden the gas turbine's operating range, increasing flexibility and profitability while maintaining National Grid Company regulations such as primary and secondary frequency control, reactive power control etc.

**Fast Start Flexibility©** enhancement provide up to 2% less fuel usage during start for higher efficiency for base-load and peak-load periods.

### How It Works?

#### Fast Start Flexibility©

This enhancement extends the operating range at which fuel consumption levels can be maintained to minimum by increasing gas turbine start capability. Currently, the typical start cycle for the LM6K gas turbine is 855 sec.'s as shown in Figure-1.

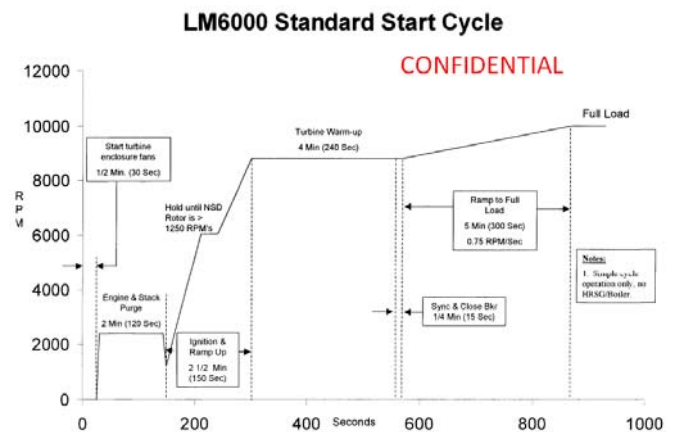


Figure-1. The Standard Start Cycle.

The Fast Start Flexibility is targeted to provide about 33% less time, allowing full production time at as low as 575 sec.'s while maintaining safe operation levels as shown in Figure-2.

In some cases, the fast start flexibility may be as high as 35% depending on site-specific allowable start levels. Reducing start-up and production cycle time with **Fast Start Flexibility©** by 35%, customers are able to reduce the amount of fuel consumed during off-peak hours shut-down

## Fast Start Flexibility©

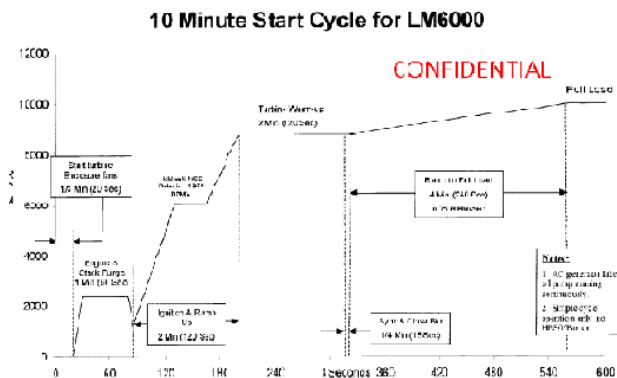


Figure-2. 10 minute Start Cycle by **FSF©**

and avoid start-up costs, as well as minimize maintenance requirements associated with anonymous SML, SDTI, FSWM or similar shut-downs.

The **Fast Start Flexibility©** is one of GT-APS's ecomagination products and this helps drive customers' performance through more environmentally compatible products and services. A typical customer with a LM6K gas turbine operating per year with 300 starts at minimized sequence time will save more than **23 hours** per year by installing **Fast Start Flexibility©** option.

### Application of Fast Start Flexibility©

The fast start option is applicable to LM6000PA, PC, PD, PF gas turbines included but not limited to DLE combustors with Woodward MicroNet™-NT CPU, GE Mark VI or higher, Millenium controls.

The peak fire capability requires installation of **Primary Frequency Regulation, PFR©** software to ensure that combustion system parameters

are kept at optimal performance. **PFR©**, is one of the core technologies provided as part of GT-APS's **PowerEfficiencyLM PELM©**, software.

The peak fire functionality, by **Power Augmentation Control (PAC)**, provides the ability to safely operate the turbine at a higher firing temperature while maintaining primary frequency control obligation by NGC requirements when demand for more output capacity is at a premium.

Fast Start enhancement can be implemented in a few hours, including a one-day outage at the installation of **PFR©** and **PAC©** application period. If coordinated well, the service can be implemented with no impact on the planned outage schedule for upgrading existing PFC applications for NGC.

### Benefits

Increased revenue potential from less fuel consumption during start cycles.

- Lower costs
- Less fuel consumption
- Faster combined cycle start-up's
- Improved reliability with more stable operation