# Stellantis Optimizes Non-productive Energy Through "Excellent Plant Shutdown" Initiative


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## ABSTRACT

Stellantis is currently implementing an aggressive initiative to reduce its non-productive energy. This is being implemented to help Stellantis hit its corporate GHG and energy reduction targets, to help improve its competitiveness, and to reduce its production cost per vehicle. Following the success of energy curtailment initiatives implemented at manufacturing facilities during the COVID-19 extended shut-down in early 2020, the Stellantis North America and joint Strategic Energy Management (SEM) team launched an “Excellent Plant Shutdown” Pilot Program across 9 Stellantis Facilities enrolled in DTE’s SEM Program, collectively achieving over 22 million kWh in electricity savings over 2 years.

An energy focus group was established at each plant, to coordinate with responsible parties on the plant floor. A series of demand targets were established based on the duration of the non-production period. Curtailment actions were integrated within existing Standard Operating Procedures and training material. An auditing process was implemented to ensure curtailment actions persisted, automatic systems were not disabled, and to identify potential missed opportunities. The team developed data driven feedback reports to track performance against the reduction targets and previous achievements. These reports are reviewed on a weekly basis and shared with the team leads to promote continual improvement.

SEM presented an environment whereby the focus groups from each facility, with the support of the corporate team, could share lessons learned from past curtailment initiatives, ongoing challenges, strategies, and successes. This substantially increased the effectiveness of the program and the rate of realized energy savings across the entire Stellantis portfolio.


## 1. Context

Following the merger of Fiat Chrysler Automobiles (FCA) and Groupe PSA in 2021, Stellantis, N.V. established ambitious goals, committing to **achieve carbon net zero by 2038**. On March 1st, 2022, Stellantis announced their Dare Forward 2030[1] strategic plan. The goals for the Manufacturing Scope 1 and 2 absolute carbon emissions versus 2021 are:

- **50%** reduction tCO2e absolute by 2025
- **75%** reduction tCO2e absolute by 2030
- **100%** reduction tCO2e absolute by 2038

With an established long-term sustainability plan, Stellantis had a clear direction for significant energy and $CO_2$ reduction. This led to a collaborative review and selection of the top energy management best practices from Ex-FCA and Ex-PSA globally. These best practices

[1] Dare Forward 2030 was announced on March 1, 2022, Stellantis’ Blueprint for Cutting-Edge Freedom of Mobility

focused on enhancing existing processes, operational procedures, and guidelines. One of the best practices was focused on reducing energy use during non-production periods. This was called the Excellent Plant Shutdown performance process. This model was further refined when the facilities were forced to cease operations for almost two (2) months at the start of the COVID-19 pandemic.

The SEM team had developed curtailment procedures to be implemented during extended shutdown periods, defined as non-productive periods greater than 48 hours. These curtailment procedures were initially developed as a response to the COVID-19 extended shutdown events at Detroit Assembly Complex Jefferson (DACJ) and Sterling Stamping Plant (SSP), which were the first two (2) Stellantis facilities enrolled in DTE's SEM Program (Bassett, P., Dunbar, K., and Nicol, J., 2021).

Learning from the success of the COVID-19 extended shutdown procedures at DACJ and SSP, Warren Truck Assembly Plant (WTAP) utilized the tools and processes developed in SEM to implement curtailment strategies during their three (3) month retooling period, beginning in July 2020.

The extended shutdown curtailment at the three facilities led to the following achieved energy savings:

- ***4,458,175 kWh*** of electricity, and
- ***713,309 Therms*** of natural gas.

## 2. Stellantis "Excellent Plant Shutdown" initiative

Since the COVID-19 shutdown in 2020, Stellantis manufacturing plants were faced with frequent and sudden interruptions to plant production schedules, caused by post-COVID supply chain disruptions and labor impacts, which could sometimes last for multiple days. The plants were forced to adapt to quick changes between different modes of operation, without much notice.

The plants had established shutdown procedures, which were intended to curtail energy with no impact to production. However, written procedures for shorter non-production periods were limited. The Excellent Plant Shutdown performance process was devised as a strategy to enhance existing procedures, and to continually optimize energy use during planned and unplanned shutdowns of varying durations and activity levels.

The joint SEM teams began establishing the following energy reduction targets, categorized by duration of non-production period. This was important to optimize energy use during all periods of non-production; including the smaller shutdowns during breaks, lunch periods and production shift changes, in addition to what plants were already focused on, such as weekends and holidays. The longer period shutdown opportunities were found to be different between plant types. For these periods, stamping and powertrain had higher reduction targets due to their lower fixed loads compared with assembly, as shown in Table 1 below.

