



APICS2018

The Sustainable Supply Chain: Leveraging Digitalization and Sustainability to Build a More Competitive Supply Chain

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APICS 2018 Session Evaluation

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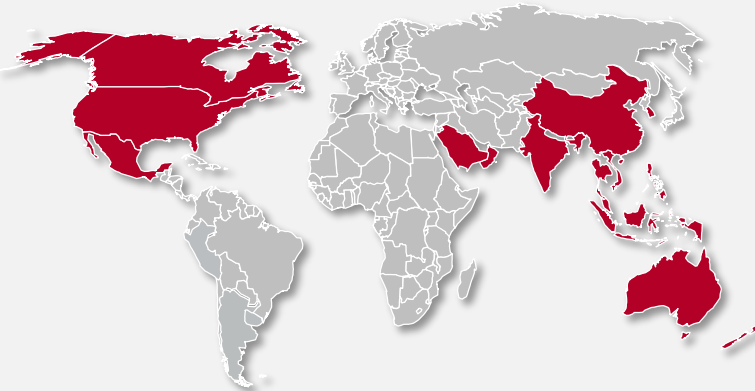
Abstract

As supply chain leaders navigate the increasing role of digital technologies and automation, there is significant opportunity for organizations to ensure sustainability is integrated across the components of plan, source, make and deliver.

The key topics addressed in this session will be the value of emerging technologies, lean concepts, and automation in supply chain. Attendees will also learn about how the integration of sustainable supply chain and digitalization can enhance the sustainability and performance of supply chains and the broader organization.

Founded	1902
Market Cap ¹	\$4.7B
Headquarters	Chicago, IL
Employees ²	6,800
Plant Locations ²	51
2017 Sales ²	\$3,204M
2017 AOP ³	\$438M
2017 Adjusted EPS ³	\$1.80

GLOBAL FOOTPRINT



- #1** IN NORTH AMERICAN GYPSUM
- #1** IN AUSTRALIA / ASIA GYPSUM (USG BORAL)
- #2** IN NORTH AMERICAN CEILINGS

Leading Manufacturer of Building Materials and Innovative Solutions

1. As of 2/28/2018.
 2. Does not include USG Boral Joint Venture, which has: 3,200 employees, 49 plant locations and US\$1.2B sales in CY 2017.
 3. Non GAAP metric – See reconciliation to GAAP results in Appendix.

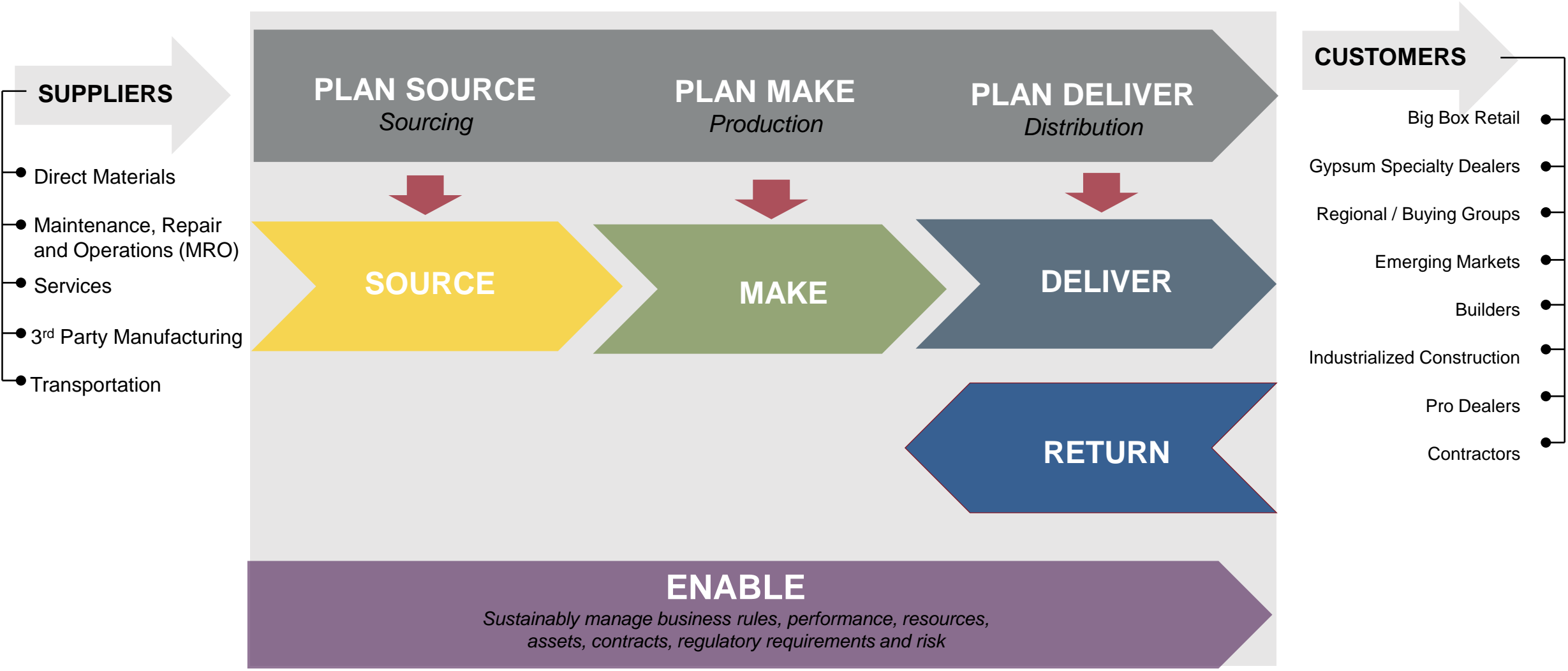
- **WHAT IS SUSTAINABLE SUPPLY CHAIN?**
- USG OPERATIONAL MODEL & STRATEGY
- TRANSFORMING TO A SUSTAINABLE SUPPLY CHAIN
- Q&A

Sustainable supply chain management integrates **environmental, economic and social factors** into the whole supply chain lifecycle from **product design and development, to material selection and transportation, manufacturing, packaging, distribution, use** and ultimately disposal or reuse.

- WHAT IS SUSTAINABLE SUPPLY CHAIN?
- **USG OPERATIONAL MODEL**
- TRANSFORMING TO A SUSTAINABLE SUPPLY CHAIN
- Q&A

Sustainable Supply Chain

The USG Operational Model





WHAT IS SUSTAINABLE SUPPLY CHAIN?



