



Energy Management System Manual
50001 Ready – 2018 Version
General Motors Corporation



ECO Team





General Motors Corporation
EnMS Manual 2018

Version: 1
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General Motors Corporation EnMS



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GENERAL INFORMATION

The General Motors Corporation (GM) is a global company committed to delivering safer, better and more sustainable ways for people to get around. General Motors, its subsidiaries and its joint venture entities sell vehicles under the Chevrolet, Buick, GMC, Cadillac, Holden, Baojun, Wuling and Jiefang brands.

General Motors believes electric, self-driving, connected vehicles and shared mobility services will transform how we get around, and we are drawing the blueprint to advance our vision of a world of zero crashes, zero emissions and zero congestion. More information on the company and its subsidiaries, including OnStar, a global leader in vehicle safety and security services, and Maven, its personal mobility brand, can be found at <http://www.gm.com>

50001 READY SCOPE OF MANUAL

This 50001 Ready Manual serves to assist in providing documented information relative to GM’s Energy Management System (EnMS). This process helps the Sites achieve the intended outcomes of its EnMS, which provides value for the environment, the Site itself, and stakeholders. Consistent with our Energy Policy, the intended outcomes of our EnMS include:

- Enhancement of Environmental Performance
- Achievement of Energy Objectives

The remaining sections of the EnMS are numbered according to the tasks as detailed by US DoE 50001 Ready guidance for which the organization has developed supporting documented information and additional reference material.

This procedure applies to the following Sites Energy Management System (EnMS).

Table 1- US Manufacturing Energy Management Sites

Assembly	Global Propulsion	Stamping	GMCH
Arlington	Bay City	Flint	Grand Rapids
Bowling Green	Bedford	Marion	Lockport
Fairfax	Brownstown	Parma	Rochester
Flint	Defiance	Pontiac	
Ft. Wayne	Flint Engine		
Lansing Delta	Romulus	Joint Venture	
Lansing Grand River	Saginaw	DMAX	
Orion	Toledo		
Spring Hill	Tonawanda		
Wentzville			



DEFINITIONS

The following definitions may be specific to a Site or to GM's business processes and are provided to add clarity to the Manual.

Key Terms

50001 Ready – US DoE ISO 50001 lite recognition without certification
BMS (ems) – Building energy management system
Boundary and Boundaries are interchangeable
BPD- Business Plan Deployment Process
CAP - Corrective Action Plan
Competency- competence can be attained through a variety of methods, including training and OJT
Conformity, Conformance are interchangeable indicating > 80% of Task intent is achieved.
Conformance with Comment – Between >60% and < 80% of Task intent is achieved.
Continual Improvement- EnMS should recognize that both continual improvement of energy performance and continual improvement of the EnMS are the intended outcomes to be demonstrated.
Corrective Action- Steps required to address EnMS Conformance Issues.
CUC – Central Utility Complex
Documented Information, Documents, Records and Online EnMS resources are interchangeable.
Effectiveness- Demonstration that EnMS is consistently being followed.
EMS – Environmental Management System
EnB – Energy Baseline
Energy Improvement – Detailed in Sufficiency Plan
EnMS – Energy Management System
EnPI- Energy Performance Indicators
EOL- Energy Optimization Leader
EOS- Energy OnStar
EPC – Energy Performance Contract
EtQ- Energy Savings Project Database
Energy Team- Individuals leading and supporting EnMS efforts
EU- Energy User
GM2100 – GM Energy Utility Database
GMS – Global Manufacturing System
Interested Party- includes people or organizations that can affect, be affected by, or perceive to be affected by both decisions and activities related to EnMS.
JES - Job Element Sheet
KC - Key Characteristics
KPI – Key Performance Indicator
Non-Conformance - < 60% of a Task intent is being achieved.
NPP – Non-Portfolio Project



Normalization- the baseline and indicators used to demonstrate energy performance must be normalized like KPI's because of variations in relevant Variables.

On-Site Suppliers, Resident Engineers and SA Employees are interchangeable.

OJT – On the Job Training

PM Tickets – Preventative Maintenance Tickets

PDPM – Project Delivery Program Management

RIM – Record Identification Matrix

RV – Relevant Variables

Risk – Factors that can impact the success of EnMS

SEU- Significant Energy User can be facilities, systems, processes or equipment.

Static Factors – Details that are not expected to change over time.

TAC – Technical Assistance Center

TIS – Task Instruction Sheet

US DoE – United States Department of Energy

WWTP – Wastewater Treatment Plant



1. 50001 Ready Task 1: EnMS and Our Organization

(4.1, 4.2, 4.4 and 5.3) - We determine the strategic issues that affect our ability to improve energy performance and achieve the goals of our 50001 Ready energy management system.

1.1 Purpose

Determine the strategic internal and external issues and expectations that could impact our EnMS and document how 50001 Ready, EnMS and BPD tools have been integrated into our business process.

1.2 Requirements – EnMS and Our Organization

General Motors follows a Global Manufacturing System (GMS) that includes Plan Do Check Act (PDCA) tools that support business requirements at all levels of the organization. The main component is the Business Plan Deployment (BPD) tool which has levels 0-5 business plans from Executive Leaders (0), Plant Leaders (1), Department Leaders (2), Group Leaders (3) and Plant teams (4/5). Each BPD has items for Safety, People, Quality, Responsiveness, Cost and Environment / Energy (SPQRCE) that is used to track and report performance on each of the SPQRCE specific business goals at the various levels throughout GM. The BPD's are reviewed periodically and items not on track trigger the development of corrective actions to get back on track. 50001 Ready is a part of GM's EnMS which is recorded under the "E" items of the BPD's as applicable. GM's 50001 Ready Process is available via an online SharePoint website for internal use.

General Motors has determined which strategic internal and external issues could impact the EnMS and have documented them in the 50001 Ready Navigator Playbook, linked below.

1.3 References

01 Task 7 Worksheet



2. 50001 Ready Task 2: People and Legal Requirements

(9.1)– We determine the interested parties and energy-related legal and other requirements relevant to our energy performance and the energy management system. At defined intervals, we review these requirements and evaluate our compliance with them.

