Performance Guarantee

This document introduces ProaTEQ Treatment, outlines GUE Project Scope and Pricing, states our four Guarantees, documents details of those guarantees, performance criteria, and Customer Credits provided.

Product Overview. ProaTEQ[1] is an oil based Chemical treatment that is inserted into refrigeration lines of cooling equipment to mitigate the adverse effects of oil fouling.

Oil Fouling. Oil fouling is a process in which, over time, compressor lubricating oil becomes entrained with refrigerant, escapes the compressor, and forms an unwanted, insulating, boundary layer on the inside surface of heat transfer tubing in the evaporator and condenser. This layer builds over time, inhibiting heat transfer between air and refrigerant. This unwanted insulating effect leads to a loss in unit cooling capacity.

The effect is well-known in the HVAC industry. A paper published at the ASHRAE 1987 Winter Symposium[2] said that the degradation was up to 30% of capacity with maximum effect at about 7 years of unit age. See Georgetown Utilities Enterprise, LLC "Chemical Industry Case Study"[3] for details.

ProaTEQ Formulation and Action. The ProaTEQ treatment is formulated using a polarized molecular structure that is attracted to the metal tubing surface by Van der Waals (sub-atomic) forces. It penetrates and dislodges the oil boundary layer. Due to its polarity, no other molecule can adhere to it, and it cannot adhere to itself, or anything except the metal surface. In addition to dislodging the boundary layer, it forms a one molecule (Nano-) thick coating on the inside surface, and prevents the oil boundary layer from ever forming again. It is a permanent metallurgical retrofit. It is not a maintenance measure; and a unit, once treated, never needs retreatment.

How ProaTEQ Saves Energy and Cost. When capacity is lost due to oil fouling, the unit suffers loss of performance in three ways:

- ***Increased kWh*** -- Due to the reduction in capacity, the cycle time to meet any load will increase, using more kWh.
- ***Loss of Cooling*** -- For certain load levels, which the unit previously met, the unit can no longer meet that load, causing continuous running, loss of thermostat control and loss of cooling service.
- ***Increased Wear*** -- A multi-stage unit will activate higher stages at lower load levels, increasing kW at lower loads, and adding wear to the unit.

ProaTEQ recovers a portion of the lost capacity, returning the capacity of an oil fouled unit to a significant fraction of its design capacity. Typically, ProaTEQ recovers about 70% of the capacity lost due to oil fouling.[4]

Energy Savings and Cooling Service Recovery. Typically, energy and "hard dollar savings" will be realized, in addition to cooling service recovery:

- ***Met Loads That Remain Met*** – For load levels being met by the fouled unit, the treated unit also meets them, at a reduced cycle time, proportional to the capacity gain. Hard savings occur, 20%-28% of kWh use and cost at these load levels[5].
- ***Unmet Loads That Become Met*** – For larger loads, the fouled unit will not meet the load, but the treated unit will. Treatment first restores set-point and then reduces cycle time. Hard savings occur, but only after cooling service is recovered and the unit can cycle. Hard savings range 1-20%.
- ***Unmet Loads That Remain Unmet*** – For the largest loads, where the fouled unit does not meet the load, and the treated unit still does not meet the load, a portion of the cooling service will be recovered, but the unit will still not cycle and there will be no kWh savings.

Depending on the mix of met and unmet loads before and after treatment, Energy savings in the range of 15%-20% are expected on units where a degree of oil fouling is present and where most load levels are met by the fouled unit.

Demand Savings. ProaTEQ also improves the lubricity of the compressor oil. Therefore, a small reduction in compressor kW is observed, typically 1-2%. This will reduce kWh for all run time, and reduce kW demand charges marginally.

Net Savings. Combining the effect of energy and demand savings, test units delivered simulated net operating cost reductions of about 11%. Due to the low installation costs, this generated attractive paybacks.

