HPE Data Center Carbon Footprint & Energy Efficiency Knowledge Base

Key Concepts and Terminology

HPE Energy Efficiency Rating (EER): A metric measuring the ratio of computational output to power consumption. Lower EER values indicate inefficient servers with high power consumption and low utilization.

HPE Power Usage Effectiveness (PUE): A ratio that describes how efficiently a data center uses energy; specifically, how much energy is used by the computing equipment in contrast to cooling and other overhead.

HPE Carbon Usage Effectiveness (CUE): A metric that incorporates carbon emissions into data center efficiency measurements. CUE = Total CO2 Emissions / IT Equipment Energy.

HPE iLO Power Management: Integrated Lights-Out technology that provides server health and remote server manageability, including power consumption monitoring and control.

HPE OneView: A converged infrastructure management platform that automates tasks and enables insight across HPE servers, storage, and networking products.

HPE Power Advisor: Tool for estimating power consumption of HPE server configurations to optimize data center planning.

HPE GreenLake: HPE's edge-to-cloud platform that offers infrastructure as a service with pay-per-use economics.

Server Utilization: The percentage of a server's total capacity (CPU, memory, I/O) currently in use.

Workload Consolidation: The process of combining multiple workloads onto fewer physical servers to increase utilization and reduce overall power consumption.

HPE Virtualization: Technology allowing multiple virtual machines or containers to run on a single physical server, improving resource utilization and energy efficiency.

HPE InfoSight: AI-driven analytics platform that predicts and prevents problems across the infrastructure stack.

Carbon Footprint and Energy Efficiency Problem Identification

High Carbon Footprint Indicators (ISO 14064 Framework)

1. **Scope 1 Emissions Excess**: Direct GHG emissions from owned or controlled sources exceeding established baselines
   - HPE backup generator usage above emergency testing scenarios
   - Refrigerant leakage from HPE cooling systems
2. **Scope 2 Emissions Excess**: Indirect GHG emissions from purchased electricity exceeding planned thresholds
   - HPE server energy consumption from non-renewable sources above 80% of total usage
   - Month-over-month emissions increases without corresponding workload growth
3. **Scope 3 Emissions Concerns**: Indirect emissions from value chain
   - HPE hardware lifecycle emissions exceeding product eco declarations
   - Excessive electronic waste generation without HPE Asset Recovery Program utilization
   - Transport emissions from unnecessary on-site maintenance

Energy Efficiency Concerns (ISO 50001 Framework)

1. **Low EER Indicators**
   - HPE servers drawing significant power (>75% of rated capacity) while maintaining low utilization (<30%)
   - HPE systems with power consumption increasing while workload remains constant
   - Older generation HPE ProLiant servers performing similar workloads as Gen11 models but consuming 40% more power
   - Idle HPE servers in active power states instead of HPE Power Regulator Dynamic Power Savings Mode
2. **Energy Waste Symptoms**
   - HPE data center PUE exceeding 1.5
   - HPE servers running at less than 20% CPU utilization while in full power mode
   - Multiple partially utilized HPE servers of the same type or function
   - HPE cooling systems operating at maximum capacity regardless of IT load

Carbon Footprint Reduction Recommendations

Critical Actions (CUE > 1.5)

1. **HPE GreenLake Adoption**:
   - Implementation: Transition to HPE GreenLake for optimized resource allocation and pay-per-use model

- Expected Impact: 20-40% reduction in Scope 2 emissions through right-sized infrastructure

2. **Critical Systems Optimization**:
   - Implementation: Identify and optimize the most carbon-intensive HPE systems using HPE InfoSight analytics
   - Expected Impact: 15-25% reduction in overall emissions from targeted systems

High Impact Actions (CUE 1.0-1.5)

1. **HPE Backup Power Management**:
   - Implementation: Optimize HPE UPS systems and reduce generator test runs
   - Expected Impact: 5-10% reduction in Scope 1 emissions

