**Date last modified/updated:** Click here to enter a date. **Internal audit:** Click here to enter a date.

**Who last modified/updated:** Click here to enter text. **Management review:** Click here to enter a date.

**This part of the Navigator Playbook is completed when you have:**

1. **Determined what data or information is needed to establish trends in EnMS performance, including trends in nonconformities, corrective actions, and results in monitoring and measurement, internal and external audits, and evaluations of compliance with applicable energy-related legal and other requirements.**
2. **Determined what data or information is needed to monitor, measure, analyze and evaluate the results of the EnMS and its effectiveness as related to the intended outcomes of your EnMS and the strategic goals and priorities of your organization.**
3. **Determined the methods to be used, when the monitoring and measurement will be done, and when the results will be analyzed and evaluated.**
4. **Implemented the monitoring, measurement analysis of EnMS performance and the evaluation of EnMS effectiveness.**
5. Determine what data or information is needed to establish trends in EnMS performance, including trends in nonconformities, corrective actions, and results in monitoring and measurement, internal and external audits, and evaluations of compliance with applicable energy-related legal and other requirements.

|  |  |  |
| --- | --- | --- |
| ☒ | We have established a process for determining the results of the management system and for connecting these results back to top management’s expectations and the organization’s strategic direction and priorities. | Conducted on quarterly basis |
| ☒ | These expectations and priorities include:  | Items checked below |

☒ Cost savings

☒ Reduction of CO2 emissions

☐ Reduced risks to security of energy supply

☐ Improved community relations

☒ Other Guest satisfaction

☒ Other Local laws/regulations

|  |  |  |
| --- | --- | --- |
| ☒ | We have evaluated the effectiveness of the EnMS using the performance evaluation and improvement processes of the EnMS as outlined below: | Items checked below |

☒ Monitoring, measurement and analysis (this task).

☒ Evaluating compliance with the applicable energy-related legal and other requirements (People and Legal Requirements Affecting the EnMS task).

☒ Performing internal audits to provide information on whether the EnMS is effectively implemented and maintained (Internal Audits task).

☒ Management review of the EnMS’s ongoing suitability, adequacy, effectiveness and alignment with the strategic direction of the organization (Management Review task).

☒ Finding and fixing nonconformities and problems in the management system (Corrective Actions task).

|  |  |  |
| --- | --- | --- |
| ☒ | We have developed trend information on EnMS performance and prepared it for review by top management and evaluation of EnMS effectiveness. This trend information includes: | Items checked below |

☒ Nonconformities

☒ Corrective actions

☒ Monitoring and measuring results

☒ Results of EnMS internal audits

☐ Results of EnMS external audits (if applicable)

☒Results of evaluations of compliance with applicable energy-related legal and other requirements

*The following worksheet can be useful in identifying the compliance evaluation trend information, along with other data and metrics related to trends in EnMS performance that will be monitored, measured and analyzed for management review and the evaluation of the EnMS effectiveness.*

Monitoring and Measurement of Key Characteristics Planning Worksheet

**Date:** 7/31/21 **Prepared by:** Director of Engineering

**Key Characteristic: Energy sources, Current energy use and consumption**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Energy Source/****Energy Use/****Energy Consumption** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Electricity | Engineering | Utility bills and installed submeters | Monthly | Energy management information system, once it is installed; supplemented by manual review | Annual calibration per manufacturer instructions |
| Natural Gas | Engineering | Utility bills | Monthly | Energy management information system (EMIS), once it is installed; supplemented by manual review | None – utility-grade meter |
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**Key Characteristic: Significant energy uses**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Significant Energy Use** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Chillers | Engineering | Building Management System (BMS) trends | Daily | Automated monitoring of kW/ton | Flow meter tested on annual basis |
| Boilers | Engineering | BMS trends | Daily | Manually currently, but incorporating trends into BMS or EMIS | Monitoring points reviewed as part of annual boiler tune-ups |
| Kitchen operations | Food & Beverage | Submetering | Weekly | Manual review in spreadsheet | Power monitoring equipment checked annually |

**Key Characteristic: Variables affecting significant energy uses**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Significant Energy Use Variable** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Outside air temperatures | Engineering | Reviewed in BMS and nearby weather station | Daily (sometimes hourly) | BMS (or EMIS) trends | On-site weather station compared to nearby airport for anomalies |
| Occupancy rates | Operations | Reservation management software | Daily | Trends from reservation management software | None |
| Food & beverage covers | Food & Beverage | Reservation management software | Daily | Trends from reservation management software | None |

**Key Characteristic: Future energy use and consumption of the significant energy uses**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Future Energy Use/Consumption** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Chillers | Engineering | BMS trends | Daily | Automated monitoring of kW/ton | Flow meter tested on annual basis |
| Boilers | Engineering | BMS trends | Daily | Manually currently, but incorporating trends into BMS | Monitoring points reviewed as part of annual boiler tune-ups |
| Kitchen operations | Food & Beverage | Submetering | Weekly | Manual review in spreadsheet | Power monitoring equipment checked annually |