Four Guarantees. The nature of savings delivered by ProaTEQ treatment are such that GUE can offer the following ***Four Guarantees***:

1. ***There will be no damage to the Customer equipment due to using our products and services***. Any damage found attributable to our product or services will be compensated to the terms and limits of our insurance coverage[6].
2. ***Fleet Capacity, in Tons, over all Treated Units, will increases by at least 10%.***
3. ***Fleet Performance, in kW/Ton, over all Treated Units, will be improved (reduced) by at least 10%.***
4. ***For Units that have experienced significant Oil Fouling, but currently meet the load most of the time, referred to as "Capacity-Qualified Units", GUE will guarantee a three-year payback on the ProaTEQ Treatment Cost.***

Project Description. Each ProaTEQ Treatment project undertaken by Georgetown Utilities Enterprise, LLC (GUE) has the following four phases:

- Phase I: Condition Assessment and Base Pricing
- Phase II: Treatment and Capacity Measurement
- Phase III: Analysis, Modeling, and Reporting
- Phase IV: Final Price Adjustment

Each Phase is described below.

Phase I: Condition Assessment and Base Pricing. A project Proposal, stating a Proposal Price, will be made based on an equipment list of all in-scope units, provided by the Customer, containing:

- Manufacturer
- Model number
- Serial number
- Nameplate Capacity
- Age

The Proposal Price will be based on the total Tons to be treated at the standard pricing schedule of:

- Product and Installation:
  - $90/Ton for the first 1,000 Tons
  - $80/Ton for the 1,001st to 2,000th Tons
  - $70/Ton for the 2,001st Ton and beyond
  - Negotiable for projects over 5,000 Tons
  - $20/Ton for Field-Declined Unit (Phase II)
- $185/unit for individual Unit Performance Report
- $1,300/Crew-Day for Pre-Treatment Inventory (1-2 Crew-Days max); and
- $1,150/Crew-Day for Extended Travel[7]

Upon signing a Purchase Order with a P.O. Price based on our Proposal and any resulting negotiations; GUE will visit the Customer site and perform a walk-through of all units categorizing them into one of four initial Condition Classes:

- Treatable Only
- Treatable and Measurable Only
- Treatable, Measurable, and Capacity Qualified
- Untreatable

Virtually all units are expected to be Treatable but some may be disqualified for various reasons, such as being out of service, down for maintenance, etc. A unit is Treatable and Measurable if it can be tested using the GUE Field Capacity Measurement Protocol.[8] A unit is Treatable, Measurable, and Capacity Qualified if it is at least five (5) years old[9], and if, in the judgement of GUE Engineers, it is expected to test within at least 60% of its rated capacity under the GUE Field Capacity Measurement Protocol.

A Base Price will be provided to the Customer based on the Tons of Treatable Equipment from the inventory, and the standard pricing schedule. This Base Price will be subject to adjustment based on the outcome of Phases II (Change in Condition Classes) and IV (offsets due to guarantee provisions).

Phase II: Treatment and Capacity Measurement. GUE staff will Treat and perform GUE Capacity Measurement on each unit. If a Phase I Measurable unit is found to be Unmeasurable in Phase II, the customer may decline to have it treated, by rule or by real-time decision, making it a Field-Declined Unit[10].

Treatment and Capacity Measurement involves the following eight steps. They must be performed when

unit is warmed up and running at full capacity. Ambient temperatures in the high 90s are most desirable:

1. Measure and record Pre-Treatment current and voltage for all Lines of the unit's power supply, and compute Pre-Treatment power draw, in kW, using standard formulas and an assumed power factor[11] or one provided by the Customer.
2. Compute Pre-Treatment Capacity, in Tons using GUE Field Capacity Measurement Protocol.
3. Confirm that the unit is Capacity Qualified (or not) based on Pre-Treatment Capacity measurement. If the unit is not Capacity Qualified, give the Customer the opportunity to not treat the unit by rule or by real-time decision, making it a "Field Declined Unit".
4. Measure suction and discharge pressures on each compressor.
5. Insert the ProaTEQ additive into suction line of each compressor.
6. Wait approximately 30 minutes for ProaTEQ to coat all the unit's internal heat transfer surfaces.
7. Measure and record Post-Treatment current and voltage for all Lines of the unit's power supply and compute the Post-Treatment Power draw, in kW, as in step 1.
8. Compute Post-Treatment Capacity using GUE Field Capacity Measurement Protocol

On completion of these steps, the data from these measurements will be stored in a deliverable database.

Also, each unit will be assigned to a "Final Condition Class" for purposes of Payment, Analysis, and Guarantee Administration under Phase IV. To the extent any units changing class cause a price increase, GUE will advise the Customer.

Phase III: Analysis, Modeling, and Reporting. The database developed in Phase II will be subject to two types of analyses, as described below.