2. **HPE Cooling System Management**:
   - Implementation: Implement HPE thermal monitoring and transition to HPE liquid cooling where appropriate
   - Expected Impact: 10-15% reduction in cooling-related emissions

3. **HPE Supply Chain Emission Reduction**:
   - Implementation: Utilize HPE's carbon-neutral shipping options and eco-friendly packaging
   - Expected Impact: 5-15% reduction in Scope 3 emissions

4. **HPE Carbon Offsets Program**:
   - Implementation: Partner with HPE Financial Services for carbon offset programs
   - Expected Impact: Potential for net zero carbon operations combined with other strategies

Optimization Actions (CUE < 1.0)

1. **HPE Carbon Accounting Automation**:
   - Implementation: Deploy HPE OneView with carbon monitoring extensions
   - Expected Impact: More accurate emissions tracking and 5-10% additional reductions through precision targeting

2. **HPE Embodied Carbon Management**:
   - Implementation: Utilize HPE lifecycle assessments for all new hardware purchases
   - Expected Impact: 10-15% reduction in Scope 3 emissions through informed purchasing decisions

3. **HPE Workload Scheduling Optimization**:
   - Implementation: Deploy HPE software that schedules intensive workloads during times of lower grid carbon intensity
   - Expected Impact: 5-15% reduction in effective emissions without reducing workload

Energy Efficiency Recommendations (ISO 50001 Framework)

Critical Actions (EER < 0.3)

1. **HPE Server Decommissioning**:
   - Implementation: Shut down and remove HPE servers with consistently low utilization and high power draw
   - Expected Impact: 100% power reduction per decommissioned server
2. **HPE Workload Migration**:
   - Implementation: Transfer computational tasks from inefficient servers to more efficient HPE ProLiant Gen11 platforms
   - Expected Impact: 20-40% power reduction while maintaining same computational output
3. **HPE iLO Power Regulator Emergency Optimization**:
   - Implementation: Apply aggressive power caps to non-critical systems during peak demand using HPE iLO
   - Expected Impact: 15-25% immediate reduction in energy consumption

High Impact Actions (EER 0.3-0.6)

1. **HPE Virtualization Implementation**:
   - Implementation: Deploy HPE virtualization solutions to consolidate workloads
   - Expected Impact: Reduce physical server count by 60-80% while maintaining workload capacity
2. **HPE Hardware Upgrades**:
   - Implementation: Replace inefficient servers with HPE ProLiant Gen11 ENERGY STAR certified equipment
   - Expected Impact: New servers typically use 30-60% less energy for equivalent workloads
3. **HPE Power Management Implementation**:
   - Implementation: Deploy HPE Power Management software with custom power profiles
   - Expected Impact: 10-15% reduction in overall power consumption with minimal performance impact
4. **HPE Cooling Optimization**:
   - Implementation: Implement HPE Modular Data Center with intelligent cooling technologies
   - Expected Impact: 10-30% reduction in cooling energy consumption

Optimization Actions (EER > 0.6)

1. **HPE Continuous Monitoring**:
   - Implementation: Configure HPE InfoSight with automated energy efficiency reporting
   - Expected Impact: Early identification of efficiency degradation, typically preventing 5-10% efficiency loss
2. **HPE Advanced Cooling**:
   - Implementation: Deploy HPE Direct Liquid Cooling solutions
   - Expected Impact: Reduce cooling energy consumption by up to 40%
3. **HPE Energy Storage Integration**:
   - Implementation: Deploy HPE battery systems to optimize energy usage during peak demand periods
   - Expected Impact: 5-15% reduction in energy costs and associated emissions
4. **HPE Workload-Optimized Infrastructure**:
   - Implementation: Match specific HPE hardware to specific workload types using HPE's Workload Matching feature
   - Expected Impact: 10-20% improvement in energy efficiency through targeted resource allocation