Table 1. Excellent Plant Shutdown energy reduction targets

| **Duration of non-production period** | **4-12 hours** | **12-24 hours** | **>24 hours** |
|---|---|---|---|
| Assembly | 30% | 50% | 82% |
| Powertrain and Stamping | 30% | 50% | 85% |

Although the energy reduction targets apply to all sources of energy, the SEM Team decided to first concentrate on electricity, as electrical information was more readily available. A gap analysis of the potential electricity savings during non-production periods was developed for each Stellantis manufacturing facility enrolled in DTE's SEM Program. This gap analysis assumed the targets, as shared in Table 1 above, would be met during each non-production period and amounted to **147,653,344 kWh** of total potential electricity savings per year.

The results of this gap analysis, shown in Figure 1 below, were presented to Management for approval, and the Excellent Plan Shutdown initiative was kicked off in July 2021 for five (5) Stellantis manufacturing plants. The team targeted the next Labor Day 2021 holiday shutdown as a first implementation milestone date. The initial success of the Excellent Plant Shutdown initiative subsequently led to the recruitment of the three (3) remaining Stellantis manufacturing plants to DTE's SEM Program.

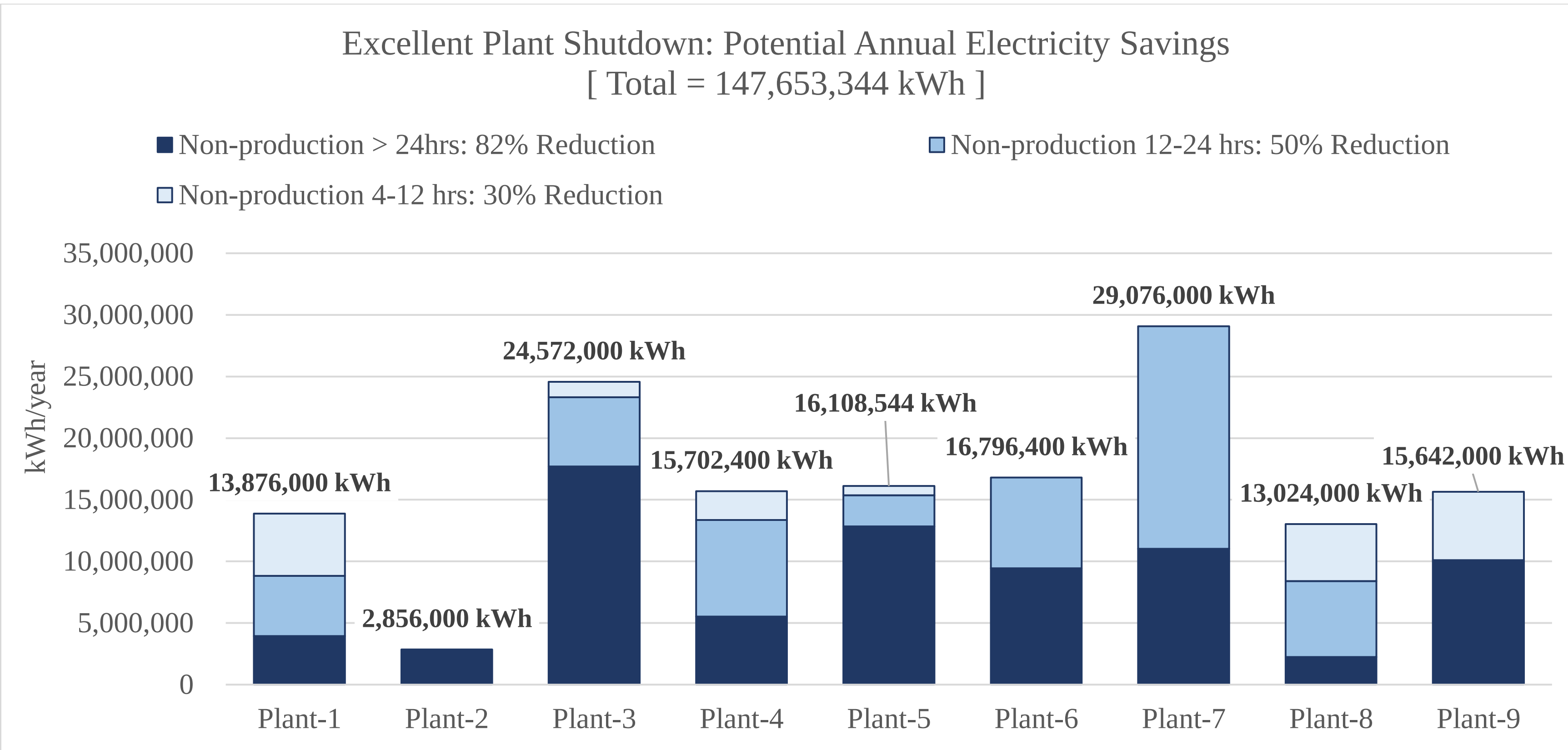


Figure 1. Excellent Plant Shutdown Gap Analysis Results

## 3. Management processes

The Excellent Plant Shutdown performance process, shown in Figure 1 below, follows an 8-step systematic approach to optimize non-productive energy use, based on a continual improvement cycle. A planning tool was developed to record implementation status and the results of each step.

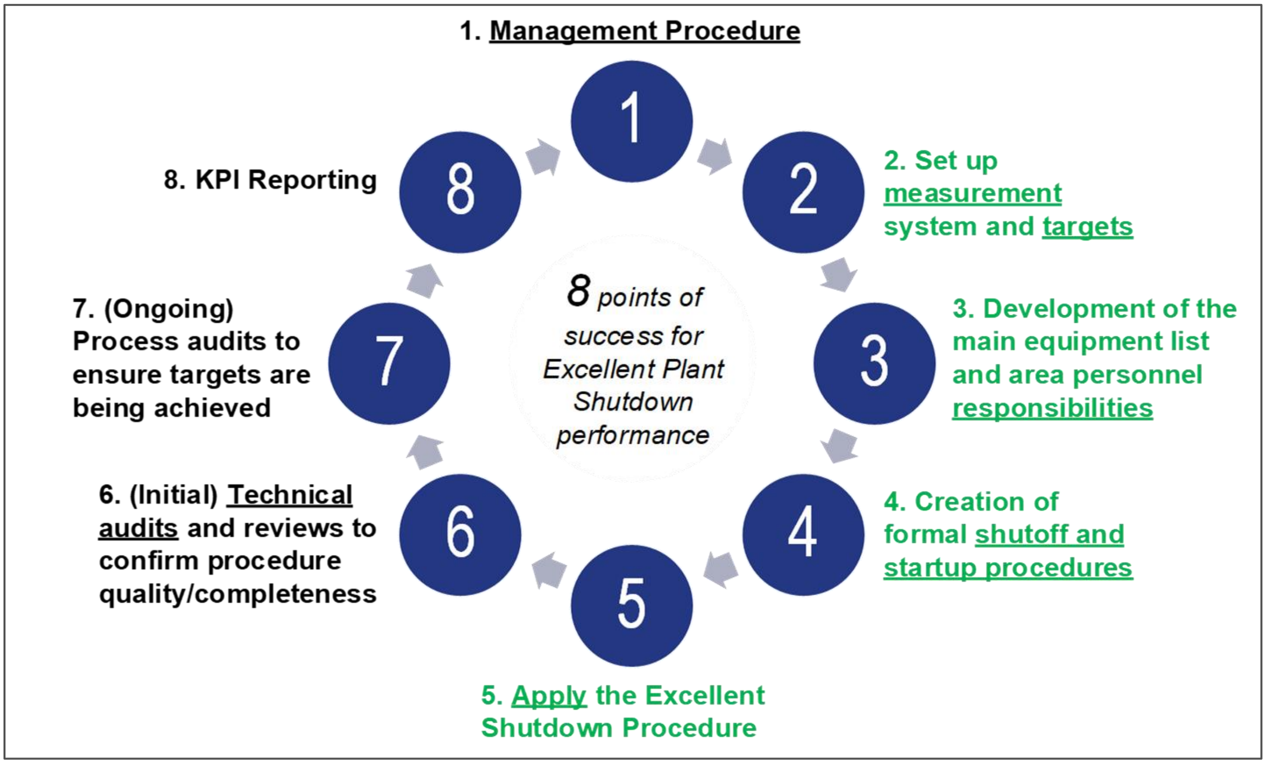


Figure 2: Excellent Plant Shutdown Performance Process

The Stellantis Energy Team members coordinated these activities during and in between weekly SEM calls, to drive implementation of Excellent Plant Shutdown. This methodology, detailed below, was eventually deployed across all the Stellantis facilities in North America.