Analyses Supporting Capacity and Performance Guarantees. For all Treated and Measurable Units,[12] the following computations are performed:

1. The Aggregate Pre-Treatment (signified by the subscript i for "initial") Capacity will be computed (AC_i). This will be the sum of the Pre-Treatment Capacity (C_i) over all units.
2. The Aggregate Post-Treatment (signified by the subscript f for "final") Capacity will be computed (AC_f). This will be the sum of Post-Treatment Capacity (C_f) over all units.
3. The Change (denoted by the Greek letter delta, Δ) in Aggregate Capacity and the Percentage change in Aggregate Capacity will be computed:

$$\Delta(AC) = AC_f - AC_i$$
$$\Delta(AC)Pct = 100 * (\Delta(AC) / AC_i)$$

4. The Aggregate Pre-Treatment power (kW) draw will be computed (AkW_i). It will be the sum of the Pre-Treatment kW draw (kW_i) over all units.
5. The Aggregate Post Treatment power (kW) draw will be computed, (AkW_f). It will be the sum of Post Treatment power draw (kW_f) over all units.

The Fleet Aggregate Performance, in kW/Ton, and the percentage change in fleet aggregate Performance are:

$$AP_i = AkW_i / AC_i$$
$$AP_f = AkW_f / AC_f$$
$$\Delta(AP) = AP_f - AP_i$$
$$\Delta(AP)Pct = 100 * (\Delta AP / AP_i)$$

Analyses Supporting Payback Guarantee. The following analyses are done for units with final Condition Class of Treatable, Measurable and Capacity Qualified.

GUE will model the pre-treatment annual energy use (AQ_i) and annual operating cost (AOC_i), and the post treatment annual energy use (AQ_f) and annual operating cost (AOC_f)[13]. The annual energy use and operating cost will be summed over all units.

(AAQ_i) is the Aggregate Annual Pre-Treatment Energy Use; that is the sum of the (AQ_i) over all units. ($AAOC_i$) is the Aggregate Annual Pre-Treatment Operating Cost, the sum of Pre-Treatment Annual Operating Cost over all units. (AAQ_f) and ($AAOC_f$) are the comparable aggregate Post-Treatment quantities.

The "Hard Dollar Savings", per year, is the Change in Aggregate Annual Operating Cost, or Δ(AAOC), where:

$$\Delta(AAOC) = AAOC_i - AAOC_f$$

That is, the Change in Aggregate Annual Operating Cost is the difference between the Aggregate Annual

Operating cost before treatment and the Aggregate Annual Operating Cost after the treatment.

On completion, all data computed here will be reported to the Customer in a Final Report.

Phase IV: Final Price Adjustment. In Phase IV, the Base Price from Phase I will be subject to adjustment due to the findings of Phases II and III. These may be increases (as in when an Untreatable unit is re-classified as Treatable) or reductions (as in when a Treatable unit is Field Declined, A Treatable unit is found Untreatable, etc.). The Base Price may also be reduced as the result of a credit generated via the guarantee process. The guarantees are detailed below.

The Capacity Guarantee states that for all Treatable and Measurable Units, the ***Aggregate Capacity will increase by at least ten percent (10%).*** That is:

$$\Delta(AC)Pct \quad \geq \quad 10\%$$

The Performance Guarantee states that for all Treatable and Measurable Units, ***the Aggregate kW/Ton Performance of the fleet improves (is reduced) by at least ten percent (-10%).*** That is:

$$\Delta(AP)Pct \quad \leq \quad -10\%$$

If either guarantee is unmet, a credit will be based on the largest shortfall. The shortfall, as a percent of the goal, defines the credit, as a percent of the project price[14].

As an example, if there is a 1% shortfall in Capacity and a 2% shortfall in Performance, the larger will be used. Since a 2% shortfall is 20% of the 10% goal, then the project price is reduced by 20% of the Base Price.

The Payback Guarantee applies only to the Capacity Qualified units, and the base for computing any Payback Guarantee Credit is limited to the Treatment Cost of the Capacity Qualified Units only. This cost is represented symbolically by TCCQU.

The Payback guarantee states that ***the Change (Reduction) in Aggregate Annual Operating Cost, Δ(AAOC), "the Hard Dollar Savings", will be large enough that the Treatment Cost of Capacity Qualified Units (TCCQU) will be fully recovered in three years or less.*** That is:

$$\Delta(AAOC) \quad \geq \quad TCCQU / 3$$

The Payback Guarantee Credit is computed as follows. If the Δ(AAOC) is less than one third the Treatment Cost of Capacity Qualified Units, GUE will issue a credit that reduces the TCCQU until it is less than 3 times the Δ(AAOC). This guarantees a 3-year payback on the Treatment Cost of Capacity Qualified Units.

