ENVIRONMENTAL SUSTAINABILITY OF ARAB FERTILIZER INDUSTRY

COMPREHENSIVE ANALYSIS OF FOUR PILLARS

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الإتحاد العربي للأسمدة
Arab Int'l Organization
هيئة عربية دولية
Arab Fertilizers Association
Since 1975

The fertilizer industry plays a crucial role in global food security, but its operations also raise environmental concerns. Recognizing this, a growing number of fertilizer companies are embracing sustainability practices aligned with the Global Reporting Initiative (GRI) standards. This technical publication aims to investigate the environmental sustainability practices within the Arab fertilizer industry, with a focus on four key pillars: energy consumption, GHG emissions, water consumption, and waste generation. By examining various factors aligned with the Global Reporting Initiative (GRI) standards, such as energy sources, renewable energy utilization, GHG emissions reduction initiatives, water consumption practices, and waste management strategies, this publication highlights the industry's efforts towards achieving a more sustainable and responsible production process.

The Global Reporting Initiative (GRI) standard plays a crucial role in promoting environmental sustainability within the industrial sector. GRI provides internationally recognized guidelines for organizations to measure, report, and disclose their environmental performance. By adhering to GRI standards, companies in the industrial sector can enhance transparency, accountability, and comparability in their reporting practices, enabling stakeholders to make informed decisions and evaluate the organizations' environmental impact.

The GRI standards offer a comprehensive set of guidelines for organizations to report on their environmental, social, and economic impacts. For the fertilizer industry, these standards provide a valuable roadmap.

Energy Consumption	The GRI 302 Energy 2016 standards mandate that companies provide comprehensive reports on their overall energy usage, categorized by energy sources (such as renewable and non-renewable) and energy intensity (the amount of energy used per unit of production). Prominent fertilizer companies are embracing renewable energy alternatives like solar and wind power in order to decrease their dependence on fossil fuels. These initiatives align with the following disclosure requirements: 1. Disclosure 302-1: Energy consumption within the organization. 2. Disclosure 302-2: Energy consumption outside of the organization. 3. Disclosure 302-3: Energy intensity. 4. Disclosure 302-4: Reduction of energy consumption. 5. Disclosure 302-5: Reduction in energy requirements of products and services..
GHG Emissions	GRI 305 EMISSIONS 2016 requires companies to report on their greenhouse gas (GHG) emissions, categorized by scope (direct, indirect from purchased electricity, and other indirect). Many fertilizer companies are implementing GHG reduction strategies like fuel switching, process optimization, and carbon capture and storage technologies. Disclosure 305-1 Direct (Scope 1) GHG emissions Disclosure 305-2 Energy indirect (Scope 2) GHG emissions Disclosure 305-3 Other indirect (Scope 3) GHG emissions Disclosure 305-4 GHG emissions intensity Disclosure 305-5 Reduction of GHG emissions Disclosure 305-7 Nitrogen oxides (NOX), sulfur oxides (SOX), and other significant air emissions
Water Consumption	GRI 303 2018 Water & Effluents requires companies to report on their total water withdrawal, by source (e.g., surface water, groundwater), and water use efficiency. Fertilizer companies are adopting water conservation techniques like closed-loop cooling systems, wastewater treatment and reuse, and precision irrigation technologies. Disclosure 303-1 Interactions with water as a shared resource Disclosure 303-2 Management of water discharge-related impacts Disclosure 303-3 Water withdrawal Disclosure 303-4 Water discharge Disclosure 303-5 Water consumption
Waste Generation	GRI 306 Effluents & Waste 2016 requires companies to report on the types and quantities of waste generated, as well as their waste management practices (e.g., recycling, reuse, disposal). Fertilizer companies are implementing waste minimization initiatives, exploring recycling and composting options, and developing innovative solutions for safe disposal of hazardous waste streams. Disclosure 306-1 Water discharge by quality and destination Disclosure 306-2 Waste by type and disposal method Disclosure 306-3 Significant spills Disclosure 306-4 Transport of hazardous waste Disclosure 306-5 Water bodies affected by water discharges and/or runoff

Energy Consumption

The fertilizer industry faces the unique challenge of balancing high energy demands with environmental responsibility. Traditionally, it has relied heavily on non-renewable energy sources like natural gas and coal. Renewables made up 29 percent of global electricity generation by the end of 2020. Additionally, many producers purchase electricity, heating, cooling, and steam, while some even sell excess renewable energy back to the grid. This dynamic energy landscape paints a picture of an industry in transition, actively seeking a more sustainable future.

