America’s Most Energy-Efficient Manufacturing Plants

Webinar Series from U.S. EPA ENERGY STAR Program for Industry

Part 1: Cement and Glass Plants
October 13, 2021
Noon ET
Topics

• Overview
  • Why energy efficiency
  • How to measure energy efficiency
• Energy-efficient glass plant
• Energy-efficient cement plant
• Q&A
Why focus on plants?

Share of total U.S. Energy consumption by end-use sectors (2020)

- Industrial: 33%
- Transportation: 26%
- Commercial: 18%
- Residential: 22%

Source: U.S. Energy Information Agency, Monthly Energy Review, Table 2.1 April 2021
Why focus on plants?

High process temps = high energy consumption

Highest energy consuming industrial sectors are **extremely** thermally intensive:

- Cement kilns: 2642° – 3600° F
- Glass Furnace: 2600 - 3000° F
- Steel Mill Blast Furnace: 1600° – 2300° F

Using less energy saves money and reduces GHG emissions
What is energy efficiency?

Using less energy to get the same job done
America’s most energy-efficient factories

Low Energy Intensity
ENERGY STAR Certified Plants

Most energy efficient plants in the nation

• Plants in top quartile of efficiency
• Plants apply for certification via EPA ENERGY STAR program
• Energy and production data is verified by Professional Engineer
• Facilities recertify annually to demonstrate continued performance
How is plant energy efficiency measured?

ENERGY STAR Energy Performance Indicators

- Auto Assembly
- Auto Engine
- Auto Transmission
- Cement
- Commercial Bread & Roll
- Container Glass
- Cookie & Cracker
- Flat Glass
- Frozen Fried Potato Processing
- Fluid Milk Processing
- Integrated Paper Mill
- Integrated Steel Plant
- Juice Processing
- Metal Casting
  - Aluminum
  - Iron
- Nitrogenous Fertilizer
- Petroleum Refining
- Pharmaceutical
- Pulp Mill
- Wet Corn Milling

www.energystar.gov/plants
ENERGY STAR Score from ENERGY STAR Energy Performance Indicator

Based on underlying predictive energy use model from actual plant energy and production data

www.energystar.gov/plants
Certified Plant Directory

Find certified buildings and plants: energystar.gov/buildinglist
America’s Most Energy-Efficient Manufacturing Plants

Since 2006

230+ plants
ENERGY STAR certified

$6 billion+
savings on energy bills

65 million
metric tons GHG emissions avoided

Find certified buildings and plants: energystar.gov/buildinglist
America’s Most Energy-Efficient Manufacturing Plants

Today’s Webinar

Bridgeton, NJ
GLASS PLANT
7 Years Certified

Rillito, AZ
CEMENT PLANT
9 Years Certified
America’s Most Energy-Efficient Manufacturing Plants

Today’s Webinar

Brian Kristofic
Director of Sustainability
Ardagh Glass Packaging-North America

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Energy Manager
Ardagh Glass Packaging-North America

Bill Jerald
Chief Energy Engineer
CalPortland
Listen for…

Can something similar be done in my plant or building?

How can I use ENERGY STAR to better manage energy and GHGs?
America’s Most Energy-Efficient Manufacturing Plants

Today’s Webinar

Bridgeton, NJ
GLASS PLANT
7 Years Certified
Since 2010, ten AGP – NA facilities have received 47 ENERGY STAR plant and building certifications.
Our Sustainability strategy

Our sustainability strategy

Our sustainability levers

**Environment and Ecology**
- Minimise our GHG emissions
  - Get to 100% renewable energy
  - Hybrid furnace
  - Recycled content increase
  - Product design
  - Energy efficiency projects
  - Low carbon transport
  - Sustainable sourcing
  - Minimize NOx
- Minimise our ecological impact
  - Maintain excellence on water management
  - Support increased recycling and use of recycled content
  - Promote circularity narratives on use of infinitely recyclable materials

**Social**
- Our people & our communities
  - Excellence on health and safety
  - Increase our retention, promotion and inclusion of diverse profiles
  - Engage proactively with our local communities through grassroots "Giving Back" initiatives

Our direct link with UN’s Sustainable Development Goals

Our sustainability filter
Sustainability only has a sustainable impact if it is economically viable both long and short term
Bridgeton plant overview

- 1966 – Built by Leone Industries
- 2012 – Purchased by Ardagh Group
- 146,000 sq. feet – plant space
- 65,000 sq. feet – warehouse space
- 5.5 MW DC 20-acre solar facility installed 2019
- 2 furnaces, 24/7/365 operations
- Manufacture approximately 1.5 million glass containers per day for the food, beverage and spirits markets
- Approximately 360 employees
Glassmaking Process: https://www.youtube.com/watch?v=p7y7Gtc1mX4
AGP introduction: https://www.youtube.com/watch?v=c8-6j_V9lkE
Opportunities for energy efficiency