**Step 1: Management procedure**

- Define and communicate the purpose and expected outcome of the Excellent Plant Shutdown Process
- Obtain management approval

**Step 2: Set up measurement system and targets**

- Produce data collection plan for departments, systems, and equipment with the ability to control during periods of non-production

**Step 3: Development of the main equipment list and department personnel responsibilities**

- Prioritize departments for implementation of Excellent Plant Shutdown procedure
- Assign accountability of Excellent Plant Shutdown performance to department managers
- Define systems and equipment having the largest potential for energy improvement during non-production
- Define roles and responsibilities related to implementation and auditing of shutoff and startup procedures

**Step 4: Creation of formal shutoff and startup procedures**

- Work with plant operations and maintenance personnel in each department to develop shutoff and startup procedures for each department to be implemented during non-production events
- Integrate shutoff and startup procedures within existing operations and maintenance Standard Operating Procedures (SOPs) and processes
- Coordinate any training required for implementation of shutoff and startup procedures to relevant personnel

**Step 5: Apply the Excellent Shutdown Procedure**

- Implement startup and shutoff procedures according to the Excellent Plant Shutdown Procedure

**Step 6: (Initial) Technical audits and reviews to confirm procedure quality/ completeness**

- Produce an audit checklist to be used during facility walkthroughs
- Perform audits of the Excellent Plant Shutdown procedure during non-production events

**Step 7: (Ongoing) Process audits to ensure targets are being achieved**

- Perform monthly, weekly, and daily audits of the Excellent Plant Shutdown procedure

**Step 8: Key Performance Indicator (KPI) Reporting**

- Monthly, weekly, real-time communication of results to responsible parties
- Review of reports to support investigation of additional opportunities
- Track performance against past achieved performance to promote persistence of Excellent Plant Shutdown implementation
- Track performance against target to facilitate strategic discussions on what is needed to close the gap
- Communicate performance results, barriers, and challenges to management during Quarterly Management Reviews.

## 4. Data driven energy management

Much of the success of the Excellent Plant Shutdown initiative can be attributed to the wealth of energy and process data available from production and facility systems at Stellantis. Energy management information can be used to generate useful reports, and to provide feedback to plant personnel on the energy performance of systems under their control. This feedback is used to keep managers accountable, and to trigger an investigation if energy performance drifts from expected levels. These reports can also double as a means for further opportunity identification, and measurement and verification of energy savings.

However, this process, referred to as "data driven energy management," does not come without challenges. Even a system designed to automatically shutdown during periods of inactivity requires various levels of oversight to ensure the system is not overridden and continues to function as originally intended. Management processes such as the Excellent Plant Shutdown ensure persistence of energy performance and provide the strategic direction in breaking down barriers to achieving the energy reduction targets established. Fail-safe mechanisms were included on automated control systems to allow for interim adjustments, but then would automatically revert to the original operation after a short period.

The following are the main sources of information used in the Excellent Plant Shutdown process to support development of KPIs and reports used for tracking energy performance.

- ***DTE Load Watch***: a web-based platform, providing 15-minute electrical demand data at a plant level for each facility.
- ***Power Monitoring System***: a web-based real-time power monitoring system, providing real-time and historical electricity demand data at plant sub levels for each facility.
- ***Leidos Energy Management System (EMS)***: a web-based custom energy management system used for energy monitoring and control of equipment. Data availability and controls capability in Leidos EMS vary from each facility and are continually being upgraded and optimized to support continual improvement.
- ***Factory Information System (FIS):*** a production and process monitoring system, providing real-time and historical department-level production data.
- ***Audits & Energy Treasure Hunts:*** outputs from manual audits and opportunity identification processes.

Stellantis also uses several other information systems for monitoring and control of process systems and equipment. These information systems are used in conjunction with those listed above to conduct targeted analyses for investigation of additional opportunities as well as for monitoring, control, measurement, and verification of procedures established through Excellent Plant Shutdown.

### a) Leidos EMS real-time alerts

One of the biggest challenges currently being faced is the ability to provide real-time useful information to the right people who would take action, without distracting from their other responsibilities. Weekly reports are useful in providing feedback on the previous weeks' performance. However, this information can only be used to improve performance during future non-production periods.

As a response, an alert system was developed in Leidos EMS to issue simple email alerts to maintenance managers, identifying missed opportunities in real-time. These email alerts get triggered during instances where the department-level electricity demand is above a designated threshold during non-production periods. A one-hour buffer period is given between alerts, to allow enough time to investigate and respond to this deviation. This alert process is currently being piloted at Sterling Heights Assembly Plant (SHAP). An example email alert is shown below.