USG OPERATIONAL MODEL



TRANSFORMING TO A SUSTAINABLE SUPPLY CHAIN

LEAN
DIGITIZATION
SUSTAINABILITY



Q&A

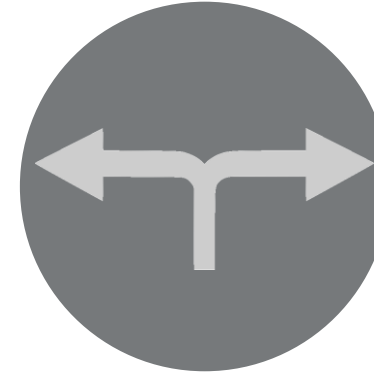
Maximizing the value of the supply chain and minimizing the waste that exists



Inventory



Waiting



Motion



Defects



Transportation

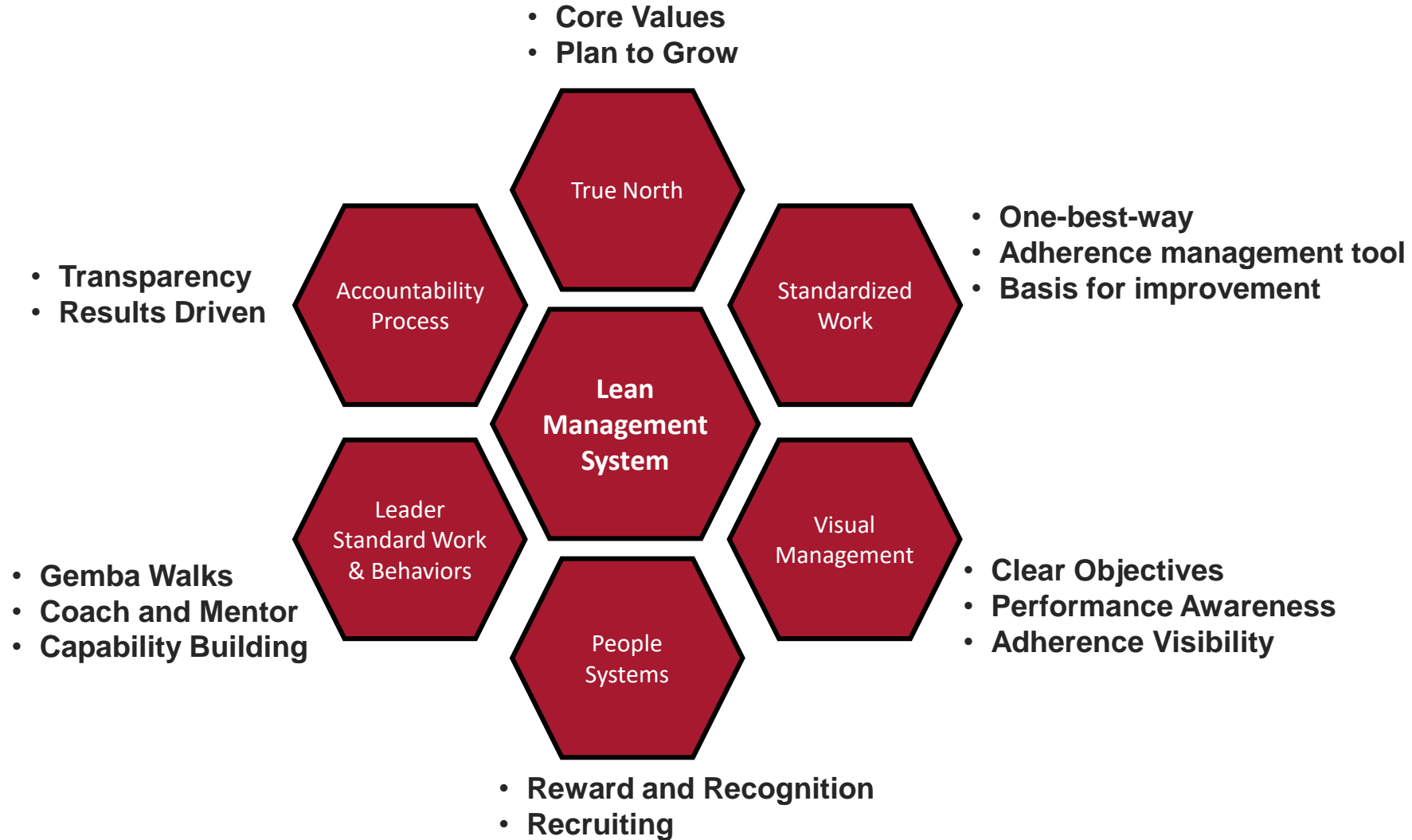


Overproduction



Overprocessing

Examples of Lean Tools: 5S, Lean Six Sigma, Kanban, Standard Work, Value-stream mapping, Error-proofing, 5 Why's



Lean Management Transportation Freight Optimizations (\$7MM)

OPPORTUNITY: USG ships over 1,000 truckloads of finished goods per day. Payloads for these shipments are not always at capacity.

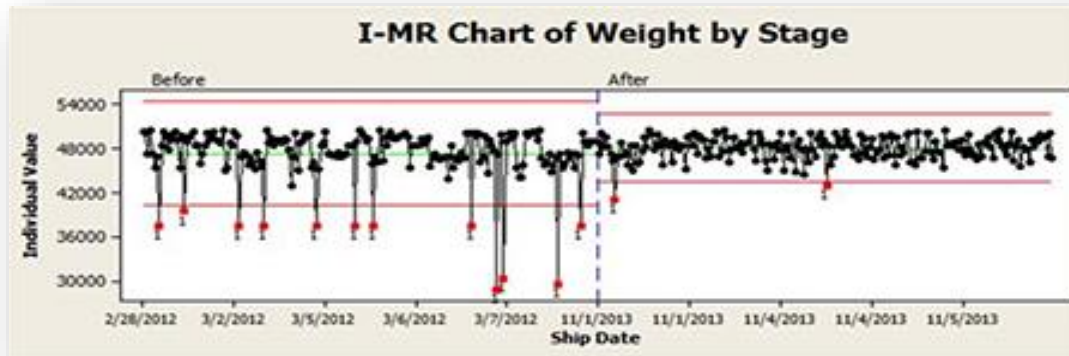
GOAL: Optimize carrier capacity to leverage equipment for outbound shipments on rail and truck to reduce freight costs

STRATEGY:

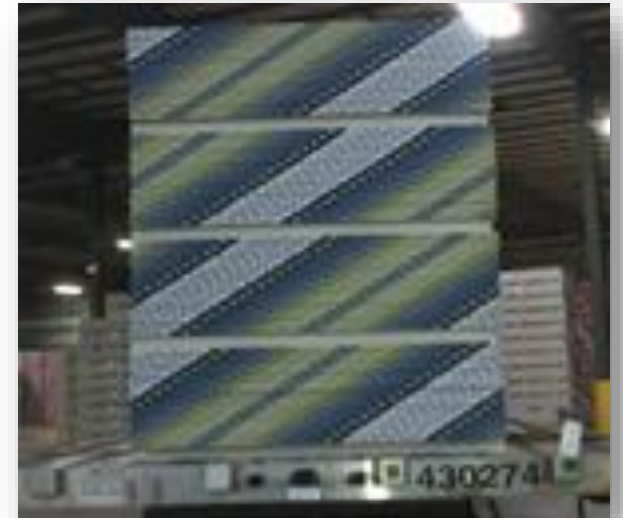
- Used data and Pareto charts to focus project team and resources
- Conducted customer survey to identify critical customer requirements
- Moods Median Tests and staged control charts depicted the statistical change made by the cross functional team
- Created monthly report to monitor solution, calculate savings, and identify improvements

OUTCOME

By reducing the variation the team was able to increase the average payload weight by 2.4%; this resulted in an annual freight savings of \$390,000 per year at the pilot plant.