2.1 Purpose

Document the process to ensure that identifying and establishing access to the federal, state and local legal requirements, as it applies to the organization's energy use, consumption and efficiency is met.

2.2 Requirements- Key Features

Each Site establishes procedures to follow direction from GM Legal Staff as it relates to all legal and other requirements, to identify, implement and have access to the applicable legal requirements and others, meaning 'other' Corporate requirements, contractual and arrangements that the Organization subscribes with interested parties concerning the use and consumption of energy and energy efficiency in the activities, products and services.

It is the responsibility of the EOL with support from FAM and the energy conservation group to identify the requirements for review and to determine its applicability.

In the case of applicable requirements, it is the responsibility of the ME leader to take the necessary actions to ensure compliance with these requirements to be considered for establishing, implementing and maintaining the EnMS.

The applicable requirements are reviewed according to legal guidance, requirements and other operating requirements.

2.3 References

None



3. 50001 Ready Task 3: Scope and Boundaries

(4.3) - We have documented and approved the scope and boundaries of our 50001 Ready energy management system.

3.1 Purpose

Document the process to ensure the extent of activities, facilities and decision structures that are to be included in the Energy Management System (EnMS) including potential external factors.

3.2 Requirements - Scope and Boundaries

This manual is meant to document, implement, maintain and improve the EnMS of the listed Sites, in their operations. The EnMS is aimed at activities that may significantly impact the use and consumption of energy, as a result of the manufacturing operations at the listed Sites. The activities of non-resident contractors from outside the facility of the listed Sites are excluded from the energy management system since their administration and control are not under the administration of the Site. Product design activities, as well as the activities of the Purchasing Department are carried out in corporate offices respectively falling out of the control and administration of the listed Sites.

3.3 References

Refer to Table 1 for Plant List and links to Plant Specific Tools.



4. 50001 Ready Task 4: Top Management Commitment

(5.1) - Our top management demonstrates leadership and commitment to continual improvement of energy performance and the effectiveness of the 50001 Ready system.

4.1 Purpose

To show the commitment and support of senior management to the EnMS and the conformance to achieving energy conservation targets.

4.2 Requirements - Senior Management Commitment

Each Site's senior management has a commitment to establish and continually improve the EnMS.

Senior management refers to an EnMS administrator and approves the establishment of a team in each Site, to develop and implement this process.

It is the responsibility of senior management to provide the necessary resources to establish, implement, maintain and improve the EnMS, while keeping a business need to identify the scope and limits of the EnMS. It is the responsibility of senior management to communicate the importance of the EnMS within the Organization and to ensure that the objectives and energy goals are met by tracking energy performance indicators appropriate to the BPD.

Senior management takes its commitment in consideration for energy performance as it impacts long-term plans.

4.3 References

50001 Ready EnMS One Pager



5. 50001 Ready Task 5: Energy Policy

(5.2) - We have an energy policy statement, which has been approved by top management and communicated across the organization.

5.1 Purpose

To document the process to ensure that the energy policy states top management's commitment to achieving continual improvement in energy performance, to ensure that the correct information and resources are in place to meet the energy objectives and targets, and that the energy policy complies with applicable legal requirements and all other energy-related requirements subscribed to by the organization. In addition, the policy must support the purchasing of energy-efficient products and services as well as supporting energy performance improvement in design activities.

5.2 Requirements - Energy Policy

The listed Sites establish that an energy policy is documented and communicated to all levels of the organization, revised and updated as necessary.

As a socially responsible company General Motors, is dedicated to the use and efficient power consumption according to the strategy of sustainability. This dedication goes beyond the enforcement of laws, to cover the integration of best practices in the use, consumption and energy efficiency, in our business decisions with the commitment to continuous improvement of our energy performance.

The listed Sites, are committed to comply with applicable legal and corporate energy requirements, assess the use, consumption and energy efficiency of our activities, and make use of efficient power consumption and reduce this consumption by setting appropriate objectives and targets.

The listed Sites will focus its efforts on the following:

1. Promoting awareness of the use and efficient consumption of energy by our employees, suppliers and contractors as well as provide information and necessary training.
2. Practice effective and efficient energy use by reducing and/or eliminating the waste, encouraging the conservation of natural resources, supporting the acquisition of energy-efficient products and services, and designing improvements to promote conservation.

Each Site will ensure the availability of information as well as the resources necessary to achieve the objectives and goals of each of our departments. This information will be reviewed periodically to measure our progress toward continuous improvement.

This policy is available to all employees of the listed Sites.



5.3 References

General Motors Energy Management Policy

General Motors offers a range of mobility services in more than 120 countries around the world. We are committed to safety in everything we do, earn customers for life, build brands that inspire passion and loyalty, translate breakthrough technologies into vehicles and experiences that people love, and create **sustainable** solutions that improve the communities in which we live and work. Our vision is a future world with zero crashes, zero emissions and zero congestion.

In support of our vision, General Motors is committed to continuous improvement in energy management for our operations. We will continue to establish goals and objectives to meet the future vision of “Zero Emissions”. The goals will be based on these pillars:

- Reliable, competitive, and sustainable energy sourcing
- Energy efficiency and conservation
- 100% Renewable electricity use by 2040

Objectives to meet the goals will be consistent with all laws and regulations for the counties in which we operate. Energy management is integrated into our manufacturing business plan, Global Management System (GMS). Annually, goals, objectives, and targets are established for each facility to meet company goals for energy intensity. Monthly, performance to targets are measured to ensure a pathway to annual goals. When the pathway is not met, countermeasures are established to correct the pathway to meet the targets with regular review by management at all levels of the company. All mobility operations will use a similar method to plan for energy management and provide adequate resources and funding to achieve our goals and objectives consistent with ongoing business return on investment objectives.

General Motors is committed to procurement of energy efficient products and services to meet our goal and objectives. We understand that the most effective step change for efficiency is with new products and services for continuous improvement.

Dated September 18, 2018



6. 50001 Ready Task 6: Energy Team and Resources

(5.3 and 7.1)– We have an energy team authorized by top management to oversee the energy management system. Responsibilities and authorities are assigned and communicated, and processes are in place to identify and provide resources.

