

Sun Eco Assessment Service - Advanced

Thailand

1. Scope

In this fixed price service, Sun will make commercially reasonable efforts to provide Customer with a Sun Eco Assessment Service for Data Center – Advanced ("Service"). The Service includes a data center evaluation of existing environmental conditions, identification of design or implementation areas in need of improvement, and development of a plan for helping to optimize energy usage, cooling and general environmental conditions at the facility.

2. Tasks and Deliverables

2.1 Pre-Visit Data Collection

- During the planning stages, and prior to a visit at Customer's site, data regarding the Subject Area (as defined in Section 4 below) and the site in general will be collected through questionnaires and telephone interviews (as available and appropriate).

2.2 Site visit

- Sun will conduct a visit at Customer's site to collect the information necessary to provide the Service. The site visit for this Service will typically require one (1) to two (2) engineer days on site. This may be accomplished with one person for two days or two people for one day. If the site visit requires multiple days, these will typically be consecutive days. The Service may also be provided on non-consecutive days, under certain circumstances, as agreed by the parties.
- The site visit will be scheduled for mutually convenient times and dates. Site visits must be scheduled and confirmed with a minimum of sixteen (16) calendar days advance notice before the proposed date. All scheduling considerations will be decided at the discretion of Sun with the appropriate Customer approval. Any requests for modification of the schedule by Customer must be approved by Sun.

2.3 Assessments

2.3.1 General Site Data & Future Planning Assessment. Sun will provide the following assessments:

- **Visual Examination of the Subject Area.** This Service includes the collection and documentation of critical site information and compilation of this information in a single, illustrated resource that includes both technical data and executive-level explanations to facilitate Customer's decision-making process. Inspections of all aspects of the Subject Area will be conducted. This includes the subfloor void, ambient equipment space, ceiling void, ancillary rooms, infrastructure support rooms and associated spaces. Conditions are documented and areas of concern are noted.
- **Data Center Preferred Practices.** The facility is evaluated in relation to industry-recognized preferred practices, consensus and compliance standards, manufacturer specifications and field-verified methodologies (as described in Section 4, below). Areas covered will range from desired conditions and Subject Area design to general cleaning and maintenance. Anything that could affect the cooling efficiency, power consumption, space utilization or hardware availability may be included at Sun's discretion. References are modified as necessary based on industry or geography. General and specific references are discussed with the Customer and included in associated project documentation.
- **Monitoring & Maintenance.** Sun will examine existing monitoring capabilities to identify areas where improvements in either design or utilization may facilitate operation of a more stable and efficient facility. The evaluation will examine the design of the the existing data center monitoring system in an effort to determine whether it has the capability to perform as intended. In addition, the utilization of the system will be examined to determine whether site personnel are maximizing utilization of the system. Critical alarms trending and predictive analysis capabilities and utilization are also evaluated. The examination of the monitoring system will include evaluation of areas such as sensor location, critical

alarm thresholds, trending, use policies and other factors that can affect the capability and utilization of the system.

- Future Planning Considerations: All data from the assessment is evaluated with regard to its effects on existing conditions, what short-term measures can be implemented to optimize the existing infrastructure and what effects it will have on long-term planning. Discussions with site personnel will be used to determine future planning requirements.