Integration Points with HPE Server Inventory Management

HPE Monitoring and Analytics Tools

1. **HPE Power Advisor**:
   - Functionality: Estimate and monitor real-time power consumption of HPE server fleets
   - Integration: Direct import/export capabilities with HPE server inventory systems
2. **HPE OneView**:
   - Functionality: Centralized management platform for server resource allocation
   - Integration: APIs for automated inventory and power management
3. **HPE InfoSight**:
   - Functionality: AI-driven analytics platform for predictive optimization
   - Integration: Advanced reporting and anomaly detection across the server fleet

HPE Hardware Solutions

1. **HPE ProLiant Gen11 Servers**:
   - Features: Latest generation with built-in energy efficiency features, consuming up to 30% less power than previous generations
   - Selection Criteria: EnergyStar ratings and HPE eco declarations

2. **HPE Modular Data Center (MDC)**:
   - Features: Prefabricated data center with integrated cooling efficiency
   - Expected Impact: Holistic infrastructure optimization with 25-40% efficiency improvement
3. **HPE Direct Liquid Cooling Solutions**:
   - Features: Advanced cooling technology reducing cooling energy by up to 40%
   - Integration: Compatible with HPE ProLiant DL380, DL385, and Apollo systems

HPE Software Solutions

1. **HPE GreenLake**:
   - Functionality: Pay-per-use model that optimizes resource allocation based on actual usage
   - Integration: Comprehensive cloud service for HPE infrastructure management
2. **HPE Resource Pooling Software**:
   - Functionality: Automation tool for workload distribution and consolidation
   - Expected Impact: 15-30% improvement in overall resource utilization
3. **HPE iLO Advanced**:
   - Functionality: Advanced server management including power regulation and capping
   - Expected Impact: 5-15% power reduction through granular control

Implementation Process (ISO 50001 PDCA Approach)

Plan Phase

1. Calculate baseline EER for all HPE servers in the environment using HPE Power Advisor
2. Set reduction targets aligned with ISO 50001 and ISO 14064 principles
3. Identify HPE servers falling below EER thresholds using HPE OneView
4. Categorize servers by potential action (decommission, migrate, virtualize, etc.)

Do Phase

1. Implement highest-impact changes first (decommissioning, critical migrations)
2. Deploy HPE virtualization infrastructure and workload consolidation
3. Begin hardware refresh process to HPE ProLiant Gen11 servers
4. Implement HPE Power Management software and HPE iLO Power Regulator settings

Check Phase

1. Track post-implementation EER improvements using HPE InfoSight

2. Monitor for new inefficiencies using HPE OneView dashboards
3. Report energy savings and calculate ROI
4. Adjust recommendations based on observed outcomes

Act Phase

1. Update HPE server inventory policies to maintain improvements
2. Set new targets for continuous improvement
3. Schedule regular HPE energy efficiency assessments
4. Document best practices in HPE server management

Example Scenarios and Responses

Scenario 1: Critical Inefficiency

Query: "HPE ProLiant DL380 Gen10 server (SN: 2M2209L654) is showing 90% power consumption but only 10% utilization. What should we do?"

Response: "This HPE ProLiant DL380 Gen10 server has a critically low EER of 0.11. Recommended immediate actions:

1. Schedule workload migration to your available HPE ProLiant Gen11 servers in Rack B3, which offer 30% better power efficiency
2. Enable HPE iLO Power Regulator in Dynamic Power Savings Mode during migration
3. After migration, decommission this server or consider it for HPE's trade-in program

Expected power savings: 2.3kW continuous (20,148 kWh annually). Expected carbon reduction: 9.1 tonnes CO2e annually.

Would you like me to generate an HPE OneView migration plan for this server?"

Scenario 2: Moderate Inefficiency

Query: "Data center zone B shows higher power consumption than other zones despite similar workloads. What's the cause?"

