# GM BOTTOM-LINE IMPROVEMENT AND RESILIENCY PLAN

Path to 100% renewable energy consumption by 2050

GENERAL MOTORS

# Introduction


**“Establishing a 100 percent renewable energy goal helps us better serve society by reducing environmental impact,” said GM Chairman and CEO Mary Barra. “This pursuit of renewable energy benefits our customers and communities through cleaner air while strengthening our business through lower and more stable energy costs.”–Mary Barra**

# 2020 Sustainability Goal Progress

**VOC Emissions from Paint Shops**
- Achieved 10% vs 10% Reduction goal (kg/veh)

**Renewable Energy**
105 MW vs 125 MW goal by 2020

**Biodiversity**
60 GM sites are Wildlife Habitat Council certified
We have certified sites in 11 countries (USA, Canada, Mexico, Brazil, Argentina, Colombia, UK, China, Thailand, Vietnam, and South Korea)
The acreage of managed habitats on our properties is over 4,700

**$CO_2$ Footprint**
- 11% vs 20% Reduction (CO2e tons/veh) by 2020

**Total Waste**
- 23% vs 10% Reduction (kg/veh)
- New target 40% reduction

**Energy Use**
- 11% vs 20% Reduction (MWH/veh) by 2020

**Water Use**
- 11% vs 15% Reduction (m3/veh) by 2020

**Landfill Free**
- 89 Mfg sites vs 100 Mfg sites goal by 2020
- 33 Non-Mfg sites vs 25 non-mfg sites
- New target 50 non-mfg sites

Legend:
2020 Goal Met or Exceeded
Glide Path Status (RYG)

**Community Outreach**
- All manufacturing sites
- Explore new global coordinated effort

2010 Baseline

# HOW GM WILL ACHIEVE 100% RENEWABLE ENERGY

INCREASING ENERGY EFFICIENCY

SOURCING RENEWABLES

ADDRESSING INTERMITTENCY THROUGH BATTERY STORAGE

INFLUENCING POLICY TO DRIVE SCALE

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# THE POWER OF COMMITMENT

**350** FACILITIES *IN* **59** COUNTRIES

**100%** RENEWABLE ENERGY

# BY 2050

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# ENERGY EFFICIENCY
# STEP 1

# 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 has been an Energy Star® partner for 20 years

GM-2100 Data Inputs

GM-2100 System Operations

GM-2100 Output

## Site data

- Weather
- Floor space
- Sector
- Location

## Invoices

## Meter readings

## Production data

## Calculations & data analysis

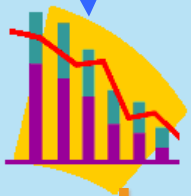
- GHG
- Forecasts
- Scorecard

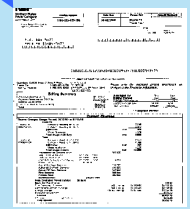
GM 2100 GLOBAL UTILITIES INFORMATION SYSTEM

## Site & Utility Liaison

## Information

## … on screen



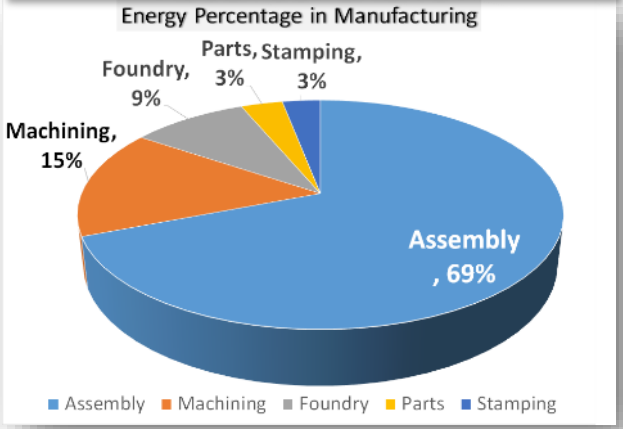


## … or printed … charts … images

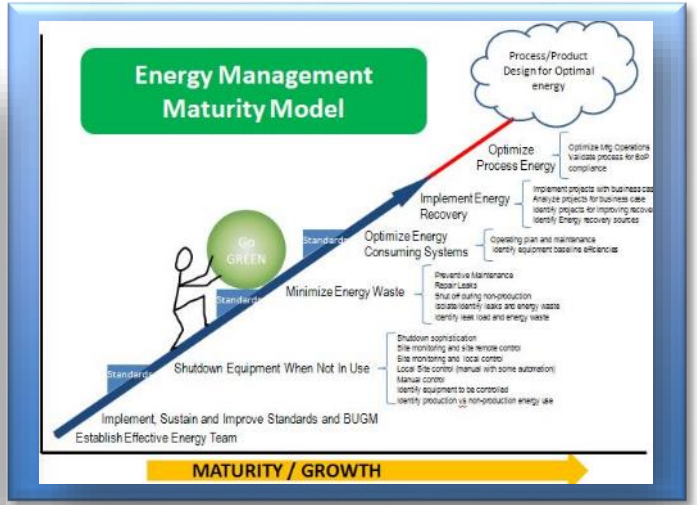
## … for use throughout the business, wherever utility data is needed