"*Energy target is **3,500kW** and actual energy consumption is **3,841kW**. [useless consumption]"*

### b) Weekly performance reports

A weekly report was developed to track electricity demand against target during non-production periods. The average normal production electrical demand is estimated based on historical trends, and the actual and target reductions loads are calculated each week. The lowest historical achieved load is also presented, to provide a frame of reference to the plant on what has been achieved under existing conditions.

This report is generated on a weekly basis, for total site and department-level electricity demand at each Stellantis facility. During the SEM calls, the demand trends are reviewed to assess actual versus expected overall performance, durations of shutdowns and startups, and to strategize methods of shortening shutdown/startup times and cut down the load even further. An example weekly performance report is presented in Figure 3 below.

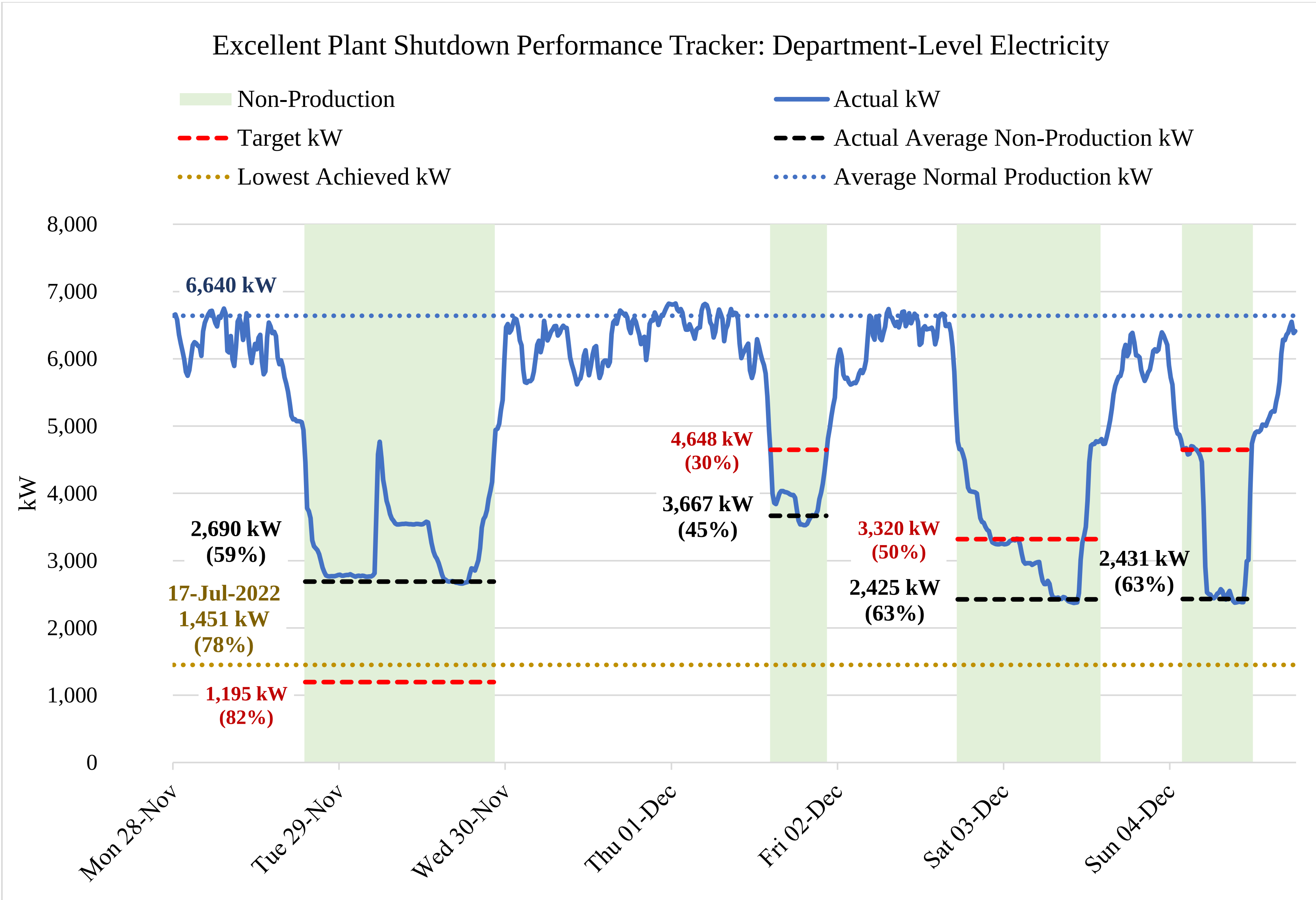


Figure 3. Example of department-level weekly performance tracker

c) **Multi-plant benchmark reports**

Following planned holiday shutdowns, comparison reports are produced to provide benchmark energy performance information for comparable facilities and departments. The performance results are then communicated to the plants to discuss successes and challenges related to implementation of the Excellent Plant Shutdown procedures.