The final Customer Invoice will be the Base Price, net of any Condition Class changes, Field Declines, Field Decline Charges, and less any credits for Capacity, Performance, or Payback Guarantees.

Conclusion. Georgetown Utilities Enterprise, LLC puts "Skin in the Game". GUE provides its Customers the best deal in the Energy Services Business. As noted previously, GUE offers four specific guarantees:

1. ***There will be no damage to the Customer equipment due to using our products and services***. Any damage found attributable to our product or services will be compensated to the terms and limits of our insurance coverage[15].
2. ***Fleet Capacity, in Tons, over all Treated Units, will increases by at least 10%.***
3. ***Fleet Performance, in kW/Ton, over all Treated Units, will be improved (reduced) by at least 10%.***
4. ***For Units that have experienced significant Oil Fouling, but currently meet the load most of the time, referred to as "Capacity-Qualified Units", GUE will guarantee a three-year payback on the ProaTEQ Treatment Cost.***

We know of no other Energy Services Company, of any size, any brand, or any scope offering a guarantee as good as ours.

Contact GUE. Persons interested in learning more about GUE or ProaTEQ or our past projects, can contact Patrick McCarthy, Senior Vice President at Georgetown Utilities Enterprise, LLC. Phone at (301) 529-6647 (Mobile) or (301) 926-7886 (Office). Email at pmccarthy@georgetownutilities.com. Or visit our web site at www.georgetownutilities.com.

GUE is a small, minority-owned business, licensed in New Hudson, MI, with offices in VA and MD. GUE is an 8a business under the US Small Business Administration Act, and a member of the US Minority Supplier Development Council.

END NOTES

[1] ProaTEQ™ is a registered Trademark of EnSaTEQ, Inc. of Woodville, AL. Georgetown Utilities Enterprise, LLC has been a licensed retailer of ProaTEQ since 2006.

[2] "A Survey of Refrigerant Heat Transfer and Pressure Drop Emphasizing Oil Effects and In-Tube Augmentation". ASHRAE Winter Symposium, 1987. Schlager, Pate, and Bergles.

[3] "Chemical Industry Case Study – January 2016". Technical Paper by Georgetown Utilities Enterprise, LLC. New Hudson, MI. Copyright, Georgetown Utilities, LLC. Jan. 2016.

[4] It is important to note that older units lose capacity due to reasons other than oil fouling. ProaTEQ does not address such issues and thus is not expected to restore capacity lost due to such other factors.

[5] In a pilot test of a 50-Ton unit, the capacity improvement relative to the fouled unit was about 29%. The kWh reduction in load bins where the load was being met by the fouled unit, was also 29%. The overall kWh and energy cost reduction, including bins with Met Loads and bins with Unmet Loads that Became Met was about 19%. The Total Operating Cost reduction, including Demand Charges that were only marginally impacted plus the kWh and energy cost reduction, was about 11%. See "Chemical Industry Case Study", cited in note 3 above.

[6] GUE carries $5 million business liability insurance and $1 million Professional Liability. EnSaTEQ, the manufacturer of ProaTEQ, carried $2 million product liability insurance. In use since 1998, ProaTEQ has never had a valid equipment liability claim against it. Having done ProaTEQ installations since 2006, GUE has never had a claim against it for any Customer equipment damage.

[7] Base prices include two Crew Days of Travel to locations within an 800-mile radius of Knoxville, TN. Work in a 1,600-mile radius will require an extra 2 Cred-Days of travel; work in the CONUS in a 2,500-mile radius will require and extra 4 Crew-Days of travel

[8] The GUE Field Capacity Measurement Protocol is as follows:

- Ensure unit is warmed up, and running at full capacity
- Measure wet bulb temperature in supply and return air streams
- Look up enthalpy in supply and return from psychrometric table
- Measure air velocity at three points across supply air channel; average measurements for air flow speed (ft./min)
- Compute CFM from ft./min air speed times air flow cross sectional area
- Compute Capacity, in TONS, Using:

$$\text{TONS} = (\text{BTU/HR})/12{,}000$$
$$= (\rho * 60 * \text{CFM} * \Delta H) / 12{,}000$$

