

General Motors Manufacturing Energy Management

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Overview of GM Manufacturing

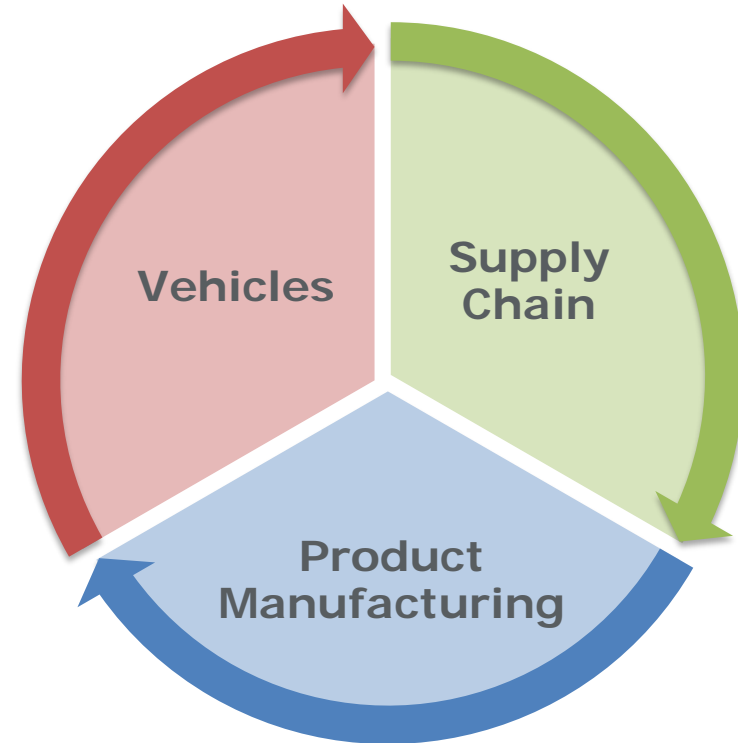
- Design, build and sell the world's best vehicles
- Building 9 million vehicles per year= \$1 billion in energy
- Enough electricity to power 1 million homes
- Carbon equivalent of 172 million trees for 10 years
- Enough water to fill 166 billion glasses



GM ENVIRONMENTAL SUSTAINABILITY

*We're continually assessing our **environmental impact** and taking steps to **reduce it***

GM has a commitment to the environment and sustainability that applies to every part of our business – from our **supply chain**, to **product manufacturing**, to the **vehicles** we put on the road.



OVERVIEW OF GM'S ENERGY MANAGEMENT PROCESS & GLOBAL MANUFACTURING SYSTEM

Integrating Energy into your business plan will make it a sustainable part of your operations

What is needed to be successful?

- Top leadership support
- Resources (dedicated people and budget)
- Establish Energy as a pillar of Business Plan

Tool kit for implementation

- Benchmarking*, Goals, and Scorecards
- Meter data, dashboards
- Continuous commissioning
- Budgeting and forecast
- Energy Savings Project Implementation Process
- Recognition



GM'S GLOBAL MANUFACTURING SYSTEM

Plan, Do, Check, Act aligns with Energy Star® guidelines



GLOBAL MANUFACTURING SYSTEM



Each of the 5 GM-GMS Principles is supported by key elements. There are 29 GM-GMS Elements.

People Involvement

1. Vision, Mission
2. Health & Safety
3. Qualified People
4. Team Concept
5. Engagement
6. Open Communication
7. Shop Floor Management

Standardization

8. Workplace Organization
9. Management By Takt Time
10. Standardized Work

Built-In Quality

11. Quality Standards
12. Process & Product Validation
13. In-Process Control & Verification
14. Quality Feedback/Feedforward
15. Quality Management System

Short Lead Time

16. Simple Process Flow
17. Pull Systems
18. Lean Containerization
19. Level Scheduling & Fixed Period Orders
20. Controlled External Transportation
21. Scheduled Shipping / Receiving
22. Temporary Material Storage
23. Supply Chain Management

Continuous Improvement

24. Business Plan Deployment
25. Problem Solving
26. Lean Design
27. Andon Concept/Process
28. Total Productive Maintenance
29. Continuous Improvement Process



Why – Vision & Mission

What – Goals & Objectives

Where – Focus on where value is added

When – Schedule and Control points

How - Methods

Who – Responsible & Support



In GMS, E-Metric or Environmental / Energy is managed along with our Business Plan in "Continuous Improvement"

	Goal
S	Continue Safety Leadership
P	Engaged & Qualified Work Force
Q	Segment Leaders
R	Meet Customer Demand
C	Profitability
E	Industry Leader in Environmental Systems