2.3.2 Cooling & Air Distribution Assessment. Sun will provide the following assessments:

- Temperature & Relative Humidity Subject Area (T&RH) Profiles. The T&RH profiles are used for evaluation of existing conditions and as a baseline for trending and optimization. The profiles are evaluated against relevant industry preferred practices, hardware specifications and Customer-defined Subject Area goals. The profile locations are determined by the Sun on-site engineers based on numerous factors such as Subject Area size and shape, air conditioner placement and computer equipment type and arrangement. The profile is generated to document representative hardware intake conditions across the Subject Area. Issues such as hot-spots or high heat density hardware are also identified and evaluated.
- Temperature & Relative Humidity Measurements at Hardware Intakes. This data documents conditions at the intakes of the actual hardware. Measurements are typically multi-point, and may include intake or exhaust conditions, as appropriate to the particular evaluation. Measurements at the computer hardware intakes are used to document conditions and identify areas in need of improvement. Analysis will analyze problem areas such as air bypass, inappropriate recirculation and inefficiencies in design or implementation.
- Temperature & Relative Humidity Data Logging. T&RH data will be recorded over time at strategic locations in the data center. This evaluation will take place both during the site visit, and also for a one (1) to two (2) week period before or after the site visit. This data is used to analyze the functioning of air conditioners, the influence of outside sources (such as make-up air) and other factors related to both energy usage and availability.
- Conditioned Air Distribution Efficiency Assessment. This evaluation includes airflow assessment from the air conditioners to the final distribution at the hardware, including all airflow in between. Cooling short cycles, air distribution tile placement, hardware alignment, influences on control sensors and similar issues are examined and evaluated. For most Subject Areas, air distribution tiles and cable cutouts are evaluated and compared to available capacity to determine potential recovery air conditioner capacity for more efficient cooling and energy utilization. Where alternate designs are used, the approach is modified as necessary.
- Environmental Support Equipment Design and Installation Assessment. The design of the environmental support equipment providing cooling to the computer room is assessed in relation to site-specific conditions and computer hardware requirements.
- Perimeter Integrity Inspection. This examination looks for breaches in the Subject Area perimeter that can undermine air distribution or allow for moisture migration and contaminant infiltration.
- Contaminant Source Identification. This Service includes examinations of the physical Subject Area, air conditioner filters, outside air systems, operator activity, construction policies and procedures and other factors that can affect the contaminant profile of the Subject Area. Airborne particulate concentrations measurements in the ambient space and supply airflow are recorded. Measurements are also recorded at any points of influence.

2.3.3 Energy Distribution, Usage & Quality Assessment. Sun will provide the following assessments:

- Electrical & Cooling Load Calculations. The general electrical load of the Subject Area data center is evaluated and a total load is calculated. Factors associated with sources of heat load are calculated in

relation to available cooling capacities, and are then evaluated in relation to inefficiencies in all portions of the Subject Area and supporting infrastructure. The calculations may lead to recommendations such as design modifications, elimination of extraneous influences, equipment upgrades and distribution optimizations and refreshes of the computer technology to newer and more efficient designs ("Technology Refresh"). Data is typically collected from electrical infrastructure equipment (UPS or PDU) displays or from the Building Monitoring System serving the Subject Area. In the absence of these sources, alternative approaches will be discussed with the Customer.

- **Electrical Infrastructure & Grounding Review.** This review includes examination of the redundant components and pathways built into the delivery system. Gaps in the understanding of this pathway in regard to failure points, maintenance issues, and vulnerabilities will be identified. In addition, a review of the history and evolution of the electrical support infrastructure, including any past failures or events, will be conducted. This review will include interviews with site personnel and an inspection of the electrical distribution system for the Subject Area from utility entry to final distribution. Available site drawings, prior engineering studies and historic power quality will also be reviewed.
- **Power Quality Measurements.** Real-time power measurements will be collected at strategically chosen sample points to provide a snap-shot of power quality at the point of final distribution and to help evaluate design information or identify anomalies. Measurements will typically include multi-point, short-term trending of voltage conditions at final distribution. Additional testing can be included as a service enhancement to this Service Listing, for an additional fee.
- **Actual Equipment Power Consumption.** Amp draw on selected hardware is measured through non-obtrusive means and recorded and compared to nameplate data to give a representative example of operating conditions.

2.3.4 Space & Rack Utilization Assessment. Sun will provide the following assessments:

- **Cabinet / Rack Design & Placement Assessment.** This assessment includes examination and evaluation of cabinet or rack design, arrangement of hardware within the racks or cabinets, distribution of the equipment heatload within racks, arrangement of racks in relation to each other (intake & exhaust aisles), orientation in relation to air conditioning and supplemental cabinet-level cooling.
- **Heat Density Calculations.** General heat density calculations for the Subject Area are determined. This will include both the current operating conditions as well as system limits. In addition, the Service will evaluate system load limiters, such as cooling capacity or critical power capacity. Additional calculations at the rack level are also provided for samples of targeted equipment in high-density areas in the Subject Area.