This is intended to facilitate discussions and share learnings between facilities and departments, and to further refine the Excellent Plant Shutdown procedures.

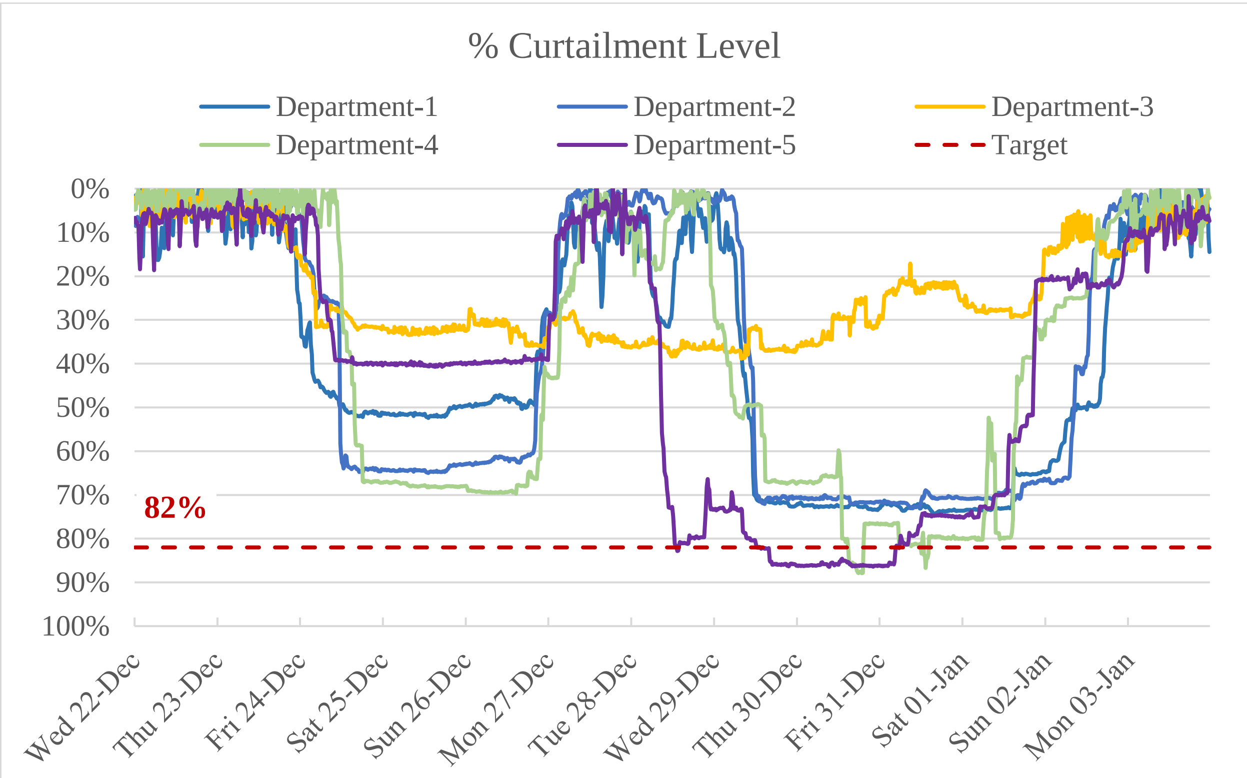


Figure 4. Example of department-level holiday comparison report

#### d) Monthly Measurement & Verification (M&V) reports

In addition to the reports described above, which aim to further improve the Excellent Plant Shutdown process, M&V reports are updated monthly to quantify annualized energy savings since the start of the initiative. These results are communicated during quarterly Management Reviews and are eventually claimed and incentivized by the DTE SEM Program.