6.1 Purpose

Document the process to ensure that the identified energy team members are trained and capable in the field of energy management and leadership, that they are familiar with company policy and procedures, that they possess skills to assist with development and implementation of the EnMS and they participate in the Energy Team sharing of information.

6.2 Requirements - Energy Team

Representative of the EnMS

Top management will appoint the representative of the EnMS whose skills and competencies are suitable for:

- Making sure that the EnMS requirements are established, implemented, maintained and ensure continuous improvement.
- Identify staff that supports the activities of energy management.
- Reporting on the performance of the EnMS to senior management
- Ensure that the planning of the activities of the EnMS support the organizations energy policy.
- Determine criteria and methods to ensure that both the operation and control of the EnMS are effective.
- Promote awareness of the energy policy and objectives at all levels of the organization.
- Define and communicate the roles, responsibilities and authorities to facilitate the effective management of energy, defined by the EnMS.

Plant Manager

- Is responsible for compliance with the applicable requirements of the EnMS at the manufacturing plants through their assigned personnel.
- Is responsible for providing the necessary human resources to deploy, maintain, and operate the EnMS within their operating areas.
- Is responsible for support for the fulfilment of goals and objectives in BPD level 1.

Energy Team Members

- The energy team is typically made up of the Facility Area Manager (FAM), the Site Utilities Manager (SUM), the Assistant Site Utilities Manager (ASUM), the Energy Conservation Engineer (ECE) and departmental representatives.
- They are responsible for coordinating and monitoring the establishment and maintenance of the EnMS.



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- They provide follow-up to the fulfillment of legal and other requirements by means of indicators.
 - They seek out and implement the best practices for saving and efficient use of energy for the improvement of the energy performance.

Facility Area Manager (FAM)

- Is responsible for coordinating and monitoring the establishment and maintenance of the EnMS.
- Is responsible for the activities of the energy team, to ensure compliance with legal and other requirements.
- Is responsible for internal and external communication of the EnMS and the energy performance of the plant through the available channels.
- Is responsible for resolution of audit findings, corrective actions, and EnMS revisions

Site Utilities Manager (SUM)

- Is responsible for managing the human, technological and financial resources of the team for the conservation of energy.
- Coordinates compliance with legal and other requirements made to governmental agencies and the corporation.
- Checks the maintenance of the EnMS.
- Is responsible for the analysis and response to internal and/or external communications.
- Seeks to implement best practices for saving and efficient use of energy for the improvement of the energy performance.

Assistant Site Manager (ASUM) (if applicable)

- Gives support in compliance with federal legal energy and other applicable requirements.
- Gives follow-up to the fulfillment of the legal and other requirements by means of indicators.
- Seeks to implement best practices for saving and efficient use of energy for the improvement of the energy performance.

Energy Conservation Engineer (ECE) (if applicable or designee)

- Is responsible for monitoring applications and significant consumption of energy.
- Is responsible to identify applications of energy users and significant energy consumption.
- Is responsible to send reports of consumption to those responsible for each department.
- Is responsible to evaluate energy-saving initiatives.
- Is responsible to track energy improvements on BPD boards, sufficiency plans and EtQ.
- Is responsible to ensure that the EnMS requirements are established, implemented, maintained to show continuous improvement of the EnMS.
- Is responsible to coordinate the planning, implementation and maintenance of the EnMS.
- Is responsible to coordinate the EnMS audit plans.



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- Is responsible for the dissemination and communication of the EnMS to all employees via plant communication channels.

Departmental Representative

- Identifies the energy consumption of the activities, products and services in their departmental areas.
- Communicates information related to their departmental areas in support of the EnMS.
- Provides support in the training and awareness of the efficient use of energy.
- Participates, supports, and is responsible to follow up on the findings found in their department during the internal and external audits of the EnMS.
- Participates and supports energy conservation efforts in their department.

Facilities Management Representative (FMR)

- Is responsible for participating in the energy conservation team meetings.
- Is responsible for supporting the needs of the areas regarding the efficient use of energy.
- Is responsible to ensure that operations and maintenance that are carried out meet the requirements of the EnMS.

Energy Optimization Leaders (EOL)

- Gives support to the establishment and maintenance of the EnMS.
- Analyzes the applicability of federal energy and other requirements.
- Gives support in the compliance to legal and other energy requirements.
- Shares updates to the energy policy
- Develops and shares public energy goals
- Shares energy conservation ideas
- Helps implement energy savings projects
- Shares energy performance

Internal Auditors

- Is responsible for an audit at least once a year, to ensure that all the tasks of the 50001 Ready program are applied in the support of the EnMS.
- Is responsible to document and track findings and any nonconformities identified.

Manufacturing Engineering Leader

- Day to day oversight of the EnMS
- Management Representative



Employees, Contractors and Service Providers

All employees, contractors and service providers are responsible for ensuring that operations carried out meet the requirements of the EnMS.

6.3 References

Task 4 EnMS Energy Team Agenda

Refer to Table 1 for Plant List and links to Plant Specific Tools.



7. 50001 Ready Task 7: Risks to EnMS Success

(6.1) – We determine strategic risks and opportunities to ensure that our organization can achieve the intended outcomes of our energy management system and energy performance improvement. We plan and implement actions to address these risks and opportunities and evaluate the effectiveness of the actions taken.

7.1 Purpose

To identify potential risks to EnMS and share these opportunities with interested parties.

7.2 Requirements – Risks to EnMS Success

Reviews occur regularly throughout the organization to review and discuss potential risks to achieving our corporate goals. If performance deviations are noted corrective actions will be established. Senior management takes the EnMS commitment in consideration for energy performance as could be impacted in long-term plans.

General Motors has identified the risks and opportunities that could impact the EnMS and have documented them in the 50001 Ready Navigator Playbook, linked below.

7.3 References

01 Task 7 Worksheet

Refer to Table 1 for Plant List and links to Plant Specific Tools.