Where:

ρ	=	specific density of dry air, 0.0765 lbm/cubic foot (CF)
60	=	conversion from minutes to hours (60 min/hr)
CFM	=	air flow rate in cubic feet per minute
ΔH	=	change in specific enthalpy Hreturn – Hsupply (Btu/lbm)
12,000	=	Conversion from Btu/hr to Tons of Refrigeration

[9] The objective here is to identify units that have experienced sufficient Oil Fouling that the ProaTEQ treatment will have significant improvement effect, yet not so impaired by other factors that ProaTEQ will not improve it enough to deliver attractive payback. At 5 years of age, a copper-coiled unit will experience sufficient oil fouling to enable solid improvement from ProaTEQ treatment. Aluminum coil units are known to foul more quickly, may be sufficiently fouled at 3 years or less to benefit. It is noted that ALL units will benefit from ProaTEQ treatment; but for the benefit to be large enough to guarantee three-year payback, the "sweet spot" is Aluminum coil units 3 years old and up to 40% capacity loss, and Copper coil units 5 years old and up to 40% capacity loss.

[10] In Phase II, when units are opened, inspected, and Capacity is measured, some units are expected to be re-classified, based on GUE's experience. For example:

- ***Untreatable to Treatable, or vice versa***: A unit deemed Untreatable in Phase I may have been repaired by the time of Phase II, and thus Treatable. An older unit deemed Treatable at Phase I may have failed and be Untreatable at Phase II.
- ***Billing and Reconciliation***: Units receiving final Condition Class of Untreatable will not be billed. Units changing from Untreatable to Treatable will be Treated and billed. Any changes in Price resulting from changes in Treatable or Untreatable Condition Classes will be addressed in Phase IV.
- ***Measurable to Unmeasurable or vice versa***: A unit deemed Measurable on initial, external, visual inspection in Phase I, may be found to be Unmeasurable in Phase II. Supply or Return channels may be inaccessible, making it impossible to perform the GUE Protocol. On opening, air flow may be far below normal, due to fan problems, rendering the GEU procedure unreliable, etc.
- ***Statistics for Unmeasurable units***: For purposes of Capacity and Performance guarantees, computations based on Measurable units will apply to all Treated units whether Measurable or not.
- ***Field Decline for Unmeasurable Units***. For a unit found in Phase II to be Unmeasurable, the Customer may decline to treat it, avoiding Treatment Cost, though incurring Field Decline charge. This may be done by rule or real-time field decision. If the latter, the Customer must provide staff available to make such decisions at the time of measurement.
- ***Capacity Qualified to Not Capacity Qualified, or vice versa***: In Phase I units will be deemed Capacity Qualified, or not,

based on age alone. Actual Capacity measurements in Phase II will refine those classifications.

- ***Field Decline due to Capacity Qualification***: For a unit found to be not Capacity Qualified, and thus not included in the Payback Guarantee, the Customer may decline to treat it, avoiding the Treatment Cost, rendering it a Field-Declined unit. This may be done by rule or real-time decision. If the latter, Customer staff must be available for timely decisions.
- ***Field Decline Limits and Charges***: The Base Price Schedule contains a nominal charge of $20/Ton for opening and measuring units that are Field Declined. Field Declines of more than twenty percent (20%) of the Tonnage comprising the Base Price is considered a Cardinal Change and may result in an increase in the Per-Ton unit price used in the Phase I the Base Price development.

[11] The kW is estimated from volt and amp measurements, by averaging the (nearly identical) line voltages, then using:

$Vp = V_L/1.73$; and
$Pp = Vp * Ip * PF$

Where:
Pp = Power on each phase, p
Vp = Phase voltage computed as above from measured line voltages
Ip = Phase current, measured
PF = Power factor, assumed 0.85 unless otherwise specified by the Customer

Then:
Power = kW = Σp (Pp)

The Total Power (kW) is the sum of the phase power values summed over the three phases.

[12] Every unit that is Treated and Measured, whether Capacity Qualified or not, is in these computations.

[13] The modeling for Annual energy use and annual avoided Operating Cost will be done using the GUE Bin Model. Technical documentation on that model is available on request.

[14] The basis for computing these credits will include all Treatment charges, but will exclude charges for Field Declined units.

[15] See Note #6 above, which details insurance coverages.