2.4 Assessment Report. Sun will provide the following to Customer:

- **Data Analysis & Report Preparation:** Following the site visit, the data collected will be analyzed and a report of findings will be prepared. The information will be analyzed both in relation to Customer's energy efficiency and availability requirements. The final report will typically be available for presentation approximately twenty-one (21) business days following the site visit.
- **Report of Findings:** The final report of findings will include a description of the work elements provided, documentation and analysis of the data and observations, graphical presentation and photo documentation (where available), specific recommendations regarding optimization of the existing environment and general observations and recommendations regarding future growth. The report will be provided in electronic format. A single shipment of up to three (3) printed copies will be provided upon request.
- **Presentation:** The assessment findings will be presented remotely via conference call after completion of the final report of findings. The findings can be presented via web meeting or in person upon request.

*Please note that portions of this Service Listing are dependent upon the availability of the data or assistance cited. In the absence of such data or assistance, the methodology and associated deliverable(s) will be modified as necessary to provide a deliverable as similar as reasonably possible within the structure of the allocated resources.

3. Customer Responsibilities

Customer will provide the following:

3.1 A project manager ("Project Manager") to:

- Provide direction and guidance to Customer as required by Sun to maintain project momentum;
- Provide information and resources in a timely manner as needed by Sun to enable Sun to provide the Service described in this Statement of Work;
- Be readily available and on-site as and when required by Sun for the duration of the Service;
- Receive any deliverables created as a result of this Service.

3.2 Adequate workspace for Sun's personnel, as well as access to telephones, copiers, faxes, conference rooms, and printing facilities as reasonably necessary.

3.3 Customer's relevant business requirements and service-level agreements.

3.4 Access to Customer personnel, including business, IT and operational staff.

3.5 Parking and access passes as required by Sun for Service delivery.

3.6 A timely response (i.e., in a time period that does not adversely affect Sun's scheduled delivery of the Service) to all of Sun's requests for information.

3.7 Timely delivery of information and support (i.e., in a time period that does not adversely affect Sun's scheduled delivery of the Service) from suppliers of non-Sun equipment and services as requested.

3.8 Any relevant operational performance standards in use by Customer related to Service delivery.

3.9 An escalation procedure in the event that Customer does not provide timely responses to Sun to enable the Service to be completed within the established time frames.

3.10 A timely response (i.e., in a time period that does not adversely affect Sun's scheduled delivery of the Service) to the review of all Service-related documentation.

3.11 Copies of Customer's relevant business, organizational, configuration and process documentation.

3.12 Facilities access and access to relevant internal and external systems as required by Sun.

3.13 Access to Customer's existing IT infrastructure.

3.14 Customer will notify Sun of any system, application, or equipment modifications known to present a potential issue, or deviations from industry standard practices.

3.15 Customer will designate a Project Coordinator who will interface with Sun and be empowered to facilitate project activities or action when requested as agreed to in the kick-off meeting.

3.16 Access to all Subject Areas and support areas. This would include not only the data center areas being studied, but also any mechanical or electrical rooms supporting the data center, and any adjoining areas exposed to the controlled environment.

3.17 Personnel familiar with the history and projected plans for the Subject Areas. A full-time escort is only necessary if it is company policy, but someone should be available to answer questions at all times during the site visit.

3.18 Personnel knowledgeable about the mechanical systems and electrical infrastructure serving the

Subject Areas. This includes any air introductions from outside the controlled environment (make-up air, fresh air, building air, shared primary air, etc.), as well as the electrical infrastructure from the utility supply to the facility to the data center (generators, UPS, PDUs, etc). Typically, 30 to 60 minutes will be needed for discussion of such mechanical systems and electrical infrastructure. Customer personnel should be available throughout the duration of the site visit to answer any questions that might arise.