8. 50001 Ready Task 8: Energy Source Data Collection and Analysis

(5.3 and 6.6) - We identify our energy sources and energy uses, have a data collection plan in place, and collect related energy and relevant variable data. We ensure the accuracy and repeatability of measurements. We analyze our energy use and consumption data.

8.1 Purpose

Document the process to ensure that key characteristics of the operations are followed, measured and analyzed with the purpose of optimizing energy performance. Energy reductions related to SEU's will be reviewed at least annually to look at static impacts along with opportunities for additional reductions.

8.2 Description

Energy is used to provide heating, cooling, lighting or do work. Energy can also be stored in devices like springs, counter weights, hydraulic units, batteries, capacitors and pressure vessels. Stored energy is not included in the EnMS at each Site. Energy Users (EU) at Sites could include air compressors, automation, boilers, chillers, CNC machines, dryers, emission control devices, heaters, HVAC, fans, fire protection, furnaces, lights, motors, offices, ovens, pumps, social areas, spray booths, stamping presses, water heaters, welders and WWTP. A list of plant specific energy users can be found in the Energy User List included as a link in the plant list referenced previously.

Significant Energy Users (SEU) are devices or operations that consume larger quantities of energy. A single LED or small motor like a hand drill are not significant in most GM facilities, but when there is a large quantity of these devices they can become significant. A large storm water pump may draw a large amount of power for limited number of hours in a year and yet there is little opportunity to reduce this energy consumption. The final decision to include devices as SEU's depends on the energy consumed, the operating hours per year, the opportunity to control or reduce the energy and other business needs that will be included as Relevant Variables (RV's) in the final analysis.

A Central Utility Center (CUC) or Powerhouse typically uses the majority the energy at a Site to convert it into other forms that are distributed to the manufacturing areas in the plant. There might be opportunities to improve the CUC operations to reduce energy and there might be opportunities in the production areas to reduce consumption of these utilities like compressed air, chilled water, hot water or steam that are provided by the CUC and as such there could be SEU's in both the CUC and production areas that will need to be coordinated under EnMS.

Some portions of a plant could have SEU's that are minor compared to other operations that have SEU's. The most important fact in the EnMS process is to improve control and reduce the energy required by the SEU's that a Site is working to improve. As SEU's are improved and better controlled additional SEU's will be considered for future inclusion in the EnMS process and at some point, new EU's and new SEU's or re-ranking of SEU's will be triggered to continually drive more improvement.



Energy Usage

Each Site uses its energy in the above areas which typically will be estimated for the secondary devices based on nameplate information, utility design spreadsheets or secondary meters when available. Primary energy source data will be automatically loaded into GM2100 (GM central utility database, Energy OnStar (EOS), Building Management System (BMS) database or Energy Information System (EIS) to assist the Site with energy consumption and conservation progress tracking.

Data Collection

Data and invoices from purchasing primary resources are stored in GM2100 and EOS platforms. The data available includes, but are not limited to:

- All energy sources
- Utility costs
- Production rates
- Operating hours
- Meteorological data – heating and cooling degree days, mean temperature
- Major equipment data
- Submeter data
-

Energy Data

Each Site collects its energy usage data from GM2100, EOS, EIS, BMS, EnPI and Process Monitoring and Control (PM&C). These systems can show real time and historical data for further analysis such as forecasting, benchmarking and energy management. GM2100 and EOS are the main platform to analyze data and manage utilities within each GM plant. The tool “Energy/Analysis” allows a user to select a Site and evaluate its overall energy usage. Each Sites energy usage for the past 12 months is available electronically via the above noted systems

Each Site has identified the equipment listed on Energy User List and has provided nameplate data or use engineering estimates to quantify the loads at the device or area level.

Data Analysis

In-depth data analysis can be performed by online Energy OnStar and Energy Information System (EIS). This information is used in developing and tracking items for the BPD and Energy Sufficiency improvement process.

8.3 Reference

EnMS Energy User List

Refer to Table 1 for Plant List and links to Plant Specific Tools.



9. 50001 Ready Task 9: Significant Energy Uses

(6.3) - We determine our significant energy uses (SEUs), identify and monitor their relevant variables and energy performance, and identify the persons that affect the SEUs. We have a process to review and update SEU data and related information, including our methods and criteria to determine that an energy use should be an SEU.

9.1 Purpose

Document the process to ensure that key characteristics of the operations are followed, measured and analyzed with the purpose of optimizing energy performance for SEU's.

9.2 Description- Significant Energy Users (SEU's) Criteria for Selection

Each Site determines the energy type associated with Energy Users by looking for large Kw's for a device based on nameplate or area consumption. Relevant Variables like impacts of weather, the operating hours, if the energy usage is automatically controlled or it is manual control and how well a Site manages the energy are included in the ranking calculation from the SEU's. This evaluation has been captured on the Energy User List under the SEU tab.

SEU Performance and Control

Each Site reviews its energy performance monthly and the Site performance is tracked on the BPD and Corrective Actions (CA) will be developed when the performance is not as anticipated. The CA's will be reviewed with plant leadership and Corporate leadership so additional measures put in place to achieve the improved energy performance.

Relevant Variables (RV)

The following variables have greatest impact on the identified SEU:

- Weather
- Operating schedule
- Load Size
- Degree equipment is un-controlled
- Plant Factor

Tools for Controlling

Each Site participates in weekly meetings as appropriate to report project status and review data excursions shown on EOS. GM2100 and EIS also provide data that may show impacts of RV's.

9.3 Reference

EnMS Energy User List

Refer to Table 1 for Plant List and links to Plant Specific Tools.



10. 50001 Ready Task 10: Energy Performance Improvements

(6.6) - We identify and prioritize energy performance improvement opportunities and have processes in place to update them.

10.1 Purpose

Document the process to ensure that key characteristics of the operations are followed, measured and analyzed with the purpose of optimizing energy performance. Energy Performance will be reviewed during BPD board discussions including SEU opportunities.

10.2 Description- Energy Opportunity Identification

GM shares with each Site several different tools to identify energy savings projects; 4000 Account Meetings, Energy Treasure Hunts, Site Observation, GM2100, EOS, EIS, EnPI, benchmarking and sharing of best practices.