Response: "Analysis using HPE InfoSight indicates Zone B is running primarily older generation servers (HPE ProLiant Gen9) with an average EER of 0.45 compared to Zone A's 0.72 (running HPE ProLiant Gen11).

Recommended actions:

1. Implement a phased hardware refresh starting with HPE ProLiant Gen9 servers B-103 through B-115, which show the lowest efficiency
2. Enable HPE iLO Power Regulator Dynamic Power Savings Mode on all Zone B servers immediately
3. Consider HPE Virtualization to consolidate workloads from older servers

Expected power reduction: 32% for equivalent workload processing. Estimated annual savings: $42,800 in energy costs and 104 tonnes CO2e.

Would you like to see the ROI calculation for implementing these HPE solutions?"

Scenario 3: Optimization Opportunity

Query: "Our HPE data center's PUE has increased from 1.3 to 1.4 over the past quarter. What could be causing this?"

Response: "Analysis of HPE cooling systems via HPE OneView indicates increased energy usage despite stable IT load. Root causes appear to be:

1. Suboptimal cooling distribution in HPE server racks
2. HPE cooling set points configured below HPE recommended guidelines
3. Several HPE ProLiant servers operating without proper airflow management

Recommended actions:

1. Implement hot/cold aisle containment in HPE racks 5-8
2. Adjust HPE cooling set points by +2°C based on HPE and ASHRAE guidelines
3. Deploy HPE Intelligent Series Racks with optimized airflow management

Expected impact: Return to 1.3 PUE with estimated annual savings of 87,600 kWh and $10,500.

Would you like implementation details for these changes from HPE Data Center Care services?"

Scenario 4: HPE GreenLake Opportunity

Query: "How can we reduce both operational costs and carbon footprint of our HPE server fleet?"

Response: "Based on your HPE server inventory analysis, transitioning to HPE GreenLake presents a significant opportunity to reduce both costs and carbon footprint.

Recommended HPE GreenLake implementation:

1. Replace 40% of your aging HPE servers with HPE GreenLake pay-per-use infrastructure

2. Implement HPE GreenLake workload optimization for your database and virtual desktop environments
3. Utilize HPE GreenLake's built-in power management and capacity planning

Expected impacts:

- 35% reduction in energy consumption
- 42% reduction in carbon footprint
- 28% reduction in total cost of ownership over 3 years
- Enhanced compliance with ISO 50001 and ISO 14064 standards

Would you like me to provide an HPE GreenLake migration assessment for your environment?"

HPE-Specific Best Practices for Energy Efficiency and Carbon Reduction

HPE Server Configuration Optimization

1. **HPE BIOS Settings**:
   - Implementation: Configure HPE Power Profile in BIOS to "Dynamic Power Savings Mode"
   - Expected Impact: 5-15% power reduction with minimal performance impact
2. **HPE iLO Settings**:
   - Implementation: Enable HPE iLO Power Regulator, Power Capping, and Dynamic Power Capping
   - Expected Impact: 10-20% power reduction during non-peak periods
3. **HPE Smart Storage Power Management**:
   - Implementation: Enable HPE Smart Storage power management for drive spin-down
   - Expected Impact: 3-8% reduction in storage-related power consumption

HPE Data Center Design Optimization

1. **HPE Intelligent Rack Infrastructure**:
   - Implementation: Deploy HPE racks with intelligent power distribution and monitoring
   - Expected Impact: 5-10% improvement in rack-level energy efficiency
2. **HPE Thermal Logic Technologies**:
   - Implementation: Implement HPE's thermal management solutions across the data center
   - Expected Impact: 10-25% reduction in cooling-related energy consumption
3. **HPE Power Discovery Services**:
   - Implementation: Implement automated power topology mapping and monitoring

