



WORLDWIDE PARTNER

## **Rio 2016 and Dow** Using Technology and Collaboration to Deliver a Low-Carbon Legacy





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The Rio 2016 Olympic Games are making history by leaving a significant legacy of low-carbon technologies in Latin America, while set to balance 2 million tonnes of CO<sub>2</sub> equivalents. This will be achieved through the emission reductions obtained in initiatives in Brazil and Latin America described in this report.



# Rio 2016: Creating a Sustainable Legacy in Brazil and Latin America with

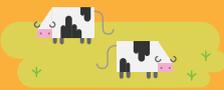
Dow's expertise and rich customer relationships to design a low-carbon future.



An incredible platform to help expand awareness and adoption of low-carbon technologies.

**Dow's commitment:** addressing society's needs and global challenges

## Agriculture



### Sustainable Livestock

Restore degraded pasturelands and increase livestock productivity to reduce GHG emissions.

📍 Mato Grosso



### Precision Agriculture

Optimize crop productivity and reduce GHG emissions through precision agriculture technologies.

📍 Mato Grosso

## Education



### Scientific Education

Reach more than 7 million students in Brazil, introducing them to STEM and sustainability concepts through the lens of sports with Rio 2016's *Transforma* program.

📍 Brazil

## Infrastructure



### PU-Based Insulation Panels

Engage the construction value chain to promote insulation technologies for operational and environmental benefits.

📍 Recife, Rio de Janeiro, São Paulo and Belo Horizonte in Brazil; expanded to Argentina and Colombia

## Industrial Processes



### Versatile Packaging Technologies

Work with film manufacturers to accelerate adoption of microfoaming, a proprietary Dow technology, which increases productivity and results in lighter films with the same protection properties.

📍 Brazil, Argentina, Mexico, Colombia, Guatemala

## Biomass-Generated Energy



Innovative power and steam generation technologies from eucalyptus and sugarcane biomass to displace fossil fuels.

📍 Bahia and Minas Gerais



**Our commitment:** 500,000 MT CO<sub>2</sub>e of GHG emission reductions in Brazil

**Our aspirational goal:** another 1.5 million MT CO<sub>2</sub>e in Brazil and Latin America

For more information:  
[www.dow.com/carbonmitigation](http://www.dow.com/carbonmitigation)

WORLDWIDE OLYMPIC PARTNER SINCE 2010. TRADITION OF SUPPORT SINCE 1980.

Collaborating for a more sustainable future.





Greetings.

Mobilizing athletes from more than 200 countries, welcoming more than 2 million spectators and hosting the biggest sporting event in the world provide the Olympic Movement with an opportunity to use the Games as an agent for positive change. Recognizing this, Dow, the Official Chemistry Company of the Rio 2016 Olympic Games, and the Rio 2016 Organizing Committee have built an unprecedented cross-sector collaboration that is using the Rio 2016 Olympic and Paralympic Games as a catalyst to increase the adoption of low-carbon technologies across Latin America.

As the Official Carbon Partner of Rio 2016, Dow has designed a tailor-made program to address both the direct and some of the associated carbon impacts of the Games and also introduce more sustainable business practices in the region. The goal is to create a beneficial and lasting legacy for various sectors of Brazil's society.

This report details how Dow is collaboratively working with various businesses and technology experts to implement mitigation projects in key economic sectors such as agriculture, infrastructure, industry and energy. Building on our 60 years in Brazil, we are proud to work with our customers and technology partners to increase awareness and adoption of technologies that deliver long-lasting economic and environmental benefits. The projects ultimately also improve the quality of life for society through cleaner energy production and better products for consumers.

Our work with Rio 2016 is an excellent example of how Dow, through our 2025 Sustainability Goals, is collaborating with like-minded partners to lead the transition to a more sustainable planet and society. Together, we present a model to accelerate progress on one of the world's most pressing challenges. Just as the Games inspire us, we believe this example of collaboration between Rio 2016 and Dow can inspire all of us as we look to create a lower-carbon future.