- Type of Energy Used
- Consumption of Non-renewable Energy:
- Type of Renewable Energy Used
- Contribution of Renewable Energy
- Purchased Electricity, Heating, Cooling, and Steam
- Sold Electricity, Heating, Cooling, and Steam
- Reductions in Energy Consumption

Energy conservation and efficiency initiatives play a vital role in minimizing the fertilizer industry's energy consumption and environmental impact. These initiatives may include adopting energy-efficient technologies, optimizing production processes, implementing energy management systems, and promoting employee awareness and engagement.

In addition to the aforementioned requirements, it is also important for companies to consider energy consumption in relation to the specific types of fertilizers they produce, namely nitrogenous, phosphate, and potash fertilizers.

When reporting on energy consumption, companies should provide a breakdown based on the types of fertilizers they produce. This enables a more detailed analysis of energy usage within the organization and helps identify areas with higher energy demands or potential for improvement.

The energy consumption associated with each type of fertilizer (nitrogenous, phosphate, and potash) varies significantly due to differences in their production processes.

Nitrogenous fertilizers	Haber-Bosch process	This widely used method for ammonia production, the key ingredient in most nitrogenous fertilizers, is highly energy-intensive. It requires high temperatures and pressures, consuming natural gas as the primary energy source.
	Urea production	Converting ammonia into urea, another common nitrogenous fertilizer, demands further energy expenditure, mainly for heating and evaporation.
Phosphate fertilizers	Rock phosphate mining and processing	Extracting and processing rock phosphate, the primary source of phosphorus, involves significant energy use in crushing, grinding, and beneficiation processes.
	Phosphoric acid production	Manufacturing phosphoric acid, a crucial intermediate for most phosphate fertilizers, consumes substantial energy due to high reaction temperatures and acid concentration steps.
Potash fertilizers	Potash mining and processing	Extracting and refining potassium chloride, the main potash fertilizer, generally requires less energy compared to phosphate production.
	Concentration and crystallization	Concentrating and crystallizing potash solutions involve energy consumption, but to a lesser extent than other fertilizer types.

GHG Emissions

GHG Emissions from Direct Energy Use (Scope 1)

- Scope 1 emissions refer to the greenhouse gas (GHG) emissions resulting from the direct energy use within the fertilizer production process. It includes emissions from on-site combustion of fossil fuels, such as gasoline, diesel, natural gas, and other fuels used in boilers, furnaces, and other equipment. These emissions are typically measured and reported in metric tons of CO_2 equivalent (CO_2e), which allows for the comparison of different GHGs based on their global warming potential.
- In the context of the fertilizer industry, Scope 1 emissions may arise from the combustion of fossil fuels in various processes, including feedstock preparation, synthesis, ammonia production, and urea production. These emissions contribute to the industry's overall carbon footprint and environmental impact.

GHG Emissions from Indirect Energy Use (Scope 2)

- Scope 2 emissions encompass the GHG emissions resulting from indirect energy use, such as purchased electricity, heating, cooling, and steam. In the fertilizer industry, these emissions arise from the consumption of grid electricity or energy supplied by external sources for various operations, including lighting, pumps, conveyors, and other equipment.
- To calculate Scope 2 emissions, organizations utilize emission factors provided by relevant authorities or use market-based methods that account for the emissions associated with the electricity generation mix. These emissions are also reported in metric tons of CO_2e.

Reduction Initiatives in GHG Emissions

- The fertilizer industry has been implementing various initiatives to reduce GHG emissions and minimize its environmental impact. These initiatives focus on improving energy efficiency, adopting cleaner technologies, and implementing sustainable practices throughout the production process.

Strategy	Description and Benefits
1. Energy Efficiency Improvements	Investments in energy-efficient equipment, process optimization, and energy audits. Adoption of heat recovery systems and optimized operating conditions.
2. Fuel Switching and Alternative Energy Sources	Exploration of renewable energy like solar, wind, and biomass for power generation. Investigating hydrogen as a cleaner fuel option.
3. Carbon Capture and Storage (CCS)	Implementation of technology to capture and store CO2 emissions from production. Involves injecting captured CO2 into geological formations for long-term storage.

Water Consumption

The type of cooling water utilized by the fertilizer industry can vary depending on factors such as location, availability, and environmental considerations. Common sources of cooling water include sea water, ground water, and surface water bodies such as rivers or lakes.

Type of Cooling Water Used

Percentage of Recycled Water

Best Practices and Initiatives to Reduce Water Consumption

Sea Water

In coastal areas, the fertilizer industry may utilize sea water for cooling purposes. Sea water is often abundant and readily available, making it a convenient choice for cooling systems. However, the use of sea water requires proper filtration and treatment to prevent the accumulation of marine organisms, scaling, and corrosion in cooling equipment.