Before



After





WHAT IS SUSTAINABLE SUPPLY CHAIN?



USG OPERATIONAL MODEL



TRANSFORMING TO A SUSTAINABLE SUPPLY CHAIN

LEAN
DIGITIZATION
SUSTAINABILITY



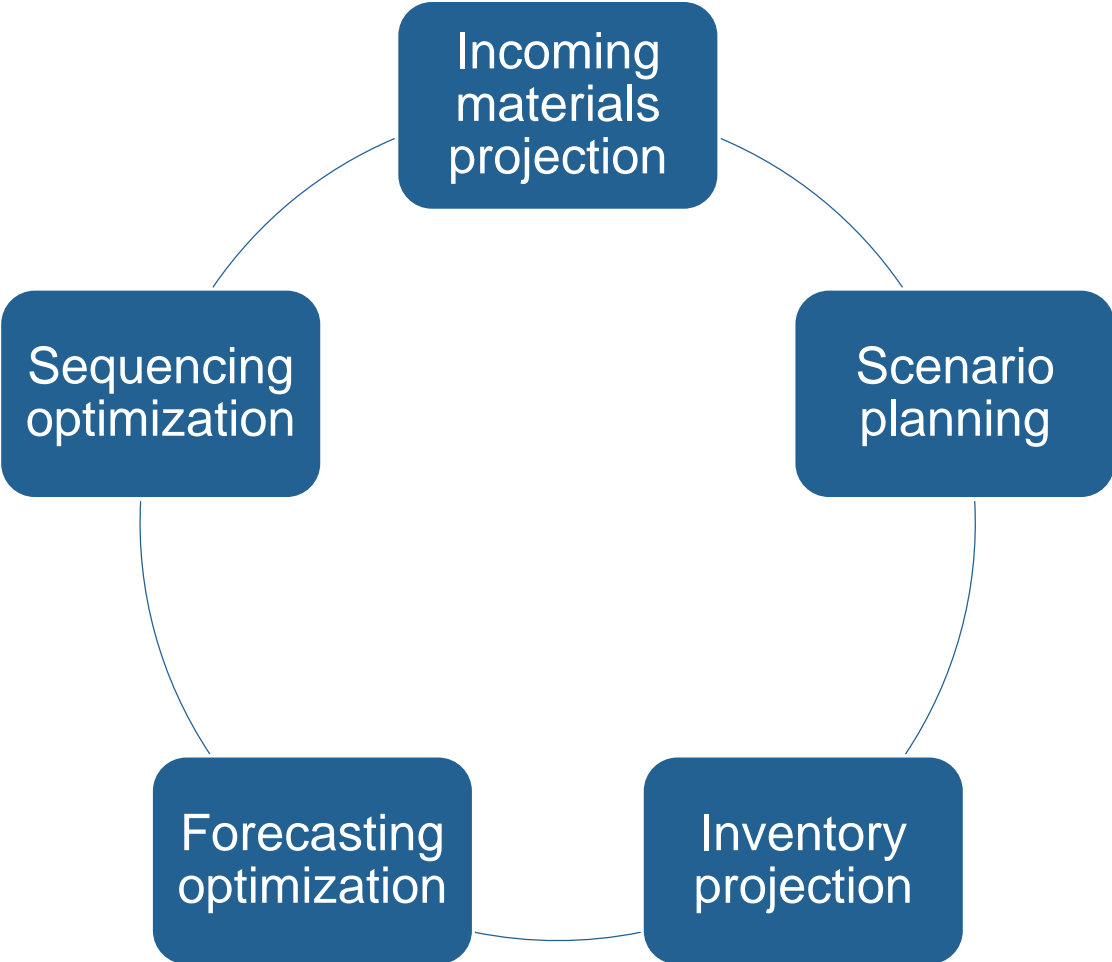
Q&A