Energy Treasure Hunt

Following EPA Energy Star Treasure Hunt Guidelines, EOLs visit various Sites every year to observe and help find improvement opportunities within different parts of the manufacturing process.

Site Observation

The SUM, ECE and EOL's are challenged to understand how energy is consumed within each Site. These people are supported by the energy team, maintenance, production and engineering and others to assist in the conservation efforts. Projects are developed that can be funded and implemented locally or through corporate funds assigned for energy conservation efforts. Non-production observations are included in the Site observations to find leaks, equipment left on, maintenance or housekeeping practices that can be improved and develop an understanding of how long it takes to shut down and start up equipment. The goal is that the Site during extended non-production periods will reduce energy by 80% from average levels during production.

Each Sites energy performance improvements are listed on the BPD tracking boards and on the Site energy sufficiency plan. Projects are tracked in corporate databases.

Energy OnStar (EOS)

GM uses its EOS tool to identify projects related to shut down effectiveness, HVAC and controls. Weekly meetings are held to review non-normal conditions. Major projects could be funded with Corporate resource like the ESPI program. Minor TAC cases (opportunities) that are highlighted automatically by this process are expected to be addressed with plant resources. Many of which are behavior or of a maintenance nature, so it is easier for the Site to address them directly.



Energy Intelligent System (EIS)

GM uses its EIS to review demand opportunities and other utility bill related issues. Payback and project complexity will determine how these projects could be funded and implemented. Projects are identified and prioritized based on highest annual energy savings and simple payback.

Energy Star Observation Walks

The Energy Star Observation Walks follow the Safety Star process for employee engagement.

Other Tools

Sites share energy conservation ideas with other Sites during the 4000-account monthly budget review meetings. GM uses the GM2100 database and US EPA benchmarking models to develop energy trend information for each Site along with KPI (energy intensity) to be able to quickly observe improvements or decays in Site performance. This information is part of the Site budgeting process which is included on the BPD and supports the creation of the energy sufficiency plan that monitors each Sites energy progress.

Project Prioritization Criteria

Projects are prioritized by various criteria: Anticipated Annual Energy Cost Savings, Expected Implementation Time, Simple Payback, Available resources required to engineer and implement and Availability of Incentives.

10.3 References

EnMS Sufficiency Plan

Refer to Table 1 for Plant List and links to Plant Specific Tools.



11. 50001 Ready Task 11: Energy Performance Indicators (EnPI) and Energy Baseline (EnB) (6.4. and 6.5) - We identify energy performance indicators and energy baselines to measure and monitor our energy performance and to demonstrate energy performance improvement. We have a methodology for determining and updating them.

11.1 Purpose

Document the process to ensure that key characteristics of the operations are followed, measured and analyzed with the purpose of optimizing energy performance. EnPI and EnB will be used to demonstrate energy performance when direct measurements are not available.

11.2 Description- Energy Performance Indicators (EnPI) and Energy Baseline (EnB)

Each Site utilizes budget performance with total kWh, total dollars, cost per unit and Key Performance Indicators (KPI's) which demonstrate conformance with the goals of EnMS. This data is obtained from GM2100, EOS and EIS databases. The Site tracks the energy performance on the BPD and thru actions outlined on the sufficiency plans which are updated monthly. US DoE EnPI files will also be used to track energy performance and they will be updated annually and include the past five years' worth of data.

The Energy Baseline (EnB) is based on General Motors' energy consumption in 2010, as adjusted based on current operating locations.

Determining and Updating Data

Two sets of Energy Performance Indicators are proposed. For the Site, the unit is (Unit of Energy / Unit of production), when production is not feasible as in Component Holdings Operations, then the Site will use (Unit of Energy / Net Revenue). For production and process, a single metric as the consumption is adequate. This is aligned with General Motor's Operational Commitments – Energy, water, carbon and waste are tracked by (Unit of consumed variable / vehicle).

Weather related HDD and CDD data is also available from these data sources to aid the Site in its performance evaluations.

11.3 References

Refer to Table 1 for Plant List and links to Plant Specific Tools.



12. 50001 Ready Task 12: Objectives & Targets

(6.2) - We establish objectives and energy performance targets.

12.1 Purpose

Document the process to ensure that key characteristics of the operations are followed, measured and analyzed with the purpose of optimizing energy performance.

12.2 Description- Baseline

GM is committed to reduce its energy intensity (MWh/vehicle) by 20% from 2010 to 2020. Each Site's baseline for energy reduction is in the GM2100 tool. Each Site monitors performance through monthly budget reviews of cost, MWh, cost per unit and KPI as shown on the BPD and energy sufficiency processes

Objectives

Each Site works towards our public commitments to reduce energy intensity. This typically reflects in a reduction of 2 – 3% yearly per Site.

Improvement Targets

Energy Budget targets for each Site are developed annually and are finalized through a series of meetings with each Site. Performance to these targets is tracked through the Sufficiency Plan and GM2100.

Timeframe for Implementation

Timeline and projects to achieve the reduction goals are shown on the BPD and Energy Sufficiency Plan.

12.3 References

EnMS Sufficiency Plan

Refer to Table 1 for Plant List and links to Plant Specific Tools.



13. 50001 Ready Task 13: Action Plans for Continual Improvement

(4.4 and 6.6) - We develop action plans and implement improvement projects to achieve our objectives and energy targets.

13.1 Purpose

To document the process to ensure that key characteristics of the operations are followed, measured and analyzed with the purpose of optimizing energy performance on a continual basis.

13.2 Description

Each Site uses the BPD process to track progress on energy related improvement ideas. Energy improvement targets are provided as part of the annual energy budgeting process and the Site develops a sufficiency plan which is updated monthly to monitor a Site's progress to achieving the reduction goal. The sufficiency plan includes simple ideas up to very complex projects and the expectation is this will be part of the energy BPD review.