Ground Water

In regions where suitable aquifers exist, the fertilizer industry may extract ground water for cooling processes. Ground water is typically of high quality and requires less treatment compared to other water sources. However, over-extraction can deplete aquifers and impact local ecosystems, necessitating careful management and monitoring of water usage.

The percentage of recycled water used within the fertilizer production process varies among companies and facilities. The fertilizer industry has implemented various best practices and initiatives to reduce water consumption and promote sustainable water management.

- Water Recycling and Reuse
- Process Optimization and Efficiency
- Water Management and Monitoring
- Water Risk Assessment and Mitigation

Waste Generation

The fertilizer industry follows several best practices to effectively manage waste generation, including by-products, liquid effleuents, residues, packaging materials, and spent catalysts. These practices focus on waste reduction, recycling, and proper disposal techniques.

Waste Minimization and Source Reduction

- The fertilizer industry emphasizes waste minimization at the source by optimizing processes, improving efficiency, and reducing the generation of waste materials, including spent catalysts. This can involve process modifications, product reformulation, and the adoption of cleaner technologies to minimize waste generation and associated environmental impacts.

Recycling and Reuse

- Fertilizer producers prioritize recycling and reuse to divert waste materials, including spent catalysts, from landfill disposal. Recycling initiatives can include reprocessing spent catalysts to recover valuable components or repurposing them for other applications within or outside the industry. Reusing packaging materials and implementing closed-loop recycling systems also contribute to waste reduction efforts.

Hazardous Waste Management

- The fertilizer industry follows stringent protocols for managing hazardous waste, including spent catalysts, generated during production processes. This includes careful handling, storage, and disposal of hazardous materials in compliance with relevant regulations. Hazardous waste, such as spent catalysts, is often treated, neutralized, or incinerated in specialized facilities to minimize environmental and health risks.

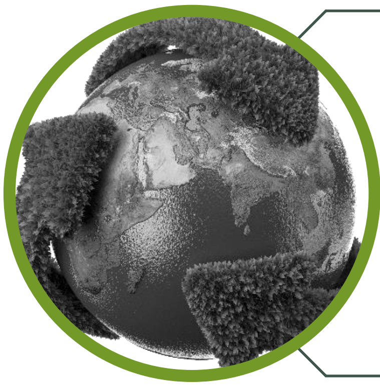
Waste Segregation and Separation

- Proper waste segregation at the source, including spent catalysts, is critical for effective waste management. Fertilizer companies implement waste separation practices, ensuring that different waste streams are kept separate to facilitate recycling, proper treatment, or disposal. Clear labeling and designated storage areas for different types of waste, including spent catalysts, help prevent contamination and enable efficient waste handling.

Waste-to-Energy Conversion

- Some fertilizer facilities explore waste-to-energy conversion technologies to extract energy from waste materials, including spent catalysts. Methods such as anaerobic digestion or thermal processes can be employed to convert organic waste, including spent catalysts, into biogas or utilize waste as a fuel source for energy generation. Waste-to-energy initiatives contribute to waste reduction, resource recovery, and the production of renewable energy.

Environmental sustainability in the fertilizer industry and a reporting system, such as the Global Reporting Initiative (GRI) standards, can be totally aligned. The GRI standards serve as a comprehensive set of guidelines that enable organizations to report on their environmental, social, and economic impacts in a transparent and standardized manner.



Transparency

- By disclosing energy sources, water consumption, waste generation, and GHG emissions, companies demonstrate accountability and build trust with stakeholders.
- The GRI standards promote transparency by providing a structured framework for organizations to disclose their environmental sustainability practices, performance, and impacts. By reporting on their environmental initiatives, the fertilizer industry can provide stakeholders with a clearer understanding of their efforts to minimize environmental impacts and promote sustainability.

Benchmarking

- GRI metrics enable companies to compare their sustainability performance with industry peers and identify areas for improvement.
- The GRI standards provide a common reporting framework that allows for comparability and benchmarking among organizations operating in the same industry. By adopting these standards, the fertilizer industry can assess its environmental performance relative to peers, identify best practices, and learn from industry leaders. This can drive healthy competition and encourage the adoption of more sustainable practices across the sector.

Stakeholder Engagement

- The GRI framework encourages dialogue with stakeholders, including farmers, communities, and investors, allowing for collaborative solutions to environmental challenges.
- Reporting based on the GRI standards facilitates effective stakeholder engagement. The fertilizer industry can communicate its environmental sustainability practices and performance to stakeholders, including investors, customers, employees, and communities. This engagement helps build trust, facilitates dialogue, and allows stakeholders to provide feedback and input on sustainability strategies.

Visit https://www.arabfertilizer.org/ for more information

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