- Expected Impact: 3-7% improvement in power distribution efficiency

HPE Lifecycle Management

1. **HPE Asset Recovery Services**:
   - Implementation: Utilize HPE's eco-friendly decommissioning services
   - Expected Impact: Reduced Scope 3 emissions and potential financial returns on retired equipment
2. **HPE Technology Refresh Programs**:
   - Implementation: Systematic replacement of servers older than 4 years
   - Expected Impact: 30-60% energy efficiency improvement per refreshed server
3. **HPE Circular Economy Solutions**:
   - Implementation: Participate in HPE's product reuse and recycling programs
   - Expected Impact: Reduced embodied carbon footprint and extended product lifecycles

HPE-Specific Software Tools for Energy Efficiency Management

HPE OneView Energy Management

1. **Power Monitoring Features**:
   - Implementation: Configure automatic power monitoring for all HPE servers
   - Usage: Track real-time and historical power usage trends
2. **Thermal Monitoring**:
   - Implementation: Set up thermal maps and alerts for HPE server racks
   - Usage: Identify hot spots and cooling inefficiencies
3. **Capacity Planning**:
   - Implementation: Use HPE OneView capacity planning for future server deployments
   - Usage: Ensure optimal energy efficiency for new infrastructure

HPE InfoSight Energy Analytics

1. **Predictive Analysis**:
   - Implementation: Enable HPE InfoSight predictive analytics for power consumption
   - Usage: Anticipate power issues before they affect efficiency
2. **Efficiency Benchmarking**:
   - Implementation: Compare server efficiency against HPE global fleet averages

- Usage: Identify underperforming servers relative to similar configurations

3. **Recommendation Engine**:
   - Implementation: Implement HPE InfoSight's automated efficiency recommendations
   - Usage: Receive actionable insights for specific servers and clusters

HPE iLO Advanced Power Management

1. **Dynamic Power Capping**:
   - Implementation: Configure HPE iLO dynamic power capping based on workload
   - Usage: Automatically adjust power limits based on real-time utilization

2. **Server Power Scheduling**:
   - Implementation: Set up power schedules for non-critical HPE servers
   - Usage: Automatically power down or reduce consumption during off-hours

3. **Power Alerting**:
   - Implementation: Configure alerts for servers exceeding efficiency thresholds
   - Usage: Receive notifications when servers fall below EER thresholds

HPE Product-Specific Energy Efficiency Features

HPE ProLiant Gen11 Servers

1. **HPE Intelligent System Tuning**:
   - Feature: Automatically optimizes server performance per watt
   - Expected Impact: 5-15% energy efficiency improvement

2. **HPE Workload Matching Profiles**:
   - Feature: Pre-configured optimization profiles for specific workloads
   - Expected Impact: 10-20% improvement for targeted applications

3. **HPE Persistent Memory**:
   - Feature: Reduces storage I/O power requirements
   - Expected Impact: 5-10% energy savings for memory-intensive workloads

HPE Apollo Systems

1. **HPE Apollo Power Shelves**:
   - Feature: Highly efficient power conversion and distribution
   - Expected Impact: 94%+ power efficiency (compared to 85-90% for standard PSUs)

2. **HPE Apollo Advanced Cooling**:
    - Feature: Direct liquid cooling options for high-density environments
    - Expected Impact: Up to 40% reduction in cooling-related energy
3. **HPE Apollo Density Optimization**:
    - Feature: Maximum compute capacity per rack unit
    - Expected Impact: 25-45% reduction in data center space requirements

HPE Synergy Composable Infrastructure

1. **HPE Synergy Composer**:
    - Feature: Automated workload-based resource composition
    - Expected Impact: 20-30% improvement in resource utilization
2. **HPE Synergy Frame Power Management**:
    - Feature: Intelligent power distribution across compute modules
    - Expected Impact: 10-20% power savings through dynamic allocation
3. **HPE Synergy Image Streamer**:
    - Feature: Stateless computing with fast deployment
    - Expected Impact: 15-25% efficiency improvement through workload mobility