Supply Chain Digitization

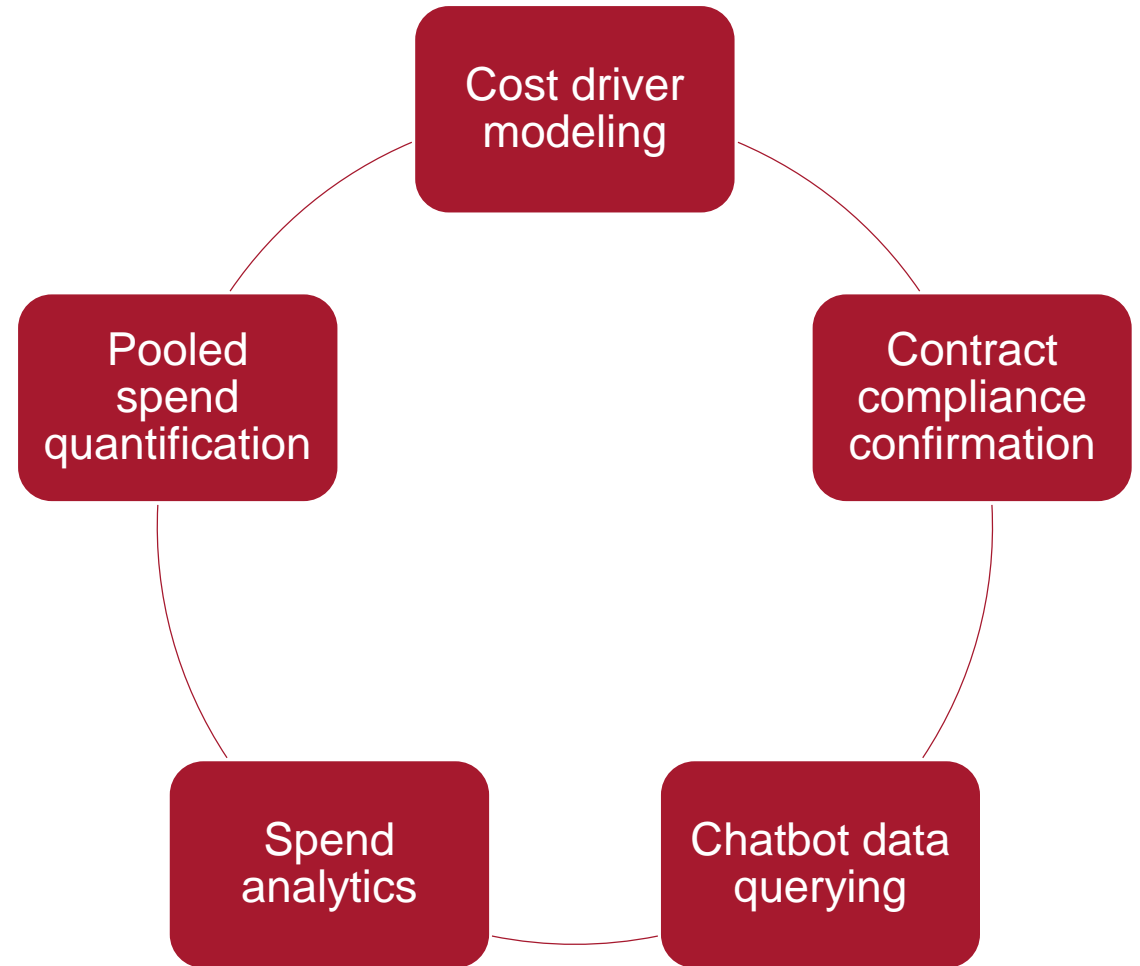
The Future of Commercial Mobility



PLAN



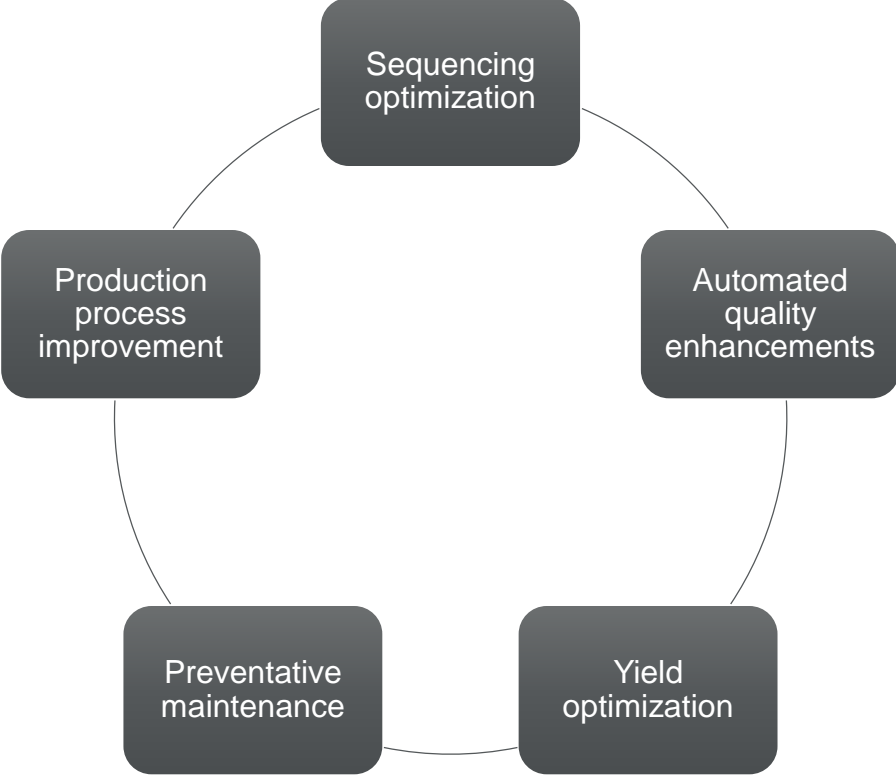
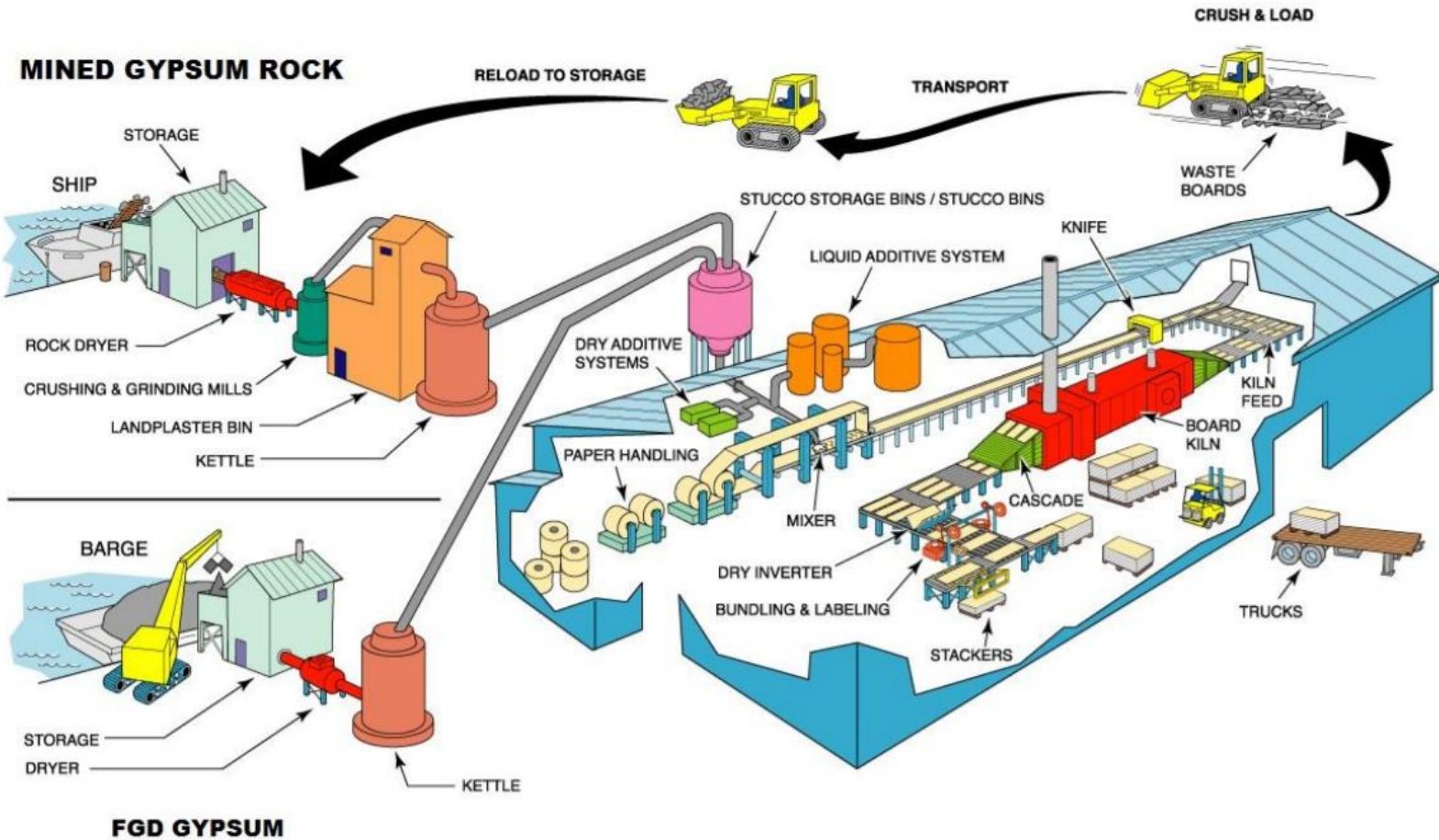
SOURCE