Key M&V Steps are detailed as follows:

- Define key measurement points and collect available supporting information
- Define the baseline performance of the system and select a representative timeline for comparison
- Consider impacts of previously implemented measures and/or changes in static factors
- Consider relevant variables such as weather and production
- Develop a methodology for evaluating performance
- Calculate savings post-implementation
- Communicate the results

An example output from an M&V report is presented in Figure 5 below. Once a performance model is established, the plant's Cumulative Sum (CUSUM) of savings is reviewed monthly by the energy management team to monitor for persistence. Inflections in the CUSUM trends can be used to validate performance improvements driven by enhancements to shutdown procedures and/or to identify deviations from expected performance.

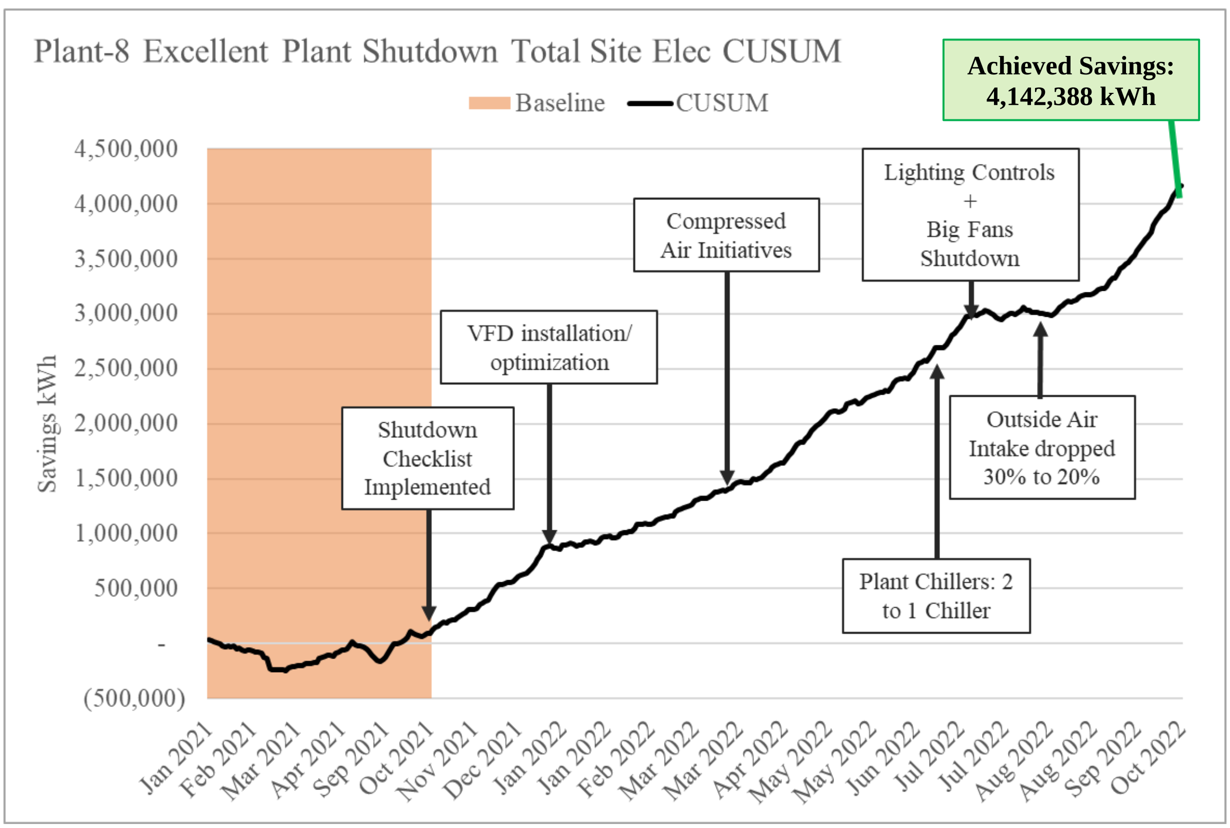


Figure 5. Example Cumulative Sum (CUSUM) of Excellent Plant Shutdown Electricity Savings

## 5. Performance Results

As of June 2023, the Stellantis plants participating in DTE's SEM Program have collectively achieved over **22 million kWh per year** of electricity savings, and Stellantis was awarded over **$1.1 million** in SEM incentives for downtime control measures implemented through Excellent Plant Shutdown. These results are summarized for each plant in Figure 6 below and represents **15%** of the total potential non-productive electricity savings identified during the gap analysis process. Through ongoing development of the Excellent Plant Shutdown process, the joint SEM team continues to close the gap towards elimination of energy waste, contributing significantly to Stellantis' carbon and energy reduction goals and greater energy awareness across all levels of the organization.