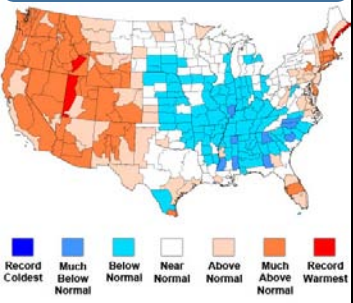
Unit

Data and communications is key enabler

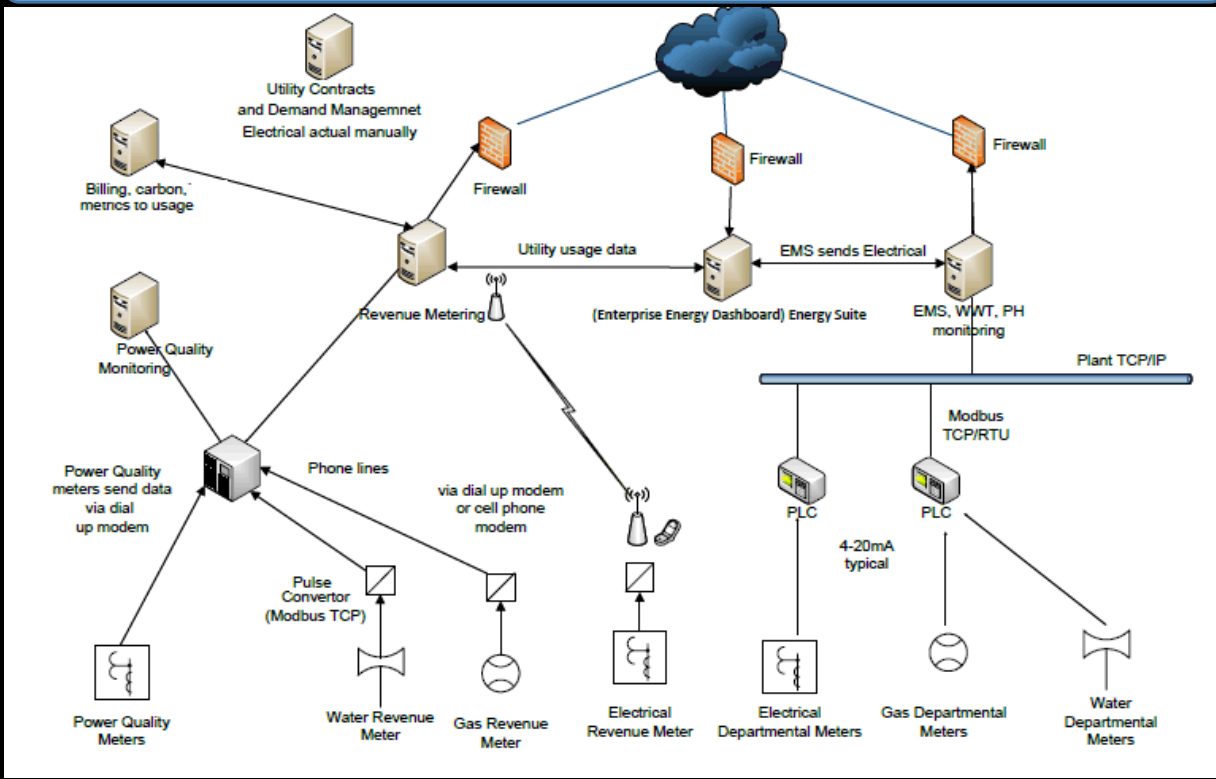
Meters



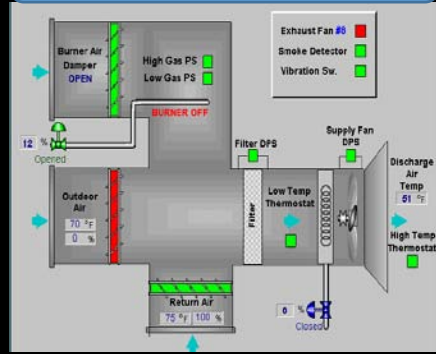
Climate



GM Energy OnStar and Global Utility online database



HVAC

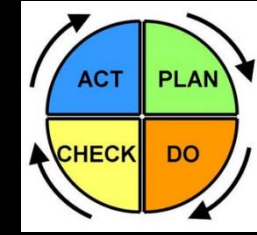


Production



2.5 Million data points per minute – US plants

Web enabled - Energy OnStar - REAL TIME DASHBOARD

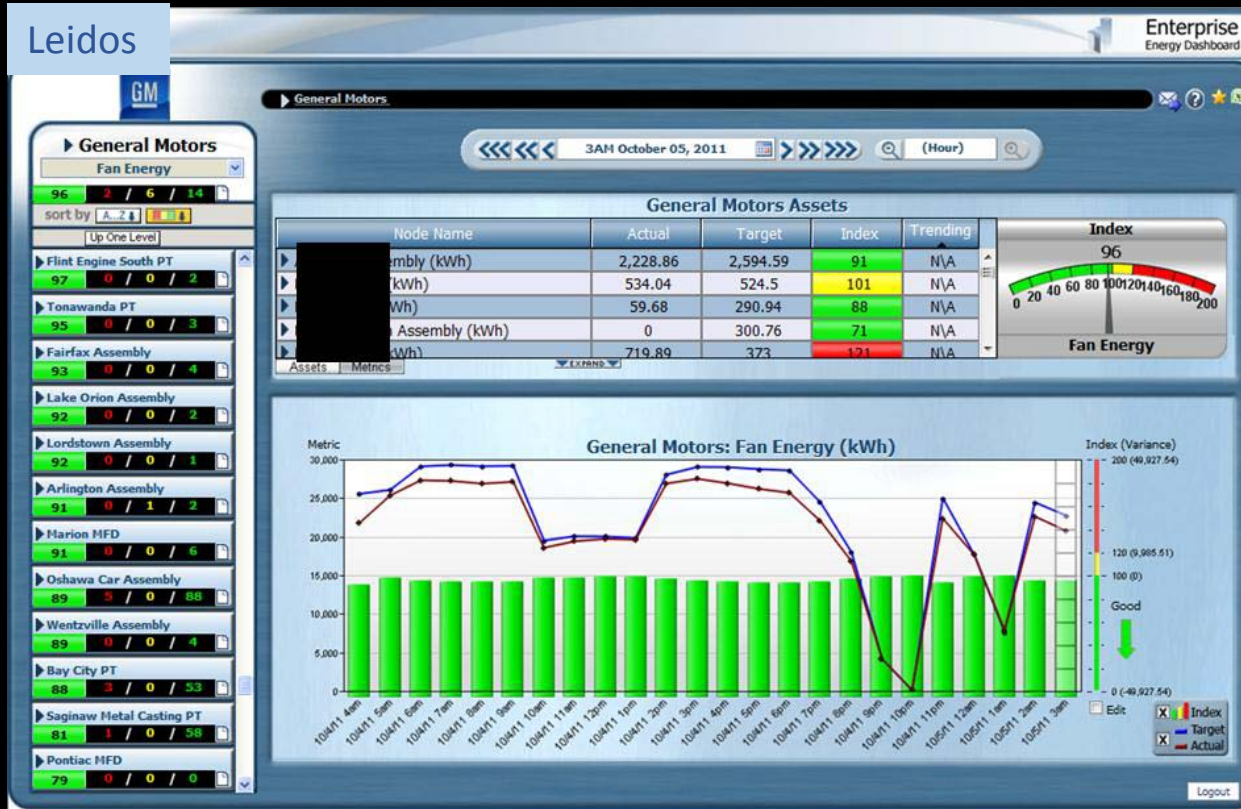


Monthly Energy, GHG, & Water Scorecard

GM	Energy per Unit Production (MWh/Unit)						Water per Unit Production (M ³ /Unit)					
	Monthly Energy			YTD Energy			Monthly Water			YTD Water		
	Actual	Target	Status	Actual	Target	Status	Actual	Target	Status	Actual	Target	Status
	1.236	1.282	●	1.517	1.579	●	2.182	2.327	●	2.138	2.212	●
Assembly	0.812	0.824	●	0.968	1.004	●	1.661	1.819	●	1.671	1.738	●
Plant 1	0.786	0.787	●	0.842	0.840	▲	1.876	2.078	●	1.557	1.984	●
Plant 2	1.850	1.905	●	2.589	2.687	●	5.192	4.803	✘	5.487	5.427	▲
Plant 3	0.354	0.443	●	0.553	0.616	●	1.008	1.349	●	1.127	1.305	●