**Key Characteristic: Energy Performance Indicators (EnPIs)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EnPI** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Electricity use per occupied room | Engineering | Sustainability Tracker | Monthly | Energy management information system (EMIS), once it is installed; supplemented by manual review | Annual calibration per manufacturer instructions |
| Natural gas use per occupied room | Engineering | Sustainability Tracker | Monthly | Manual review | None – utility-grade meter |
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**Key Characteristic: Action plan completion and effectiveness in achieving objectives and targets**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Action Plan/****Objectives and Targets** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Reduce electrical consumption per occupied room by 4% from the 2019 baseline at the end of Q4 2021 | Engineering | Sustainability Tracker | Monthly | Energy management information system, once it is installed; supplemented by manual review | Annual calibration per manufacturer instructions |
| Reduce natural gas consumption per occupied room by 3% from the 2019 baseline at the end of Q4 2021 | Engineering | Sustainability Tracker | Monthly | Manual review | None – utility-grade meter |
| Improve our Energy Star score by 3 points over calendar year 2021 | Engineering | Energy Star Portfolio Manager | Monthly | Manual review | N/A |
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**Key Characteristic: Prioritized energy performance improvement opportunities**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Energy Improvement Opportunity** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Upgrades to site building management system | Engineering | Utility meters and submeters | Monthly | EMIS, once installed, supplemented by manual review | Annual calibration per manufacturer instructions |
| Conversion of all lighting to LED | Engineering | Submeters and BMS | Monthly | EMIS, once installed, supplemented by manual review | Annual calibration per manufacturer instructions |
| Purchase of Energy Star-rated kitchen equipment | Food & Beverage | Submeters | Monthly | EMIS, once installed, supplemented by manual review | Annual calibration per manufacturer instructions |
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**Key Characteristic: Actual vs. expected energy consumption**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Actual vs. Expected Energy Consumption** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Electricity | Engineering | Sustainability Tracker | Monthly | Manual review | None – utility-grade meter |
| Natural gas | Engineering | Sustainability Tracker | Monthly | Manual review | None – utility-grade meter |
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1. Determine what data or information is needed to monitor, measure, analyze and evaluate the results of the EnMS and its effectiveness as related to the intended outcomes of your EnMS and the strategic goals and priorities of your organization.

|  |  |  |
| --- | --- | --- |
| ☒ | We reviewed the outcomes, strategic goals and issues that were developed in the task addressing An EnMS and Your Organization. | Yes. See Task 1 Playbook |
| ☒ | We developed metrics for the EnMS that align with and support these outcomes, goals and priorities.  | Yes. See Task 11 & 12 Playbooks |
| ☒ | We have obtained input from top management as appropriate. | Yes, as part of Management Review and monthly progress meetings |

1. Determine the methods to be used, when the monitoring and measurement will be done, and when the results will be analyzed and evaluated.

☒ We have determined the monitoring and measurement methods to be used and when to evaluate results.

*The following worksheet can be helpful in determining and capturing when monitoring and measurement will be done and when results will be analyzed and evaluated. These results will help support your consideration of the timing of internal audits, compliance evaluations, strategic planning and management reviews.*

Energy Measurement Plan Worksheet

Using the output from the Monitoring and Measurement of Key Characteristics Planning Worksheet, complete the following worksheet to develop your Energy Measurement Plan.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **System/ Process/ Equipment and Location** | **What data is collected?** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **Who is responsible for monitoring and measurement?** | **What calibration is required?** | **What operational control/ maintenance/ design procurement action or action plan is it linked to?** | **Where is data recorded?** | **How is data analyzed?** | **What significant deviation requires action?** | **How does this demonstrate performance?** |
| Chillers | kWh & kW/ton | Submetering and BMS trends | Daily | Engineering | Annual per manufacturer instructions | Operational controls for chiller operations | Engineering shared drive | BMS chiller plant module | kW/ton >10% of annual average based on temperature | When normalized, indicates performance versus baseline |
| Boilers | Natural gas input (MMBtu) | Submetering and BMS trends | Daily | Engineering | Flow meter tested annually | Operational controls for boiler operation | Engineering shared drive | BMS boiler plant module | Predictive model based on outside air temps | When normalized, indicates performance versus baseline |
| Kitchen equipment | kWh and MMBtu per equipment | Submetering | Monthly | Food & Beverage | Annual per manufacturer instructions | Operational controls for kitchen operations | Food & Beverage standard operation procedures | Manual review | Full load equipment performance outside specs by >10% | Demonstrates equipment is functioning as intended |
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1. Implement the monitoring, measurement analysis of EnMS performance and the evaluation of EnMS effectiveness.

☒ We performed our compliance evaluations as prescribed under the task guidance for Legal Requirements Affecting the EnMS and all necessary information has been collected.

☒ We initiated the collection, monitoring, measurement and analysis of the information needed to develop trend in the results and have implemented these as an integral part of the compliance evaluation process.

☒ We implemented the monitoring and measurement activities needed to analyze the results related to specific strategic goals and priorities and the achievement of specific intended outcomes.

☒ We have recorded all of our monitoring and measurement activities and are retaining them as documented information.

Hint: Monitoring

* This task draws heavily on information gathered in the Energy Review, so make sure all data is well documented and organized.
* Continual improvement for this task means that there is no set order to monitoring SEUs, relevant variables, action plans, improvement opportunities, and improvement projects.
* Key characteristics can be used to assess the performance of other key characteristics, such that improvement projects can be monitored by evaluating SEU performance.

☒ We are monitoring our implemented projects and have listed details below:

(Note: Table may be modified to accommodate unique criteria)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Implemented Project | When implemented | SEU addressed | Baseline Consumption | Monitoring plan/methods | SEU Performance Improved? | Action Plan changes | Improvement opportunities Identified |
| Chiller upgrade | 3/31/2021 | Chillers | 1,100,000 kWh/yr | Chilled water trending through submeters | Yes | None | Update operational controls |
| LED lighting | 1/31/2022 | Lighting | 1,000,000 kWh/yr | Spot power metering; BMS | Yes | None | Optimize occupancy sensors |
| Air handling units | 9/30/2021 | HVAC | 3,000,000 kWh/yr | Spot power metering; monitor BMS trends | Yes | None | Optimize outside air intake |
|       |       |       |       |       |       |       |       |
|       |       |       |       |       |       |       |       |

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Top Management Approval

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| ☐ | Date approved: | Click here to enter a date. |
| ☐ | Who approved: | Click here to enter text. |

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