Tools and Program Management

Each Site conducts brainstorming activities with members of the energy team, EOL, and external resources to develop a list of potential energy improvement ideas. This list is vetted to determine the best opportunities that can be implemented at each Site. A person is assigned to develop the idea into a concept to see if the original assumptions are valid. The vetted list is the basis for the Site energy sufficiency plan. As the concept of the idea is established then the means to implement is also defined which could include self-perform with internal resources, utilization of contractors or a combination of resources. The means to fund the effort is also confirmed so the work can progress.

Regular remote monitoring of the Site via EOS and EIS generates reports of potential opportunities as well.

One tool used to track Corporate funded projects, Reliance EtQ, provides the following:

- The activities to be completed to implement the project and achieve the energy target(s)
- The resources needed to complete the activities
- The time frame for completing the activities
- The person or persons responsible for completing the activities
- A description of the method for verifying project results
- A description of the method for verifying the improvement in energy performance

Project Implementation and Review

Periodic reviews with SUM, ECE, EOL and others are done to monitor progress on the completion of the project. Some projects are eligible for funding outside of GM and these require external reviews before and at the project completion to validate that the savings is real.



Each Site participates in weekly meetings as appropriate TAC case meetings to review issues determined by EOS or EIS to review the opportunity.

GMNA hosts monthly meetings defined as a 4000 Account Meeting to discuss the status of the energy and water targets for each Site. This meeting also includes sharing best energy saving practices found in various Sites.

13.3 References

EnMS Sufficiency Plan

Refer to Table 1 for Plant List and links to Plant Specific Tools.



14. 50001 Ready Task 14: Competence and Training

(5.3 and 7.2) - We ensure the competence of personnel whose work affects our energy performance and energy management system. We evaluate the effectiveness of actions taken to acquire competencies. We retain appropriate records of competencies and training.

14.1 Purpose

To ensure that plant members as noted in the training matrix are trained to have the ability, knowledge of EnMS tools and skills to support energy plans.

14.2 Requirements

For SEU's, each Site has identified a list of staff and contractors who work with the equipment. It is then the responsibility of the ME Leader to ensure that all personnel are appropriately trained and competent for their energy management role. Employees or contractors will then be trained accordingly at the launch of the EnMS and afterwards upon hire.

14.3 References

EnMS Training Matrix

Refer to Table 1 for Plant List and links to Plant Specific Tools.



15. 50001 Ready Task 15: Awareness and Communication

(7.3 and 7.4) - Our personnel and on-site contractors are aware of our energy policy and their energy-related roles and responsibilities. We have processes in place for internal and any applicable external energy management system communications.

15.1 Purpose

To ensure effective communications will inform and educate employees on the available practices around our energy policy, and their individual roles to drive our energy savings and performance.

15.2 Requirements- General

Each Site has implemented processes for managing internal and external Energy Management System communications. What, with whom, and how it communicates is described below in the table.

All communications are managed within a reasonable timeline appropriate for the situation. The processes ensure that the energy information communicated is reliable and consistent with information generated within the EnMS. The Site responds to relevant EnMS communications and retains documented information as evidence of its communications. Communications may include; for example, informal discussions, organization open days, focus groups, community dialogue, involvement in community events, websites and e-mail, press releases, advertisements and periodic newsletters, and annual or other periodic reports.

Internal Communication

Internally communicated information relevant to the EnMS, including changes to the EnMS, are communicated to various levels and functions of the Site in several ways. This includes, for example: internal audits, management reviews, management of change procedures, emails, team meetings, energy recognition activities, newsletters, inquiries to energy professionals, and BPD processes. All of these support individuals performing work under the organization's control to contribute to Continual Improvement.

15.3 References

EnMS Communication

Refer to Table 1 for Plant List and links to Plant Specific Tools.



16. 50001 Ready Task 16: Documentation and Records

(7.5) - We document information we determined is needed to ensure energy management system effectiveness and demonstrate energy performance improvement, as well as that suggested by the guidance of the 50001 Ready Navigator. We have processes in place for creating, updating, and controlling our documented information.

16.1 Purpose

Keep an accurate and organized list of documents and records for each task of the 50001 Ready process. The preference is that 50001 records and documents will follow the common tools kept on the ECO team SharePoint.

16.2 Requirements

Each Site must accurately keep track of their documents and records that are not part of the common tools located on the 50001 Ready SharePoint Site. These spreadsheets must be updated each time a document or record is added or changed. Documents and records can be found primarily on the Sharepoint noted in Table 1. Supporting information and data can be found in online systems such as GM2100, Energy OnStar, Energy Information Systems, and Production Monitoring and Control.

16.3 References

Refer to Table 1 for Plant List and links to Plant Specific Tools.



17. 50001 Ready Task 17: Operations Controls for SEUs

(8.1)- We plan and control the processes related to our significant energy uses (SEUs) and action plans, and set operation and maintenance criteria where there are risks of significant deviations in energy performance. We operate the SEU and action-plan related processes in accordance with the criteria and communicate the criteria to relevant personnel. We control planned changes, along with outsourced processes related to SEUs.

17.1 Purpose

The purpose of this procedure is to identify and plan those operations and maintenance activities related to the use and significant energy consumption to ensure that they are carried out under specified conditions.

17.2 Requirements- Establishment of Operational Controls

Establish operational controls to those activities associated with applications and Significant Energy Uses (SEU) when necessary, to ensure that they are carried out under compliance with Site EnMS.

These operational controls are consistent with the energy policy, targets and action plans developed for ensuring the effectiveness of the EnMS.

The Energy Team is responsible for identifying those responsible for the operation and maintenance activities involved in significant energy consumption and assigns them the task of operational controls.

The operational controls should ensure that such activities are carried out under specified conditions by:

- The establishment and setting of criteria for the effective operation of the SEU's, where their absence could lead to significant deviations in the effective energy performance
- The operation and maintenance of plant, processes, systems and equipment, in accordance with the established operational criteria
- Communication of operational controls to the staff who work for, or on behalf of the organization.

All significant energy individual components (> 1000 kW, 1300 Hp) and areas determined to be significant associated with applications and SEU's should have preventive maintenance details in the MAXIMO system that are focused on programs to prevent SEU equipment failures.

The maintenance coordinators of each area or their appointee are responsible for establishing and executing plans and programs for preventive maintenance of the equipment according to their area of responsibility, as well as ensuring that the programs are executed in a timely manner.

