

Primary Frequency Regulation (PFR©)

Description

Primary Frequency Regulation, **PFR©**, software is the one and only “LIVE” **Pset** planner of GT-APS PFC™ software for National Grid Company (NGC) requirements.

What is PFR©?

Primary Frequency Regulation, **PFR©**, represents a suite of software programs that work together with GT-APS PFC™ and GT-APS PFCDRS™ for ;

1. Accurate Planning; To assist users in better managing the technical/financial performance and resulting in extremely accurate planning

Hourly Generation Set Values					
Hour	Set (MW)	Hour	Set (MW)	Hour	Set (MW)
00 - 01	39.00	08 - 09	39.50	16 - 17	38.50
01 - 02	39.00	09 - 10	39.00	17 - 18	38.50
02 - 03	39.00	10 - 11	39.00	18 - 19	38.50
03 - 04	39.00	11 - 12	39.00	19 - 20	38.50
04 - 05	39.50	12 - 13	39.00	20 - 21	38.50
05 - 06	39.50	13 - 14	39.00	21 - 22	39.00
06 - 07	39.50	14 - 15	38.50	22 - 23	39.00
07 - 08	39.00	15 - 16	38.50	23 - 24	39.00

2. **Power Augmentation Control (PAC)**¹; Eliminating primary frequency control obligation by managing base load parameters such as temperature (T48 and T3) and pressure (PS3) controls which is named as Power Augmentation Control (PAC).
3. **Fast Start Flexibility (FSF)**²; To reduce the amount of fuel consumed during off-peak hours shut-downs and avoid & minimize start-up costs,

¹ See Power Augmentation Control (PAC).

² See Fast Start Flexibility (FSF)©

How PFR© Works?

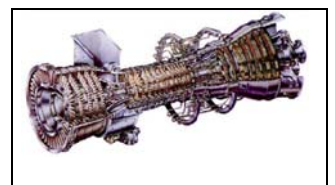
The Primary Frequency Regulation, **PFR©**, software is embedded with GT-APS PFC™ and GT-APS PFCDRS™ software's and this model-based software is built much the same way as you might build a diagram in your favorite slide presentation or graphics software. Simply runs the software as “LIVE” from Primary Frequency Regulation, **PFR©**, tool box, by doing so connected to the turbine controls instantly, and starts modeling the customer's site specific GTG set comparing with GE gas turbines design parameters and performance for the current ambient conditions.

With this model, **PFR©** generates;

1. Expected **Pset** value
2. Engine output parameters and/or performance values for
 - a. Customer's current gas turbine
 - b. Manufacturer's original design (new and clean)
 - c. Different configured (vigv, figv, no-sprint, Nox, e-sprint, DLE, etc.)

once ambient conditions are provided automatically or manually. When models are executed, a sequential modular algorithm gives the production plan for next day or so depending on the meteorological inputs availability

(Temperature, humidity, atmospheric pressure etc.) thru local meteorology web sites, links etc. to meet quickly changing load, fuel and power prices.



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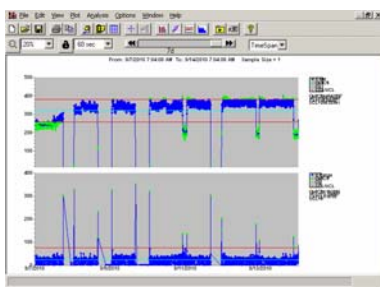
PFR© benefits

Power plant Owner's and/or operators can easily use **PFR©**;

- Primary Frequency Control reserve amount, as well as DGS (Daily Generation Schedule),
- Elimination of PFC reserve amount by optional Power Augmentation Control (PAC)¹
- Fast Start option to minimize start cycle insufficient fuel consumption (FSF)²

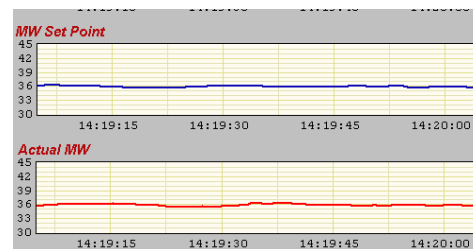
to maximize profitability, and increase performance awareness. By doing so users can continuously provide primary frequency control reserve amount well calculated by **PFR©** that;

1. "LIVE" production planning(DGS) in advance (hourly, daily or weekly)
2. Less production losses due to NGC requirements upto 800kWh.



3. Elimination of PFC reserve by **PAC**¹ (optional) which improves SFC & HR typically minimum by 1,88 to 3% or 0,006-0,008 sm3/kWh for Simple Cycle

4. Optimizing primary frequency control reserve amount in detail



5. Engine design output parameters
6. Quantify the plant's performance and efficiency to decide diagnostic and maintenance actions
7. Measure the performance before and after maintenance actions if certain conditions are met.