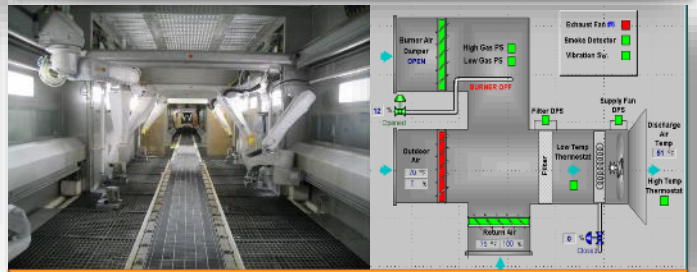
# PRIORITIZE ASSEMBLY & PAINTING OPERATIONS

## PAINT OPERATIONS ARE 70% OF ASSEMBLY ENERGY




- Recycle air to automated zones
- Design in efficiency—fans, pumps
- Three-wet paint process
- Automated shutdown



Painting: 50% of energy & 70% water use

# WEB-ENABLED ENERGY ONSTAR – REAL TIME DASHBOARD

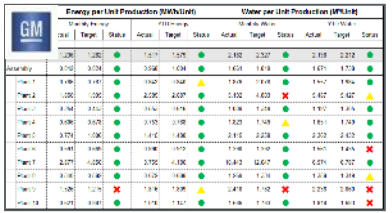

**Identified important energy metrics and targets:**

- Heat/Cool Energy
- Fan Energy
- Outside Air Index and Rate
- Run Times
- Set Points
- Supply Air Index and Rate
- Energy Metrics

Leidos


**Continuous Commissioning HVAC provides saving $4M for (6) month payback**

**Monthly Energy, GHG, & Water Scorecard**



**Roll-up to company-wide data or drill down to air handling unit**
**2.5 million data points each minute into perspective**

*Monthly* Scorecard

- Too late to react
- Need daily / hourly feedback

**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 |

# PROCURING RENEWABLE ENERGY
# STEP 2

# Landfill Gas & Waste-to-Energy

- One of the largest industrial users of landfill gas in U.S.
- Three plants use landfill gas
  - Ft Wayne Assembly 43% * EPA GLPA Award 2015
  - **Orion Assembly** **54% *EPA GPLA Award 2016**
  - Toledo Transmission 9%
  - **Hamtramck** **56%**

# Solar Power – United States

- Named “Solar Champion” for promoting renewable energy.
- More U.S. solar installations than any other automaker.
- Ranked top 25 of all commercial solar energy users in U.S. (as recent as last year)

*Global solar footprint equivalent to the size of 104 football fields*


*Opel Rüsselsheim facility in Germany, 8MW rooftop array*

**9** facilities w/ solar charging canopies (200 parking spots)

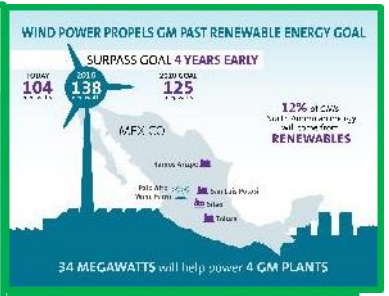
energy efficiency

# RENEWABLE ENERGY GOAL

## Previous

**2020 manufacturing goal 125 MW**

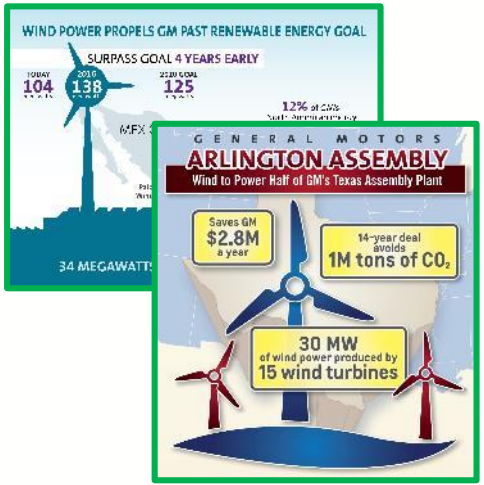
## RE100


**Set a good base, then scale**

# RENEWABLE ENERGY SOURCING METHODS

## Offsite PPA & Green Tariff

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## Onsite Investment

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## Battery Storage

# RE100 CROSS FUNCTION COLLABORATION

## KEY
### STAKEHOLDERS

For every path presented there are numerous stakeholders involved.