3.19 The most recent floor plans available. These should include the floor grid and hardware layout, including air conditioners and other support equipment. These will be used to identify test locations, problem areas and other points of reference. Due to inclusion in the report documentation, 11X17 prints are preferred. Sun requests that these plans be emailed if reasonably possible, as it would greatly facilitate Sun's preparation of its reports. Most CADD formats are acceptable.

3.20 Appropriate Height Ladder For Ceiling Access: This will be needed to gain access to the ceiling void for inspection and to access ceiling level diffusers, where applicable.

3.21 Wheeled Cart: A cart with a work surface approximately 3 to 4 feet high and top surface area approximately 10-12 square feet will allow WES field personnel to easily maneuver test equipment through the Subject Areas. The cart should be appropriate for use in a data center.

3.22 Mechanical & Electrical Single Line Drawings. Mechanical & electrical single-line drawings, where available. Sun requests that these drawings also be emailed prior to the site visit.

3.23 Access to any historical monitoring data. Sun requests all available temperature, relative humidity, power quality and environmental support equipment monitoring data. This could be from a building monitoring system, from a system specific to the data center or from chart recorders within the room space or attached to specific hardware. Customer will make copies available for off-site examination.

3.24 Permission to take photographs. Permission to take photographs is deemed granted, unless explicitly denied by Customer. These photographs greatly enhance the descriptive quality of the report. No client names, monitor screens or other proprietary information will be photographed. All photographs are strictly confidential, and will be used solely for illustration purposes.

3.25 Assistance assembling the audience for presentation of the findings of the final report. As the presentation is a general overview of the findings, it is appropriate for the audience to include senior personnel from all groups involved in the Subject Area.

3.26 Site-specific project logistics will be arranged at the time of scheduling. Failure to provide necessary authorizations may limit the effectiveness of the Service and could, at the discretion of Sun, impact scheduling or result in the postponement of the Service.

3.27 Additional Expenses. Customer will pay for reasonable travel, accommodations, meals, and incidental expenses in the event that travel is required for Sun to conduct the on-site visit.

4. Additional Provisions

4.1 Subject Area:

- The Subject Area for the Service shall be defined as a single primary equipment room not to exceed 25,000 square feet, and up to two (2) additional ancillary or support rooms (such as operations or command center, networks, tape or storage, or similar). The total area of all rooms combined shall be 35,000 square feet. Definition of the Subject Area for the Service will be determined by Sun in its sole discretion.
- Areas housing the support infrastructure for the Subject Area are not included in the maximum limits defined above, and will be examined in Sun's sole discretion as necessary to support the service.
- All rooms must be located in the same building, and be supported by the same environmental infrastructure.

4.2 Reference Standards and preferred practices used in the Service will be as follows:

- The data and observed conditions compiled during the site visit will be evaluated in relation to applicable industry and manufacturer recommendations. These include a variety of preferred practices and compliance and consensus standards.
- Hardware Manufacturer Recommendations: Specifications used will be influenced by the specific hardware in place at the facility, as well as future planned equipment. Additional manufacturer information from Sun regarding potential energy savings from equipment refresh will also be included.
- Environmental Support Equipment Manufacturer Recommendations: Specifications used will be influenced by the environmental support equipment in place at the facility. Additional information from manufacturers not in place at the facility will be used as necessary.
- Industry Standards: The following standards are used (ASHRAE, ASTM, BSI, IEC, IEE, IEEE, ISO, NEC, NFPA, Telcordia).
- Government Standards: Relevant government codes and standards will be referenced as appropriate to the location where the Services are being provided.

This Service is subject to your existing services agreement with Sun that governs the delivery of Services. If you do not have a services agreement with Sun that would govern the delivery of Services, then Sun's delivery of Services shall be subject to the terms located at www.sun.com/sales/salesterms. This Service Listing or SOW does not constitute an offer by Sun. The Services described above are subject to availability and unless otherwise stated, are only available within the above-referenced country. Any reference to "Customer" in this Service Listing entitled to receive the Services.

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