Sincerely,

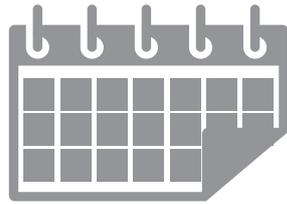
A handwritten signature in black ink, appearing to read 'Neil Hawkins', written in a cursive style.

Dr. Neil C. Hawkins  
Chief Sustainability Officer and Corporate Vice President for Environment,  
Health & Safety (EH&S)  
The Dow Chemical Company

## 2016 Rio Summer Games by the Numbers

**17 DAYS**

(August 5-21)



**100,000**

**PEOPLE**

directly involved in  
delivering the Games



**10,500**  
**ATHLETES**



**FROM**  
**206**  
**NATIONS**

**4**



**COMPETITION**  
**ZONES**

(Barra da Tijuca, Copacabana,  
Maracanã and Deodoro)

**300**  
**EVENTS**



**50,000**  
**VOLUNTEERS**



## A Breakthrough Approach to Carbon Mitigation for Events

Global, large-scale sporting events such as the Olympic Games have a significant carbon impact. However, by employing low-carbon technologies and behavioral practices, the Olympic Movement can leave a positive and lasting legacy while also delivering low-carbon Games.

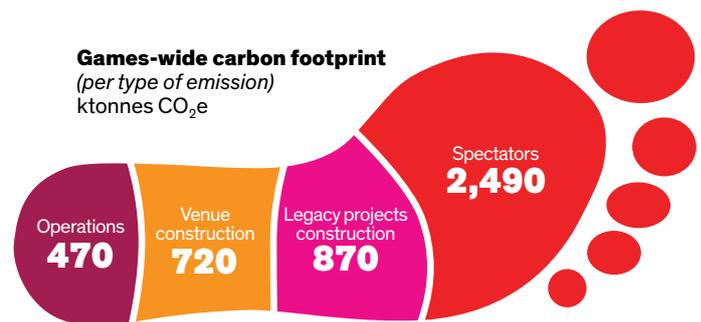
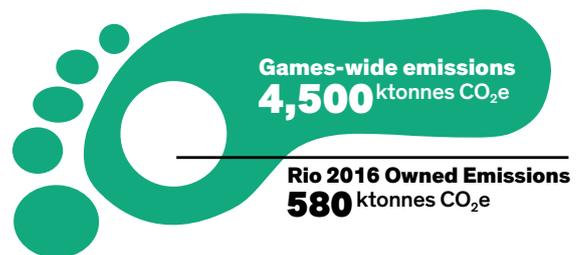
As outlined in the Rio 2016 Carbon Footprint Report<sup>1</sup>, the total carbon impact of the Rio 2016 Olympic Games is estimated as 4.5 million tonnes of carbon dioxide equivalents (CO<sub>2</sub>e).<sup>2</sup> The Rio 2016 Organizing Committee directly owns a part of this footprint – amounting to 580,000 tonnes of CO<sub>2</sub>e – mainly from Operations. Reducing the direct impact by avoiding emissions at the source and decreasing emissions through efficiency measures has been an integral part of the Organizing Committee's carbon management plan. The 580,000 tonnes of CO<sub>2</sub>e already includes estimated impacts of such reduction measures.<sup>3</sup> As the Official Carbon Partner of the first Rio 2016 Olympic Games, the first in South America, Dow has committed to deliver third-party-verified principal climate benefits of 500,000 tonnes of CO<sub>2</sub>e to be applied to this directly owned footprint.

In addition, activities such as spectators' travel footprint and lodging will result in significant carbon emissions (2.49 million tonnes of CO<sub>2</sub>e). Despite this falling beyond Rio 2016's direct control and influence, Dow recognizes these activities' significant impact on the carbon footprint associated with Games. As a result, Dow and Rio 2016 are collaborating to generate an additional 1.5 million tonnes of CO<sub>2</sub>e in climate benefits by 2026.