17.3 References

Maintenance of SEUs will be reviewed periodically in energy team meetings.
Refer to Table 1 for Plant List and links to Plant Specific Tools.



18. 50001 Ready Task 18: Energy Considerations in Design

(8.2) - We consider energy performance improvement opportunities and operational controls when designing new, modified, or renovated sites, equipment, systems, and processes.

18.1 Purpose

Document the process for considering opportunities for improvement of the energy performance and operational control in the design of new, modified or refurbished facilities and new equipment that have or may have an impact on the use (EU) and significant (SEU) consumption of energy in each Site.

18.2 Requirements

The FAM and SUM, or appropriate personnel, in conjunction with the project manager are responsible for ensuring and comply with this procedure.

The ME is responsible for the Site's projects that are being considered as potential new projects for the Site including product programs and NPP projects. As appropriate the ME will share energy impacts of projects as the planning is being finalized for impact evaluation under the EnMS.

Facility improvements as a part of local plant projects or those under the planning of Central Office at each Site will be reviewed to determine any impacts to the EnMS at the Site. This includes design and construction by entities outside of GM.

Major repairs of Energy Use devices and SEU's will be reviewed by the SUM, or appropriate personnel, to determine if the repair or replacement will impact the EnMS. Impacts will be noted, and the EnMS will be updated within 30 business days if the impact is significant.

Common specifications will be requested to update to include the opportunities for improvement determined in the final approval by the Site. The purpose of sharing the improvements is to have the best technologies while focusing continual improvement. The designate managing the project should inform the FAM, or appropriate personnel, on the final specification of facilities and equipment to be purchased with performance-related energy being documented, including efficiency over the life cycle.

If conditions or activities modify the issues raised in the initial energy evaluation related to a project, it is the responsibility of the head of the project to notify the SUM, or appropriate personnel, and update accordingly.

18.3 References

GMS Change Management (BIQ 7 / CI 7)



19. 50001 Ready Task 19: Energy Considerations in Procurement

(8.3) - We establish energy performance criteria spanning the operating life for purchases affecting energy performance, inform suppliers that this is a factor in procurement, and define and use specifications for energy supply purchases.

19.1 Purpose

To ensure that properly specified items are procured for energy impacting purchases.

19.2 Requirements

The FAM, ME Leader, or appropriate personnel will check against the list of previously identified SEUs when considering facilities-related projects at each Site. If a project is to impact a SEU, the Manufacturing Engineering teams or appropriate personnel will follow the Procurement Checklist to ensure all purchasing decisions are made considering energy use. Each Site will utilize Energy Star devices like computers, printers, ice machines, vending machines, TV's, refrigerators, microwaves and monitors whenever practical.

19.3 References

EnMS Procurement Checklist
EnMS Energy Star Devices



20. 50001 Ready Task 20: Monitoring & Measurement of EnMS

(9.1) - We monitor trends in energy management system (EnMS) performance and evaluate the effectiveness of the EnMS in achieving intended outcomes and planned results. The methods used, the frequency of the monitoring, and when the results are analyzed and evaluated are defined.

20.1 Purpose

Document the process to ensure that key characteristics of the operations are followed, measured and analyzed with the purpose of optimizing energy performance.

20.2 Requirements- Key Features

Key features mean those that determine energy performance of Significant Energy Users (SEUs), as well as other elements including Relevant Variables resulting from the energy review of Energy Performance Indicators (EPI's), the effectiveness of the Action Plans to achieve goals and targets and evaluation of actual energy consumption against the expected and other variables.

Measurement

Each Site monitors primary utility meters and maintains an electronic measurement system (GM2100) that provides real time means to monitor the devices associated with the consumption of energy including electric power and natural gas from the primary utility meters at the fence line.

The measurement of the electric power system has a main system with metering provided by the electricity supplier, while GM monitors and records the usage and energy consumption of all Sites. Supplemental measurement is available at some locations in the unit substations used to distribute the power. The monitoring and records for unit substations unit if available, they will be stored in GM2100.

The measurement of total natural gas supplied to the Site is measured by meters maintain by the Local Natural Gas Company. If secondary natural gas meters are available, they will be stored in GM2100.

Monitoring

Each Site will carry out measurements using software allowing GM to monitor the devices associated with energy consumption within the complex. This software identifies the conditions of electric power consumption in real time. Monitoring of natural gas is performed using manual readings or automated readings when available.

GM2100 Energy Management System is a client/server-based application to monitor the consumption and demands for electric power, natural gas, compressed air, water and sewage. Exterior generated energy items like steam, compressed air, chilled water that are purchased also are monitored in GM2100 as well. The measurement level is different for each energy, and this software is custom configured to meet the needs of the complex with the primary focus on power management.



Energy OnStar (EOS) is also another software-based system that allows for monitoring and adjusting setpoints of some facility related EUs. This system can monitor the consumption and demand for electricity in real time using the main utility meters and portions of the plant in the medium voltage substations.

It is the responsibility of the SUM/ECE to perform monitoring, measurement and analysis regularly or when required, to respond to events. This review will include evaluation of production, overtime, hours of operation and shutdown, volume variations in consumption related to the climate, among others; with the purpose of identifying any value outside the limits previously set or any deviation from the operating scheme of the plants, in the case of a variation which put at risk the objectives and goals, the SUM / ECE will report and request feedback to the corresponding area in energy team meetings.

Energy Performance Indicators (EPI's)

Each Site performs monitoring, measurement and analysis of performance indicators.

Action Plans

Each Site performs monitoring, measurement and analysis for the effectiveness of the action plans to achieve targets. Each Site performs monitoring, measurement and analysis of actuals against expected consumption.

Calibration

Data obtained from meters owned and maintained by the external utility providers are not under the control of GM and as such are not covered under the calibration requirements.

When outside companies are hired to calibrate or verify monitoring and measurement equipment key features, performance will be documented in a report showing the device condition upon arrival and condition after the service was completed. If the devices carry outside regulatory requirements the outside contractor must have the proper accreditations. The companies must show proof of the applicable accreditation and should extend the certificates of calibration of equipment which are given service.