Supply Chain Digitalization Advanced and Automated Analytics



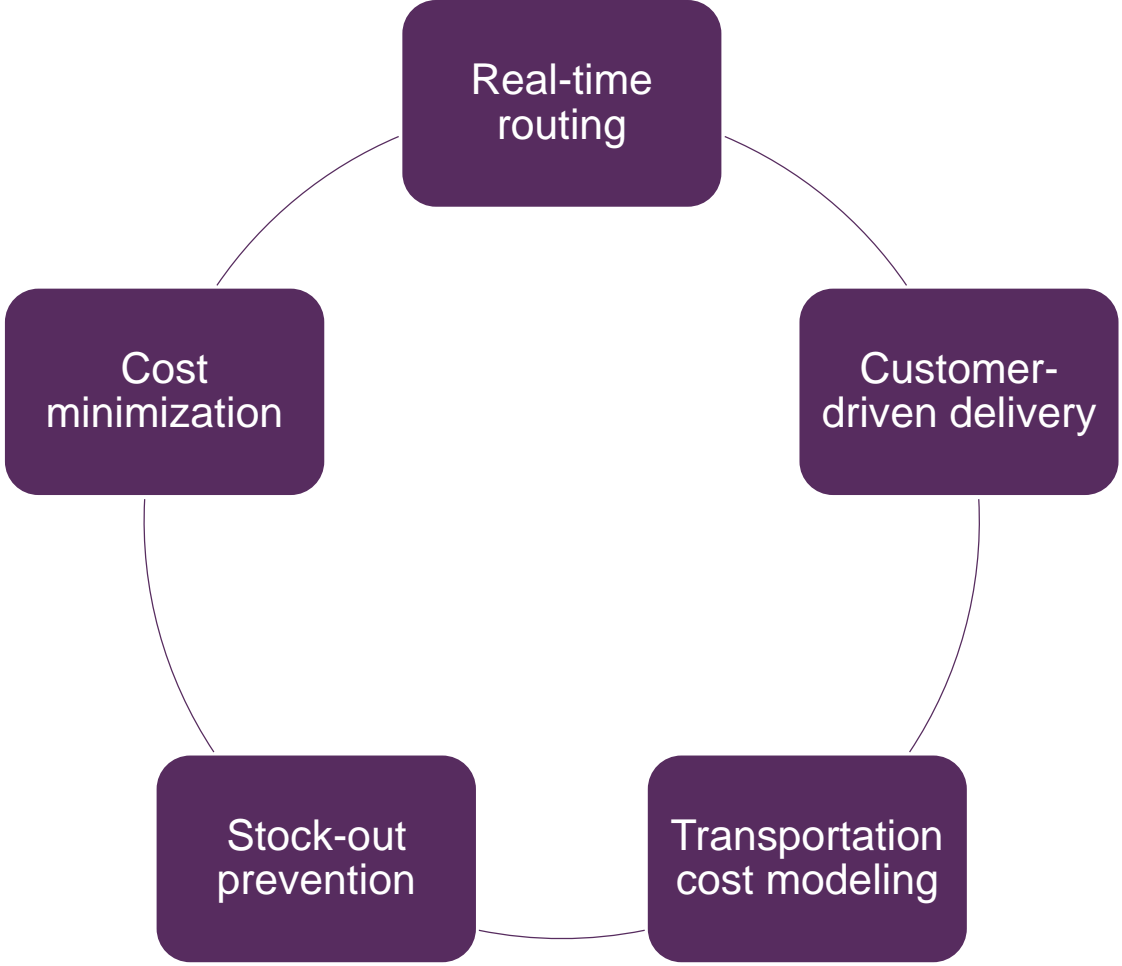
MAKE



DELIVER



PictureArchives.NET Image Contributed by Shawn Billings



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WHAT IS SUSTAINABLE SUPPLY CHAIN?



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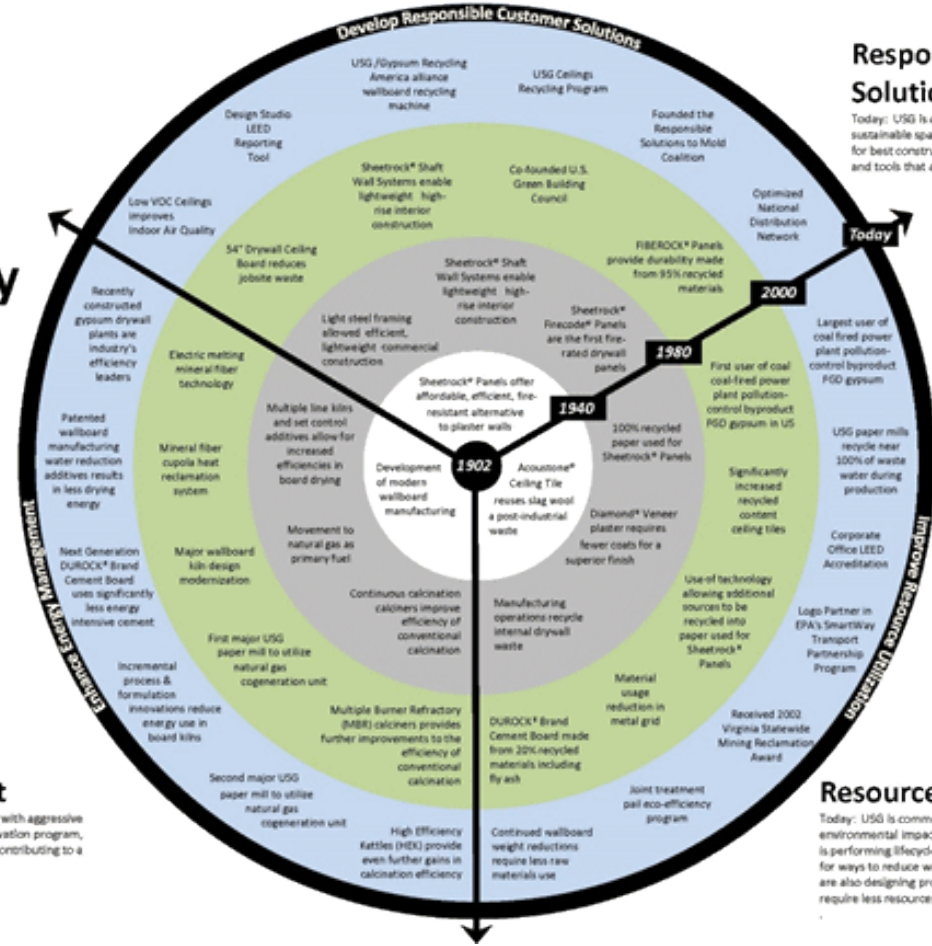


Q&A

Sustainable Supply Chain Environmental Responsibility



A Century of
Sustainability



Energy Management

Today, USG is committed to energy conservation with aggressive energy reduction goals. In addition to our conservation program, USG is actively seeking alternative energy. Both contributing to a reduced carbon footprint.