Plant 4	0.606	0.678	●	0.753	0.788	●	1.823	1.749	▲	1.651	1.749	●
Plant 5	0.774	1.006	●	1.415	1.488	●	2.115	2.258	●	2.362	2.432	●
Plant 6	0.591	0.669	●	0.890	0.912	●	1.390	1.392	●	1.561	1.435	✘
Plant 7	2.877	4.850	●	3.755	4.180	●	10.443	12.047	●	6.574	6.787	●
Plant 8	0.540	0.582	●	0.672	0.688	●	1.269	1.334	●	1.358	1.349	▲
Plant 9	1.526	1.215	✘	1.816	1.809	▲	2.410	1.782	✘	2.236	2.060	▲
Plant 10	0.621	0.807	●	1.010	1.147	●	1.586	1.783	●	1.818	1.683	✘

Identified important energy metrics & targets:

- Heat/Cool Energy
- Fan Energy
- Outside Air Index & rate
- Runtimes
- Setpoints
- Supply Air Index & rate
- Energy metrics



Roll-up to Company wide data or drill down to Air Handling Unit
2.5 Million data points each minute into perspective

Daily e-mail to plants (MWh/unit)

Daily pro-rated information for 07/29/2013:

Resource	Daily Actual	Daily Target	MTD Actual	MTD Target
Electricity	0.46	0.61	0.77	0.61
Heating	0.32	0.83	0.44	0.83
Total	0.78	1.44	1.21	1.44

Monthly Scorecard

- Too late to react
- Need daily /hourly feedback