- High use of recycled glass (cullet)
- Preheating of cullet and raw batch materials
- Regular audits to find / repair compressed air leaks
- Regular audits to find / repair natural gas leaks
- Optimize burner settings – regular maintenance of combustion fans
- Installation of energy efficient lighting
- Compressor & vacuum system upgrades under consideration

Don’t forget to ask your utility company for financial assistance.
Opportunities for energy efficiency

Use of recycled materials

- High use of recycled glass (cullet) reduces energy required. Cullet has lower melting point than raw materials.
- Every 10% increase in cullet content = 3% energy reduction.
- Availability is a constraint
- Recycling rates vary
- Reduces quarrying of virgin raw materials; for every 100 tons of cullet recycled = 120 tons of virgin materials
- Some large furnaces can consume as much as $2,000,000 per year in natural gas

Evaluate energy intensity of materials used in production
Opportunities for energy efficiency

Preheating inputs

- Bridgeton is the only Ardagh plant that currently preheats both cullet and batch with waste heat from the furnace.
- Cullet preheating can reduce energy use 10% - 15%
- Removing temperature from the exhaust stream may affect emission abatement efficiency
Opportunities for energy efficiency
Find & repair leaks

Natural gas leak audit

Video clearly shows leak

Photograph of leak

Camera Hydrocarbon sensitivity “turned on”
Provides plants a score based on production and energy data

- Allows comparison of our portfolio of plants
- Tells us how far a plant is from average or high efficiency
- Clear metric to report to management
ENERGY STAR – one part of our Sustainability measurement program

The Carbon Disclosure Project (CDP) is a global environmental impact non-profit organization that drives companies and governments to reduce their greenhouse gas emissions, safeguard water resources and protect forests.

EcoVadis is a sustainability rating platform which assesses the sustainability policies, actions and reporting of suppliers in the categories of environment, labor practices, fair business practices and sustainable procurement.

Sedex is a networking platform aimed at sharing information on policies, procedures and standards at production facility level. The information is shared with key customers and may be reinforced by external, so-called SMETAs (Sedex Members’ Ethical Trade Audits).
Thank you

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Thank you
America’s Most Energy-Efficient Manufacturing Plants
Today’s Webinar

Rillito, AZ
CEMENT PLANT
9 Years Certified
CALPORTLAND
AMERICA’S MOST ENERGY EFFICIENT PLANTS

WILLIAM JERALD, CHIEF ENERGY ENGINEER, CALPORTLAND
WE ARE CALPORTLAND

- Started operation in Colton, CA in 1891
- Building Material supplier on the West coast of the U.S.
- 3,000 employees
- Over 100 facilities
- Washington, Oregon, Nevada, California and Arizona
- All three cement plants have achieved ENERGY STAR certification at some point
- Over 60 plants have taken the ENERGY STAR Challenge for Industry, over 20 Plants have Achieved the Challenge for Industry
CALPORTLAND OPERATIONS

- Ready Mix Concrete
- Cement Terminal
- Asphalt Plant
- Crushed Aggregate Rock
- Cement Plant
CALPORTLAND ENERGY CONSUMPTION

CalPortland Energy Intensity Trend 2003-2020

- Fuel MMBTU
- Electrical MMBTU
- Total MMBTU
- MMBTU/MTON
RILLITO CEMENT PLANT

- The Rillito Cement Plant is located just North of Tucson, AZ
- Portland Cement is shipped to Tucson and Phoenix via trucks
- The plant also has the capability to ship via rail
- Over 1 Million Tons of Cement shipped annually
RILLITO CEMENT PLANT HISTORY

Rillito Cement Plant First Kiln installed 1949

Rillito Cement Plant Second Kiln installed 1953
RILLITO CEMENT PLANT HISTORY

Rillito Cement Plant Third Kiln installed 1955

Rillito Cement Plant 4th Kiln with Preheater Tower installed 1955
CEMENT PLANT PROCESS

- Quarry Mines Limestone and delivers to the plant
- Limestone is crushed and Iron and Alumina is added
- The mixture is introduced to kiln process and heated to 2500F
- Kiln discharges the processed product (called clinker)
- Clinker is pulverized into the powdered Portland cement and shipped out to customers
Portland cement is manufactured by mining Limestone, and adding Iron and Alumina to the mixture.

The material is ground to a fine powder and introduced to a pyro process in the rotary kiln.

The kiln will raise the temperature of the mixture in order to perform the chemical transition to create clinker.