Resource Utilization

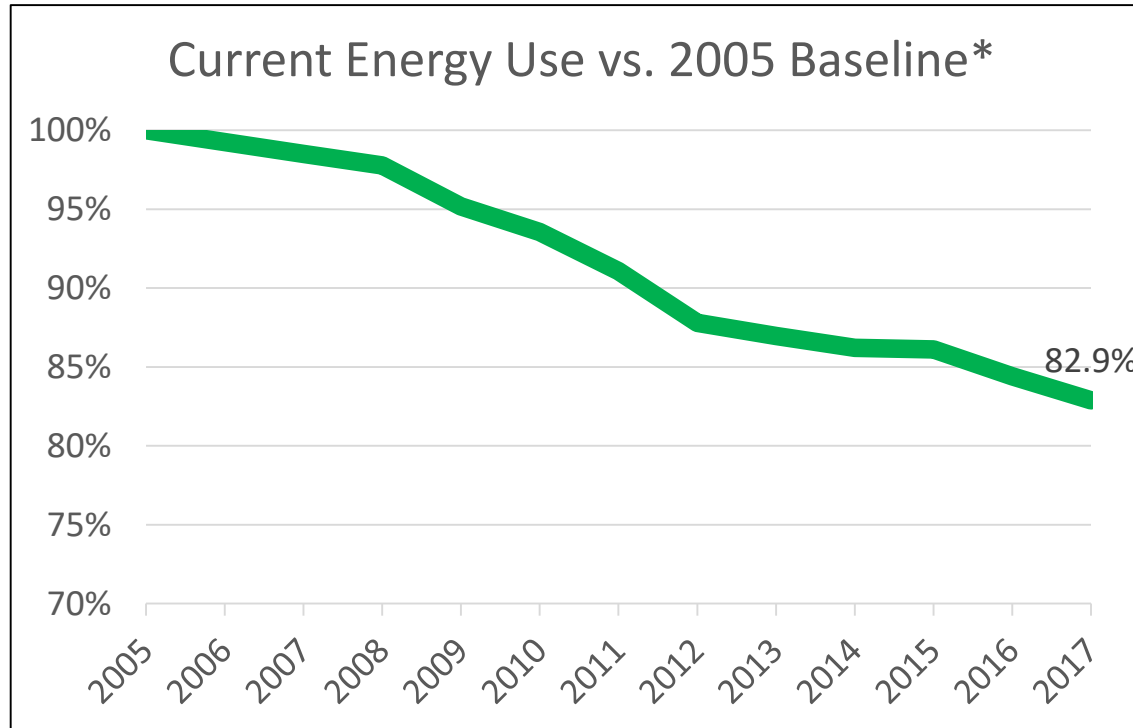
Today, USG is committed to conserving our resources and reducing our environmental impact as much as possible. To achieve our goals, USG is performing lifecycle assessments on our major products and looking for ways to reduce waste production or re-use unavoidable waste. We are also designing products that improve the built environment and require less resources to produce.

Responsible Customer Solutions

Today, USG is committed to providing products that enable sustainable spaces. We will continue to provide reliable guidance for best construction practices and provide innovative products and tools that allow our customers to build responsibly.

- Enhance Energy Management
- Improve Resource Utilization
- Developing Responsible Solutions

Approximately 98% of all raw materials entering a wallboard plant leaves as finished product!

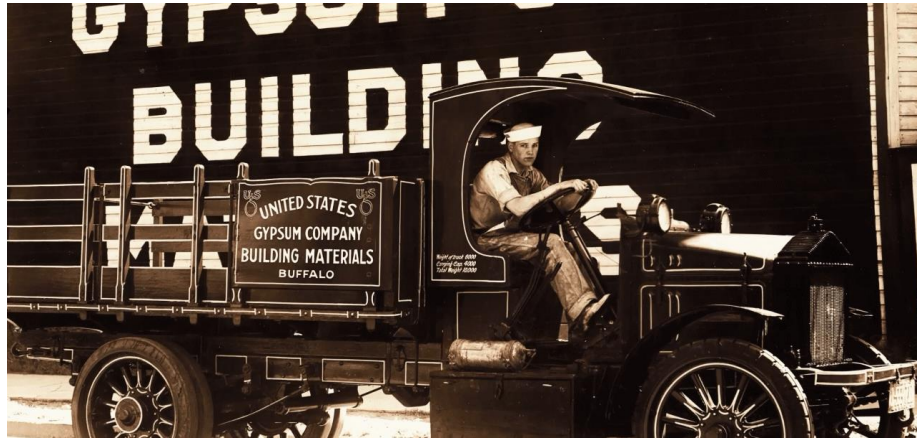


At our Slag Wool plant, we completed a project to reduce the energy required to manufacture our mineral wool ceiling tiles by more than **20 percent**. Mineral wool is made from slag, a waste byproduct from steel production.



Sustainable Supply Chain

Enhance Energy Management



One USG Lean Six Sigma project reduced 40-50 truckloads of wall board waste/year.



USG improved truck loading efficiency by up to 30% per truck.



Efficient transportation and raw material extraction



Fossil Fuel Emission Levels
(pounds per billion BTU of energy input)

Air Pollutant	Natural Gas	Oil	Coal
Carbon dioxide	120,000	160,000	210,000
Carbon monoxide	40	33	210
Nitrogen oxides	92	450	460
Sulfur dioxide	1	1,100	2,600
Particulates	7	84	2,700
Mercury	0.000	0.007	0.016

Efficiencies of Fossil Fuels

Fossil Fuel	Typical Efficiency	Current Maximum Efficiency
Coal	35%	42%
Natural Gas	45%	52%
Oil	38%	45%



ADOPTER



USG reduced energy usage on a per unit of production basis by nearly 20 percent since 2005 and is on target to meet the Architecture 2030 Challenge



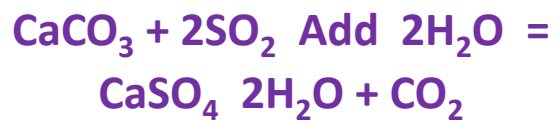
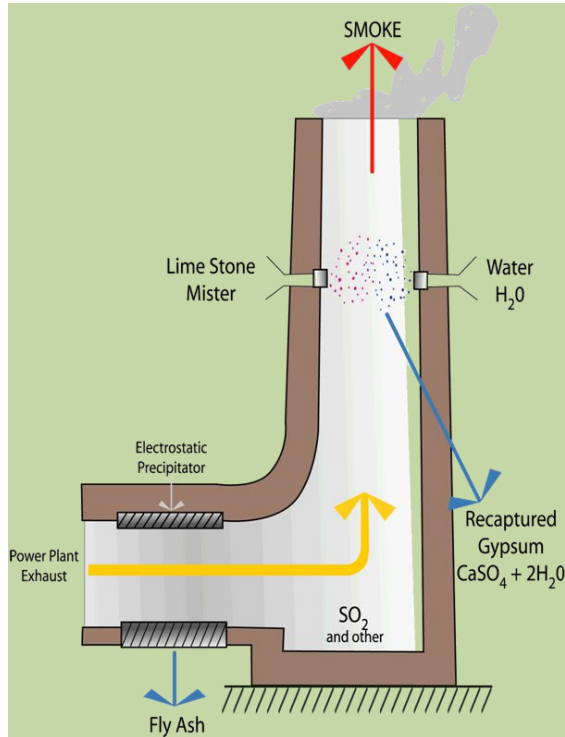
USG installed 16 acres of PV solar cells at the Plaster City, CA drywall plant which runs 2/3 of the plants energy. Eliminates 3,880 tons of CO2 emissions each year



Alternative Energies including PV, Solar thermal, co-generation, etc.