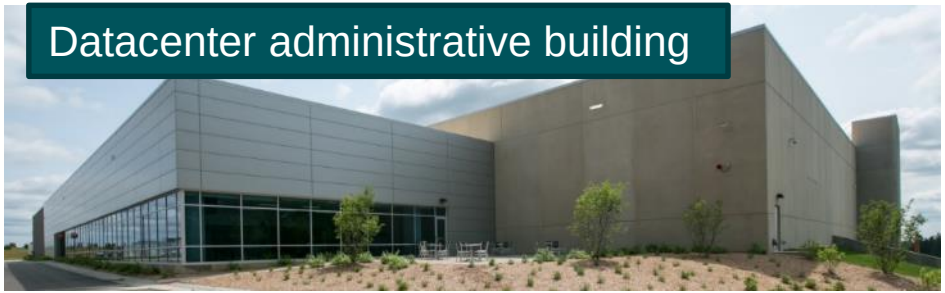
| | Onsite/ Owned | Offsite PPA | Offsite Tariff | REC Purchases | Storage |
|---|---|---|---|---|---|
| Plant Leadership | ■ | ■ | ■ | ■ | ■ |
| Regional Facilities | ■ | ■ | ■ | ■ | ■ |
| Regional Environmental | ■ | ■ | ■ | ■ | ■ |
| Facilities Construction | ■ | | | | ■ |
| CRSM | | ■ | ■ | | |
| Global Mfg. | ■ | ■ | ■ | | ■ |
| Strategy and Planning | ■ | ■ | ■ | | ■ |
| Central Layout | ■ | ■ | ■ | | ■ |
| Finance | ■ | ■ | ■ | | ■ |
| Mid-term Plan | ■ | ■ | ■ | | ■ |
| Accounting | | ■ | ■ | | |
| Treasury | | ■ | | | |
| Legal | | ■ | ■ | | |
| Gov't Relations | ■ | ■ | ■ | ■ | ■ |
| Tax Staff | ■ | | | | ■ |
| Economic Development | ■ | | | | ■ |
| Real Estate | ■ | | | | ■ |
| Communications | ■ | ■ | ■ | ■ | ■ |

# ENERGY STORAGE
# STEP 3

# OAK RIDGE NATIONAL LAB SECONDARY USE BATTERY ENERGY STORAGE


- Installed at Oak Ridge National Lab, TN on lab microgrid that includes Solar panels
- Includes 5 repurposed Chevy Volt batteries
- Has reliably run residential profiles for > 2.5 years
- Demonstrated abilities:
  - Solar generation smoothing
  - Peak shaving
  - Demand charge avoidance
  - Frequency regulation

# MILFORD DATA CENTER SECONDARY USE BATTERY ENERGY STORAGE


Functions:

- Demand charge avoidance and peak shaving
- Backup power
- EV green charging support
- Net zero

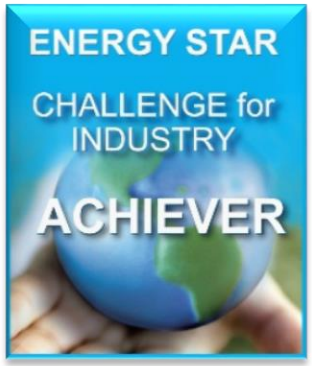
# POLICY AND SCALE
# STEP 4

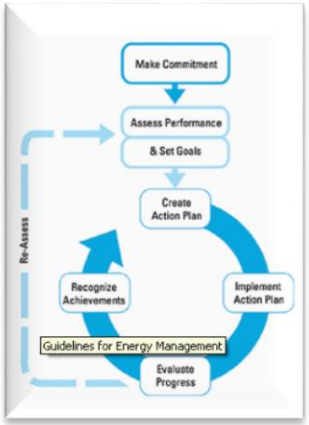
# BENEFITS OF PARTNERSHIP

## RECOGNITION

### External Recognition

- Best practice sharing
- Lessons learned
- Industry experts






- GM - 73 plants met Challenge
- Partner of the Year award – 4 years in a row


GM is a founding signatory
on the Buyer's Principles

GM is founding member of the
business renewables center, BRC
and hosting the BRC fall Meeting in 2016

# CORPORATE RENEWABLE ENERGY BUYERS' PRINCIPLES:
## INCREASING ACCESS TO RENEWABLE ENERGY

**62** COMPANIES **45** MILLION MWH OF DEMAND FOR RENEWABLE ENERGY **$5** TRILLION IN MARKET CAP


RENEWABLE ENERGY BUYERS' PRINCIPLES

WORLD RESOURCES INSTITUTE

www.buyersprinciples.org

# BUSINESS RENEWABLES CENTER