Science and collaboration are keys to the success of this mitigation program. Building on 60 years in Latin America and the success of the Sochi 2014 carbon mitigation program, Dow has developed a tailor-made program that addresses the technology needs for Brazil and the broader Latin American region. Together, the Rio 2016 Organizing Committee and Dow are using the Rio 2016 Olympic Games as an opportunity to implement innovative energy-efficient and low-carbon projects across major sectors of the Brazilian economy. These projects are designed to help Rio 2016 achieve its bold carbon strategy, while also demonstrating the power of innovation to reduce carbon

emissions and generate climate benefits long after the Games. The projects showcase opportunities to achieve sustainable development by working across sectors of society to decouple industrial and economic growth from carbon emissions.

### Total Carbon Impact of the Rio 2016 Olympic Games



Source: Rio 2016

<sup>1</sup>Report issued July 2016.

<sup>2</sup>The government of Rio de Janeiro owns emissions from venues and legacy projects construction (around 1.6 million tonnes of CO<sub>2</sub>e) and pledged to address the mitigation through environmental restoration projects and initiatives to promote a green economy. Therefore, these emissions are not a part of the Carbon Partnership between Rio 2016 and Dow.

<sup>3</sup> The final update on the directly owned footprint and reduction measures is expected from the Rio 2016 Organizing Committee in 2017.



“Ensuring the delivery of Games with a minimal carbon footprint is one of the key highlights of our sustainability strategy. Most importantly, we were able to create momentum by engaging key industries in Brazil and in Latin America toward a more sustainable way to operate. The collaborations inspired by the Olympic Games and led by our partner Dow have already created a positive legacy in our region.”

**Tania Braga**

Head of sustainability and accessibility for the Rio 2016 Organizing Committee

## Dow's Climate Solutions Framework

This carbon mitigation program is built on Dow's Climate Solutions Framework (the Framework),<sup>4</sup> which was developed by Dow scientists with carbon consultant NatureBank. Events are unique from other emissions sources as they often occur at various locations, last for only a defined period of time and can have convoluted emission ownership, which contributes to the complexity of the inventory. As a result, they are unlikely to be accounted for in the carbon budget of a city, state or region. Dow created the Framework to address the need for clearer guidance on how to properly manage and mitigate the GHG impacts of events and to lay out options available for GHG mitigation beyond the event's physical and temporal boundaries. The Framework recognizes that mitigation programs should be implemented in conjunction with efforts to minimize the event's footprint, such as improving the energy efficiency of venues. The Framework allows event owners, in collaboration with event partners, to implement a structured, yet flexible, approach to quantify and mitigate the impacts of events, while also creating a positive legacy through the adoption of innovative low-carbon technologies.

The overarching purpose of the Framework is threefold:

1. To go beyond the GHG emissions in the event inventory and provide a methodology for accounting for an event's broader societal GHG impacts.
2. To enable business and institutional leaders to implement innovative GHG-mitigation projects beyond the physical boundaries of the events.
3. To provide organizations with opportunities to take responsibility for the climate impact of events and demonstrate leadership in the development of low-GHG products and service solutions.

The Framework provides the structure for event owners and partners to implement voluntary GHG-mitigating activities that are beyond current market practices and help catalyze the adoption of lower-carbon technologies in a region. The Framework incorporates existing best practices in GHG measurement and reporting with a rigorous approach to the development of a portfolio of GHG mitigation projects. The carbon mitigation projects created under the Framework deliver high-quality emission reductions that balance or mitigate the event's impact. These emissions reductions are allocated, via contract, to the event and, although they may be registered, emissions reductions created within the Framework do not require an additional mechanism for transfer and/or trading. Projects developed under the Framework do not generate tradable or monetized financial instruments (i.e., these instruments cannot be sold or traded on carbon markets for financial gain). As a result, revenue from carbon funding does not help a project overcome a barrier, as is the case with carbon offsets.

Key criteria for the carbon mitigation projects implemented by Dow for Rio 2016 include economic viability within the Brazilian and Latin American reality and that they go beyond typical business practices, or are "beyond business as usual" (BBAU), to deliver GHG emission reductions. This ensures that low-carbon initiatives are not simply a byproduct of normal operations but rather are the result of innovation and change. To qualify, projects must demonstrate that they have implemented voluntary GHG-mitigating initiatives that faced real or perceived barriers and resulted in net GHG emission reductions beyond comparable existing and expected market practices.