Recaptured (Flue-Gas Desulphurization) Gypsum



**0.6 tons of Limestone =
1 ton of gypsum**

Did you know ...

- Gypsum panels use less than 2 liters of water and acoustical ceiling tiles about 3 liters to produce one square foot of product?
- Mineral wool made from slag, an industrial byproduct from steel production aluminum and steel suspension systems, contain up to 90 percent recycled content?
- USG is one of the top consumers of waste paper in the U.S.? We use approximately **650,000 tons** of secondary fiber each year in the production of USG wallboard and ceiling products.

Sustainable Supply Chain

Improve Resource Utilization



In 2004, USG established a wool-based acoustical ceiling tile reclamation program

Our Rainier, Oregon plant has been reclaiming drywall waste for years. Paper and gypsum are recycled

Construction drywall cut-offs generate 10 to 12% waste at the jobsite.

USG with the Durst Organization and Lend Lease, created a NYC based clean waste drywall recycling Pilot Program.



Sustainable Supply Chain Impacts:

- Raw Material Selection
- Supplier Sustainability
- Transportation Energy Reduction




USG Sheetrock® Brand EcoSmart Panels are the industry's only sustainable wallboard. They are the lightest product on the market.



20%
reduction in transportation fossil fuels



25%
less water used during manufacturing



20%
fewer CO₂ emissions during manufacturing

Sustainability



Our wet-felt ceiling plants and our paper mills recycle about 90 percent of the wastewater produced during the manufacturing process



4 to 6 million
gallons of water saved per day per mill.



Sustainable Supply Chain

Improve Resource Utilization

From 2011 to 2016 production waste to landfill as increased by 2% while manufacturing production has increased 43%.

USG Cartersville plant:

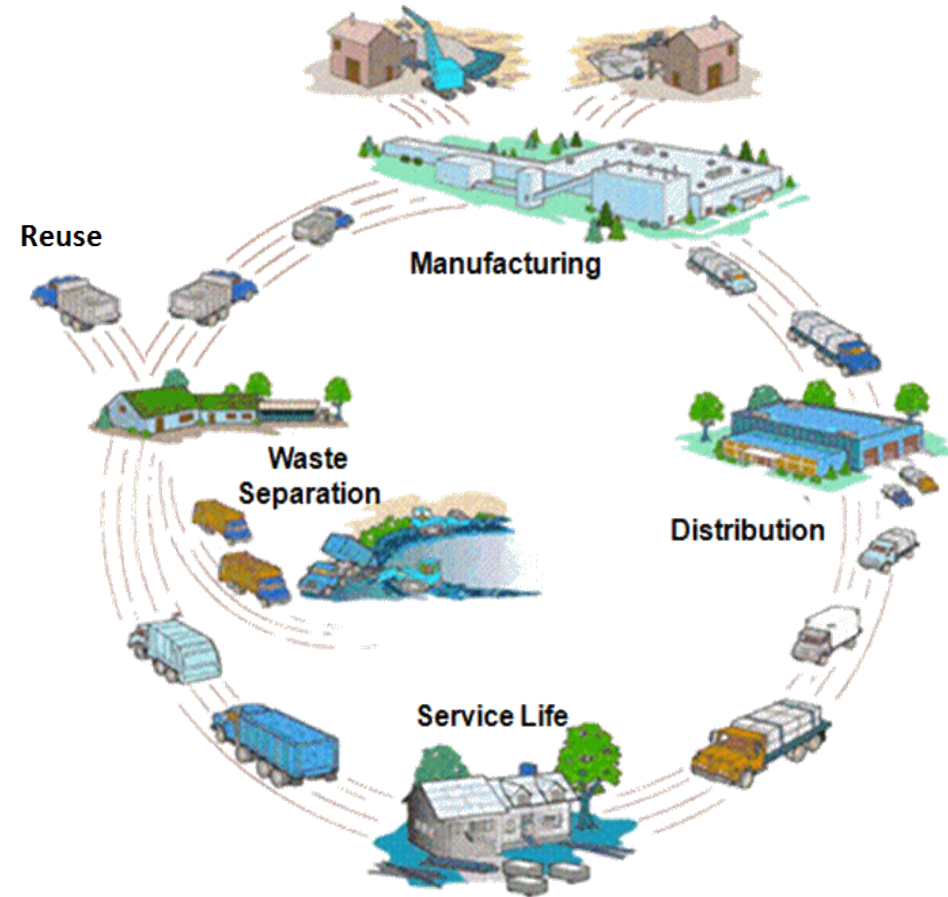
- Reduced landfill waste over 16 tons/year (55% in 2 years)
- Zero waste to landfill for two years

Waste Management recycled 2,502 tons of cardboard/paper, scrap metals, and plastics from USG plants in 2014

COMPOST	RECYCLING	WASTE
<p>ALL food fruits, vegetables, bread, meat, fish, dairy</p> <p>Bon Appetit To-Go containers, plates, utensils, napkins, cups, straws, Pepsi cups</p> <p>Coffee/Tea tea bags, coffee grounds & filters, coffee cup sleeves, wooden stir sticks</p> <p>Pizza Boxes</p> <p>Old Flowers</p> <p>Paper Towels</p>	<p>Paper (All types)</p> <p>Aluminum</p> <p>Glass</p> <p>Plastics #1-7 Check for a triangle on bottom of the container (bundle plastic bags)</p> <p>Cardboard</p> <p>Universal Waste Batteries, light bulbs, cell phones, ink cartridges</p> <p>Electronic Waste Items with an electric cord or batteries</p> <p>Paper Only paper No books or other recycling please.</p>	<p>Packaging Wrappers for candy, chips, energy bars, condiments</p> <p>Non-SCU Disposable Containers Cups, take-out containers, Styrofoam, soiled aluminum foil</p>
<p>Quick hints:</p> <p>#1 Please compost anything that was once alive, or was made of living materials.</p> <p>#2 Please no plastic, metal, or glass in the compost.</p> <p>#3 Look for these labels on the bottom of your container:</p> <p>"Nature Works"</p>	<p><i>Custodian empties weekly</i></p> <p><i>Place flattened, near any recycling bin</i></p> <p><i>Send to Facilities via intercampus mail</i></p> <p><i>Contact Facilities to request a pick up facilities-csc@scu.edu or X4742</i></p> <p><i>Located at copiers & printers</i></p>	<p><i>Please empty into the nearest common waste container, as needed</i></p> <p>There Is No AWAY... <i>When we throw our "garbage" away, we send it to a landfill. Please help SCU use resources efficiently & divert waste from landfills:</i></p> <ul style="list-style-type: none"> • Reduce the stuff you consume. • Reuse as much as you can. • Recycle and Compost where possible. • Respect others in our community, our watershed, and natural resources by learning more.
SPECIFIC TO CAMPUS OFFICES	Have a question? Please e-mail recycling@scu.edu	www.scu.edu/sustainability 03/2012