Clinker is mixed with gypsum and ground to a fine product that becomes the final product of Portland Cement.
PORTLAND CEMENT KILN PYRO PROCESS

1. Raw Feed introduced to Preheater tower
2. Heat is provided by fuel combustion
3. Ambient air is supplied through the clinker cooler; air provides cooling medium to cool the clinker produced from the kiln, and the heated air is now directed to the kiln to provide the combustion oxygen and the heating gases for the preheater tower process
4. As the Hot gas rises through the cyclones the raw mix is preheated prior to entering rotating kiln
5. The limestone raw mix is processed into a product called clinker
6. The clinker exits the kiln and is cooled by the ambient air
Plant Engineer is designated Energy Manager

Weekly meetings to discuss energy efficiency projects

Quarterly process energy meetings to report energy intensity data across corporate meeting

Focus on energy data keeps energy topics visible and a high priority
RILLITO CLINKER COOLER MODIFICATION

- Improved heat exchange allows more heat sent back to the process (energy intensity reduction)
- Cooler clinker leaving cooler
- Exit crusher improved allowing less downtime
- 7% kiln fuel efficiency improvement
The 3.5 mile long belt conveyor was due for replacement. Belt product was picked based on promise of reduced energy consumption due to the composition of the belt rubber. Metering installed and performing long term energy intensity analysis.

1-2% energy efficiency improvement
The Rillito Cement plant kiln takes alternative fuels into the upper level of the preheating tower. The original system allowed significant cold air into the process forcing higher fuel consumption, installing new double tipping valve significantly improved performance and allowed the plant to consistently burn alternative fuels efficiently, 1-2% efficiency improvement.
RILLITO PROCESS FAN IMPROVEMENTS

- The plant has performed multiple fan assessments
- Various projects have included complete fan wheel replacements, or fan wheel repair and restoration to factory specifications
- Thousands of HP of process fans on the property
RILLITO PREHEATER TOWER CYCLONE REPLACEMENT

- Cylcone is where the raw mix is introduced to the hot air process, maximizing heat transfer is important to efficiency.
- Computational Fluid Dynamic (CFD) modeling used to find the optimum design for maximizing efficiency of new cyclone.
- 3-4% kiln fuel efficiency improvement.
RILLITO COMPRESSED AIR SYSTEM UPGRADES

- Plant performs regular leak checks with ultrasonic detector
- Performed DOE in plant training for compressed air systems in 2012, Identified multiple compressed air system modification
- A 2020 vendor performed assessment identified more potential savings projects
- 5% system efficiency improvement
Dust Bin takes baghouse dust and reintroduces it to the raw mix in a metered process to reduce raw feed transient quality, improves kiln energy intensity due to stability improvements.
MICROSCOPY OF CLINKER

- Clinker samples analyzed for crystal structure formation
- Analysis helps determine kiln performance and advises necessary kiln operational and chemistry adjustments to improve performance and efficiency
ENERGY STAR EPI POSTER

- Rillito ENERGY STAR EPI score poster
- Placed throughout the plant
- Employee engagement is critical
EMPLOYEE SHIRTS
CELEBRATING
CERTIFICATION

- Rewarding and Acknowledging employees is vital to maintaining energy efficiency gains.
CERTIFICATION ANNOUNCEMENT

- CalPortland proudly shares and announces our plant certification to the community
- Sharing with our neighbors
- Sharing with our customers to make them aware of our commitment to energy efficiency and sustainability
Come and see how we are improving energy efficiency and helping our community through ENERGY STAR.
- Rillito Cement Plant
- ENERGY STAR certified since 2012
- Continual improvements over the years
- Was able to maintain certification with the new EPI baseline
THANK YOU

WILLIAM JERALD
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Sectors eligible for ENERGY STAR certification

- Auto Assembly
- Auto Engine
- Auto Transmission
- Cement
- Commercial Bread & Roll
- Container Glass
- Cookie & Cracker
- Flat Glass
- Frozen Fried Potato Processing
- Fluid Milk Processing
- Integrated Paper Mill
- Integrated Steel Plant
- Juice Processing
- Metal Casting
  - Aluminum
  - Iron
- Nitrogenous Fertilizer
- Petroleum Refining
- Pharmaceutical
- Pulp Mill
- Wet Corn Milling

2021 ENERGY STAR Certified Plant application deadline
November 30, 2021

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Next webinars

Part 2: Paper and Petroleum
Wednesday, November 17, 2021; 12 PM ET
• Georgia Pacific’s Brewton, Alabama containerboard mill
• Marathon Petroleum Corporation’s Robinson, Illinois Refinery

Part 3: Bakeries
February 9, 2022; 12 PM ET
• Weston Foods’ ACE Gaffney, South Carolina (2 years ENERGY STAR certified) and Winnipeg, Canada commercial bakeries

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