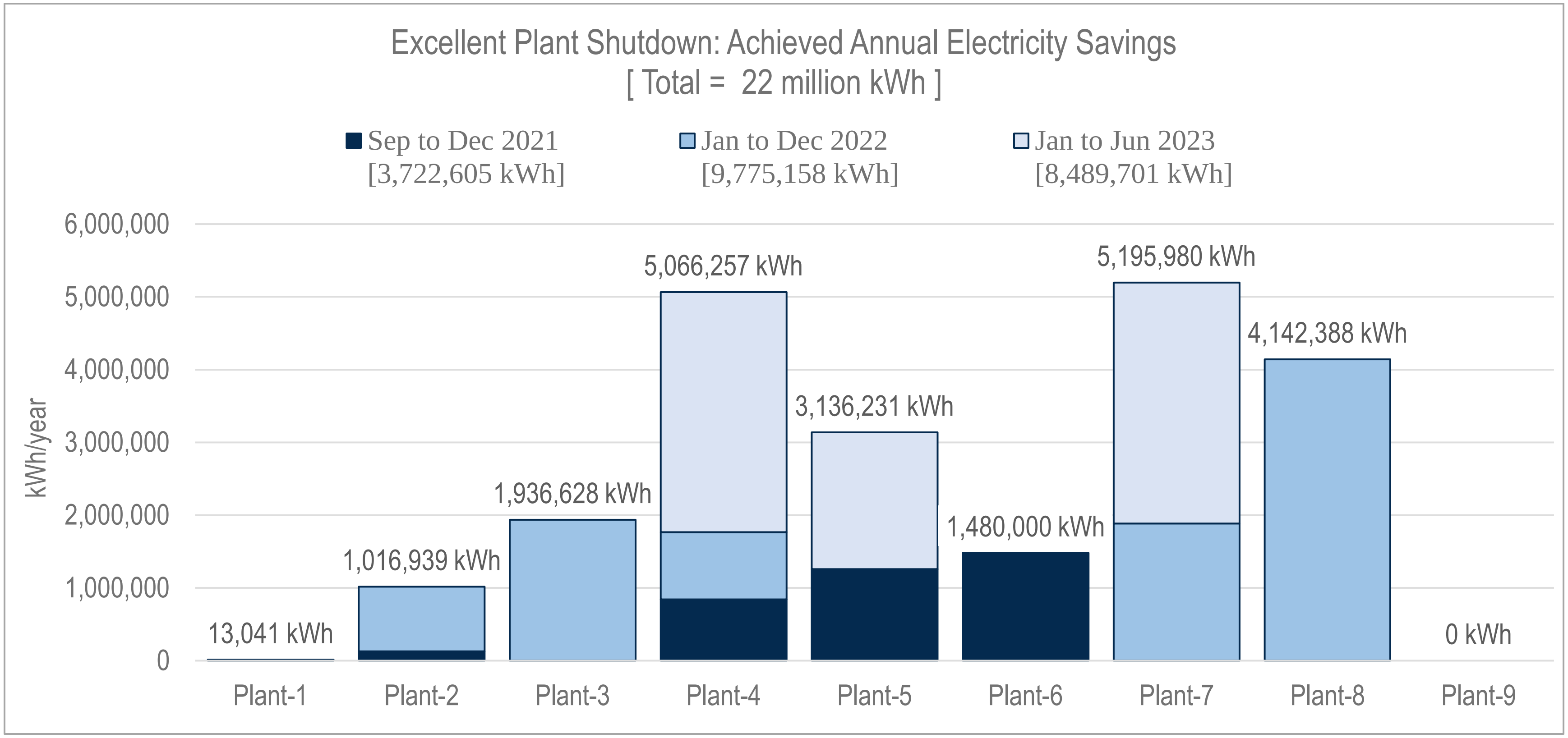


Figure 6. Achieved annual electricity savings for Stellantis SEM plants during non-production periods, since the start of the Excellent Plant Shutdown initiative

## 6. Conclusion

Industrial decarbonization requires aggressive solutions, such as the Excellent Plant Shutdown initiative. A significant opportunity exists for impacting manufacturing energy use and $CO_2$ emissions by focusing on reductions to non-production energy.

Implementation includes setting stretch-targets, developing a plan, taking action to implement change and regular monitoring of performance. Alerting key personnel of missed opportunities in real-time achieves the best results while mitigating deviations in energy performance.

The Excellent Plant Shutdown initiative, coupled with organizational commitment, SEM's continual improvement approach, and Stellantis' 8 points of success paves the path to achieving **carbon net zero by 2038**.

## 7. References

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