Waste Reduction

New Carbon or Old Carbon



Cradle to Cradle = complete process - extraction to re-use

Alternative Raw Materials Evaluation



1. WASTE PREVENTION



Prioritize the prevention of waste, rather than cleaning up and treating waste after it has been created. Plan ahead to minimize waste at every step.

2. ATOM ECONOMY



Reduce waste at the molecular level by maximizing the number of atoms from all reagents that are incorporated into the final product. Use atom economy to evaluate reaction efficiency.

3. LESS HAZARDOUS CHEMICAL SYNTHESIS



Design chemical reactions and synthetic routes to be as safe as possible. Consider the hazards of all substances handled during the reaction, including waste.

4. DESIGNING SAFER CHEMICALS



Minimize toxicity directly by molecular design. Predict and evaluate aspects such as physical properties, toxicity, and environmental fate throughout the design process.

5. SAFER SOLVENTS & AUXILIARIES



Choose the safest solvent available for any given step. Minimize the total amount of solvents and auxiliary substances used, as these make up a large percentage of the total waste created.

6. DESIGN FOR ENERGY EFFICIENCY



Choose the least energy-intensive chemical route. Avoid heating and cooling, as well as pressurized and vacuum conditions (i.e. ambient temperature & pressure are optimal).

7. USE OF RENEWABLE FEEDSTOCKS



Use chemicals which are made from renewable (i.e. plant-based) sources, rather than other, equivalent chemicals originating from petrochemical sources.

8. REDUCE DERIVATIVES



Minimize the use of temporary derivatives such as protecting groups. Avoid derivatives to reduce reaction steps, resources required, and waste created.

9. CATALYSIS



Use catalytic instead of stoichiometric reagents in reactions. Choose catalysts to help increase selectivity, minimize waste, and reduce reaction times and energy demands.

10. DESIGN FOR DEGRADATION



Design chemicals that degrade and can be discarded easily. Ensure that both chemicals and their degradation products are not toxic, bioaccumulative, or environmentally persistent.

11. REAL-TIME POLLUTION PREVENTION



Monitor chemical reactions in real-time as they occur to prevent the formation and release of any potentially hazardous and polluting substances.

12. SAFER CHEMISTRY FOR ACCIDENT PREVENTION



Choose and develop chemical procedures that are safer and inherently minimize the risk of accidents. Know the possible risks and assess them beforehand.

Sustainable Supply Chain

Develop Responsible Solutions



200+



16



61



37



1



38

Product Transparency



- Leverage Lean Management and LSS across your supply chain to improve value and minimize waste throughout the supply chain
- Selectively utilize Advanced Analytics and Automation to improve service and reduce cost
- Sustainability should be integrated across all of the components of the supply chain: Plan, Source, Make, Deliver, and Return
- Customer requirements for additional transparency drive stronger supplier relationships and visibility further into the supply chain
- Digitalization may be used enhance the sustainability and performance of supply chains and the business

Q & A

Appendices

Adjusted Operating Profit Reconciled to GAAP Operating Profit under New Reportable Segments



\$ Millions	FY 2017
Reported GAAP Operating Profit (Loss)	
• U.S. Wallboard and Surfaces	\$314
• U.S. Performance Materials	\$26
• U.S. Ceilings	\$95
• Canada	\$12
• Other	\$11
• Corporate & Eliminations	(\$91)
Total	\$367
Adjustments to GAAP Operating Profit (Loss)	
• U.S. Wallboard and Surfaces – Pension settlement charge	\$7
• U.S. Performance Materials – Pension settlement charge	\$2
• U.S. Ceilings – Pension settlement charge	\$2
• Corporate & Eliminations – Pension settlement charge	\$1
Total	\$12
Adjusted Operating Profit (Loss) – Non-GAAP measure	
• U.S. Wallboard and Surfaces	\$321
• U.S. Performance Materials	\$28
• U.S. Ceilings	\$97
• Canada	\$12
• Other	\$11
• Corporate & Eliminations	(\$90)
Other Adjustments	
• Adjusted equity income from UBBP	\$59
Total Adjusted Operating Profit	\$438

Adjusted Diluted EPS Reconciled to GAAP Diluted EPS



	FY 2017	FY 2016	FY 2015	FY 2014 ¹
Income per average diluted common share – GAAP	\$0.60	\$3.46	\$6.73	\$0.25
Adjustments per average diluted common share:				
• (Income) loss from and gain on sale of discontinued operations	\$0.06	(\$2.02)	(\$0.11)	(\$0.08)
• Loss on extinguishment of debt	\$0.15	\$0.25	\$0.13	—
• Pension settlement charge	\$0.08	\$0.11	—	\$0.09
• Exit of commercial space	—	\$0.03	—	—
• USG's share of UBBP impairment and restructuring charges	—	\$0.05	—	\$0.01
• Withholding tax on property contributed to USG Boral	—	—	—	\$0.01
• Tax effect on adjustments	(\$0.08)	(\$0.13)	\$0.05	—
• Long-lived asset impairment charges	—	\$0.08	—	\$0.61
• Gain on sale of surplus property	—	(\$0.08)	(\$0.07)	(\$0.08)
• Gain on sale of equity method investment	—	—	(\$0.07)	—
• GTL (recovery) of receivable / shipping operations	—	(\$0.05)	(\$0.05)	(\$0.05)
• Change in tax law	\$0.99	—	—	—
• Reduction in the valuation allowance of DTA	—	—	(\$4.96)	—
• Gain on Deconsolidation of Subs & Consolidation of JVs	—	—	—	(\$0.18)
• Litigation Settlement Charge	—	—	—	\$0.33
Adjusted earnings per adjusted average diluted common share – Non-GAAP	\$1.80	\$1.70	\$1.65	\$0.91
Average diluted common shares – GAAP	146,710,846	147,660,979	147,246,600	144,296,316
Adjustment to add common shares that would be dilutive based on adjusted net income	—	—	—	2,797,618
Adjusted Average diluted common shares – Non-GAAP	146,710,846	147,660,979	147,246,600	147,093,934

1. 2014 has been recasted to reflect L&W Supply as a discontinued operation



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THANK YOU



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