<sup>4</sup>The Framework is available at [www.dow.com/carbonmitigation](http://www.dow.com/carbonmitigation).



## The Nine Guiding Principles

The Framework is based on nine guiding principles.

CATEGORY	PRINCIPLE	DESCRIPTION
<b>QUALITY</b>		
	Real	Measurable, conservative and not double-counted (unique)
	Beyond Business As Usual	Emission-reduction projects push innovation boundaries and are not part of normal business practices
	Confirmed	Third-party validated, verified and monitored
<b>INNOVATION</b>		
	Diverse	Employs a wide range of low-carbon solutions and activities across multiple industries and activities
	Holistic	Recognizes both the direct and broader societal GHG impacts of events and the associated mitigation activities
	Market-driven	Utilizes the value from event exposure (marketing value) to drive mitigation activities and generate long-term benefits
<b>LEGACY</b>		
	Catalytic	Technology adoption is a key focus; recognizes that events can help promote more sustainable technologies that lead to market transformation
	Progressive	Integrates current best practices, guidance and methodologies into a flexible approach for event owners
	Focused	Enables projects in geographic and thematic areas that are tailored to the event, not constrained to a jurisdiction

### Validation and Verification

For each mitigation project, Environmental Resources Management (ERM) is providing third-party validation of the project plans against the Dow Climate Solutions Framework and verification<sup>5</sup> of resulting GHG emission reductions. In addition, ERM conducts an assessment of the forecasted generation of climate benefits based on verified evidences. The forecast, dated 29 July 2016 and also given in Appendix 1, totals more than 2.2 million tonnes of CO<sub>2</sub>e<sup>6</sup> through the realization period of the end of 2026. A status of verified emissions reductions for the portfolio as of July 2016 is provided in Appendix 2.

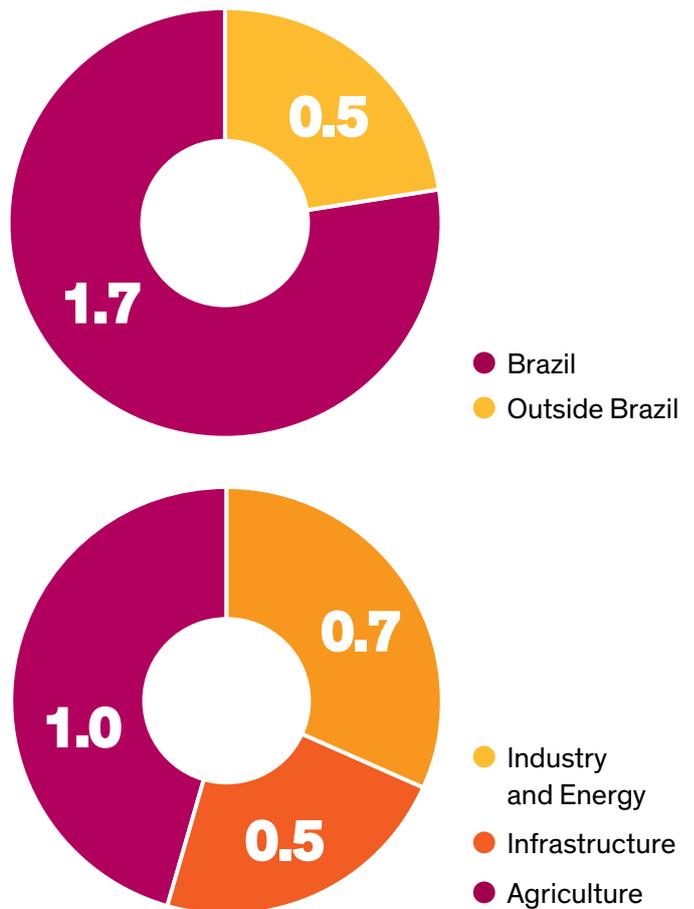
ERM has determined each project's validity as a Principal or Societal Emission Reduction Project.<sup>7</sup> Project plans were validated and implementation verified based on criteria that include:

- Clear demonstration of the additionality of the projects and fulfillment of the BBAU condition
- Use of existing GHG accounting methodologies and/or protocols
- Contractual conditions showing that the climate benefits generated by each of the projects during the crediting period will be attributed to the carbon partnership of Dow and Rio 2016 and will not be traded as carbon credits
- Detailed conservative calculations of baseline emissions and project emissions

Evidence of individual project implementation is based on site visits, invoices for purchasing new equipment or machinery, and contractual agreements between Dow and its partners.