All methods used for calibration or verification, should be certified or with traceable to an approved body and noting the methods and/or procedures of personnel qualified to carry out of the same. Employers should have a valid calibration certificate.

Requirements

This task covers the requirements for monitoring, measuring, and analyzing performance metrics with focus on the “key characteristics” of operations that determine energy performance.



Sources of energy data include GM2100, EOS, EIS, BMS and PM&C which are available online. The data in these sources is maintained centrally and validated by resources outside of the plant or by third parties and therefore is not included in the Site requirements for calibration.

Departmental or specific meter data will be used only to supplement when required.

20.3 References

EnMS Energy User List

Refer to Table 1 for Plant List and links to Plant Specific Tools.



21. 50001 Ready Task 21: Monitoring & Measurement of Energy Improvements

(6.6) - We monitor and measure the key characteristics of processes that affect our energy performance. We define the methods used, the frequency of the monitoring and measurement, and when the results are analyzed and evaluated. We evaluate our energy performance improvement and investigate and respond to significant deviations in energy performance.

21.1 Purpose

Implementation of the 50001 Ready EnMS is intended to realize and sustain energy savings and energy cost reductions. Each Site will need to calculate energy savings and track improvements to maintain their status. The 50001 Ready process allows for flexibility in defining the appropriate energy performance indicators and tracking methods, but for standardization, all GM Sites will use EnPI, EnB and Sufficiency Plan tools.

21.2 Requirements

Each Site will use the EnPI tool along with GM2100, KPI's, Budget, and Sufficiency Plan to track performance, to determine if the plant has improved its energy performance over time.

21.3 References

EnMS Sufficiency Plan

Refer to Table 1 for Plant List and links to Plant Specific Tools.



22. 50001 Ready Task 22: Internal Audit

(9.2) - We conduct internal audits of the 50001 Ready energy management system at specified intervals and report the results to relevant management. We identify trends in internal audit results for consideration in management review.

22.1 Purpose

To monitor progress and conformance with the 50001 Ready tasks including those maintained on a corporate level and those that are site specific that support the EnMS process.

22.2 Requirements

Internal audits will be done at least annually and may be done more often if needed. If a task weakness is observed over multiple site audits, then possible revision of Corporate 50001 Ready Manual and supporting tools will be investigated. Plant specific weakness will be addressed through training or issuing CA's.

22.3 References

EnMS Self Audit Checklist
50001 Ready Audit – Plant Items



23. 50001 Ready Task 23: Management Review

(6.3 and 9.3) - Top management periodically reviews the 50001 Ready energy management system and our organization's energy performance to ensure its continuing suitability, adequacy, and effectiveness.

23.1 Purpose

Get top management to review energy performance and the EnMS process including potential risks to achieve reduction goals. The Site will identify who will participate in management reviews and record information and results from each review. Management Reviews will occur at least annually and no later to July 1st.

23.2 Requirements

Each Site will identify who will participate in management reviews. It will be the responsibility of EnMS Administrator to compile information and results for the management review. Decisions and actions as a result of the review will be recorded. If management determines the EnMS is suitable, adequate, and effective, the Site will complete the 50001 Ready Self-Attestation Form and send to the Department of Energy.

23.3 References

EnMS Self Attestation Form



24. 50001 Ready Task 24: Corrective Actions

(10.1) - We identify nonconformities and other problems in the 50001 Ready energy management system and take appropriate corrective action.

24.1 Purpose

The purpose of this procedure is to document the methodology and criteria for the development, registration and maintenance of the energy review in each Site with the aim of identifying the use and consumption of energy, as well as identify, prioritize and register opportunities for improving energy performance. The BPD process uses Green – Yellow – Red ratings with Red items triggering the development of Corrective Action Plans to restore control as issues develop.

24.2 Requirements- General Information

The methodology consists of analyzing the energy consumption, identifying the significant use of energy in plants or areas through the application of criteria, as well as to identify, prioritize and register opportunities to improve the energy performance of each Site as is captured in BPD and Energy Sufficiency Plan.

The methodology includes the identification of facilities, equipment, systems, processes, personnel, and variables that significantly affect the use and consumption of energy. The methodology also determines the energy performance and estimated future energy use and consumption.

The energy review of EU, SEU, Budget and Energy Sufficiency Plan is updated each year, as well as in response to major changes in facilities, equipment, systems or processes. Monthly reviews of BPD, energy budget, shut down efficiency and sufficiency plan progress are conducted at various levels of the Site organization along with the EOL.

Corrective Action plans are developed when there is a decay indicated in energy performance. The BPD process tracks green being on target, yellow slight drift in performance and red there is repeat continued decay or significant deviation from the monthly budgeted levels. Red performance triggers the need for corrective action plans to be developed and followed until the issue is corrected.

Supplemental Energy Monitoring

The EnMS is integrated into the plant GMS and is composed of the following SEU areas: CUC, Facilities and Process. Each Site also has computer-based monitoring (PM&C) of the production process. The Site may have departmental metering or temporary devices that provide supplemental energy data. These tools help determine if further investigation or corrective actions are needed.

24.3 References

EnMS GMS Problem Solving CI4 CI5



25. 50001 Ready Task 25: Continual Improvement

(10.2) - We have a 50001 Ready energy management system and continually improve its processes and interactions. We continually improve the suitability, adequacy and effectiveness of our energy management system. We achieve and demonstrate continual energy performance improvement.

25.1 Purpose

Document the process to continually improve including suitability, adequacy, and effectiveness of our 50001 Ready process and the Energy Management System (EnMS).

25.2 Requirements - Continual Improvement

Continual Improvement opportunities will occur from the sharing of the Roadmap, Sufficiency Plan Ideas, Bench Mark Activities, Best Practices, 4000 Account Plant Lessons Learned, 50001 Audits, Energy Treasure Hunts and various site visits. Improvement ideas will be incorporated into the 50001 Ready and EnMS periodically, but at least annually there will be a review of potential improvements.

25.3 References

Refer to Table 1 for Plant List and links to Plant Specific Tools.