Q. **B-15, Overhaul Gas Turbine, Holyrood $1,291,400**

Please provide data used in calculating the Utilization Forced Outage Probability (UFOP) for the Holyrood Gas Turbine and for All Hydro Gas Turbine Units, and used in calculating the Failure Rate for the same two categories

A. The Calculations for Failure Rate and Utilization Forced Outage Probability (UFOP) for the Holyrood Gas Turbine and for All Hydro Gas Turbine Units are as follows:

Failure Rate is the rate at which a generating unit encounters a forced outage. It is computed by dividing the Number of Transitions from an Operating State to a Forced Outage by the Total Operating Time times 8760 (the number of hours in a non-leap year).

UFOP (%) is the Utilization Forced Outage Probability. It is the probability that a generating unit will not be available when required.

$$UFOP = \frac{f(\text{Forced Outage time})}{f(\text{Forced Outage time}) + \text{Operating time (adjusted)}}$$

Where f = Demand Factor

$$= \left[\frac{1 + 1}{r \quad T}\right] \Big/ \left[\frac{1 + 1 + 1}{D \quad r \quad T}\right]$$

Where r = Average Forced Outage Time

D = average in-service time per occasion of demand

$$D = \frac{\text{Operating time (adjusted)}}{SR \times \text{Total Attempted Starts}}$$

T = average reserve shutdown time between periods of need, exclusive of periods for maintenance or other planned unavailability.

$$D + T = \frac{\text{Operating time (adjusted)} + \text{Available but not operating time}}{\text{Total Attempted Starts}}$$

SR: the Starting Reliability gives the ratio of successful starts to start attempts.

$$SR = \frac{\text{Total Attempted Start} - \text{Total Start Failures}}{\text{Total Attempted Starts}}$$

Holyrood GT - 2005-2009 Statistics

Calculations

Operating Hours	76.33
Operating Hours (adjusted)	76.33
Available not operating Hours	38,599.70
Forced Outage Hours	2,867.15
Number of Forced Outages	12
Number of Starts	112
Number of Starting Failures	1
Number of Transitions to synchronous condenser mode	0
Attempted Starts	113
Number of Transitions from operating to forced outage	7

r	238.929
D	0.682
T	341.584
Demand Factor	0.005
UFOP	**15.34%**
Failure Rate	**803.35**

NLH All Units - 2005-2009 Statistics

Operating Hours	1,424.24
Operating Hours (adjusted)	1,035.43
Available not operating Hours	125,919.90
Forced Outage Hours	4,633.42
Number of Forced Outages	130
Number of Starts	527
Number of Starting Failures	26
Number of Transitions to synchronous condenser mode	538
Attempted Starts	1,091
Number of Transitions from operating to forced outage	34

r	35.64
D	0.97
T	115.39
Demand Factor	0.03
UFOP	**13.36%**
Failure Rate	**209.12**