### Dow and Rio 2016 Carbon Partnership: Forecasted Climate Benefits<sup>8</sup> (tonnes of CO<sub>2</sub>e)

More than 2.2 million tonnes of CO<sub>2</sub>e is forecasted to be generated through 2026



<sup>5</sup>Validation is the phase in which an external third party assesses the quantification approach and boundary selection detailed in the project plan and provides a reasonable level of assurance that the approach is a conservative estimation of GHG emission reductions. Verification is the phase in which an independent third party checks the project monitoring report to ensure that the implementation was completed as detailed in the project plan and that the emission reductions effectively occurred.

<sup>6</sup>Actual performance results may differ and are subject to risks, variables and uncertainties involving partnering businesses and other factors.

<sup>7</sup>Within the Dow Climate Solutions Framework, emissions sources have been divided into three categories: Scope 1, Scope 2 and Scope 3 [as prescribed by the GHG Protocol from the World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI)]. Further guidance is given to identify these GHG emissions and whether to classify them as part of the "Principal Sphere" or "Societal Sphere." Emissions within the Principal Sphere ultimately encompass the emissions that are under direct responsibility of the Organizing Committee of the Rio 2016 Olympic Games. The Societal Sphere contains only Scope 3 emissions that are not identified within the Principal Sphere. Emissions within the Principal Sphere must be balanced by Principal Emission Reduction Projects, while emissions within the Societal Sphere can be balanced by Principal or Societal Emission Reduction Projects.

<sup>8</sup>Actual performance results may differ and are subject to risks, variables and uncertainties involving partnering businesses and other factors.

<sup>9</sup>Source: "Federative Republic of Brazil Intended Nationally Determined Contribution Towards Achieving the Objective of the United Nations Framework Convention on Climate Change." Available at <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Brazil/1/BRAZIL%20INDC%20english%20FINAL.pdf>.



### Climate Change and Society

The overwhelming majority of climate scientists agree that human activities, especially those that involve the burning of fossil fuels, are responsible for most of the climate changes currently being observed. Climate change affects us all, and the new risks it poses are starting to impact societies and the global economy – and will continue to do so in the future. The United Nations has set a target to limit global average temperature rise. Meeting this goal requires worldwide reductions in GHG emissions of 40 to 70 percent by 2050 through a collaborative effort among all nations, involving governments, businesses and consumers.

What is being done with the Olympic and Paralympic Games in Rio is an example of how organizations can take action to meet commitments to reduce carbon emissions. Rio 2016's carbon mitigation program, developed by Dow, demonstrates opportunities to achieve sustainable development by working across sectors to decouple industrial and economic growth from carbon emissions. The program delivers long-lasting climate benefits to the region and supports the key areas of focus for reducing GHG emissions outlined by Brazil's Intended Nationally Determined Contribution (INDC).<sup>9</sup>

## Collaborating for a More Sustainable Future

For Rio 2016, Dow has developed a portfolio of mitigation projects to help deliver Games with minimal carbon impact and increase awareness and adoption of energy-efficient and low-carbon technologies in the region. Ultimately, this portfolio is designed to impact key sectors in Brazil and Latin America and will enable industries to do more with less, switch to lower-carbon energy sources and conserve energy through efficient solutions. These projects push for innovation, overcome real or perceived barriers and catalyze long-term change in market practices, instead of simply being the result of normal operations. The climate benefits of the projects are accounted for from the launch of each project through the end of 2026 at the latest. Dow and its partners will monitor and report performance of the portfolio throughout the realization period to demonstrate the long-term results and legacy of the Games.

Through our innovative carbon mitigation program, we have implemented strategic projects in the areas of agriculture, industry and infrastructure in Latin America:



- **Encouraging the Recovery of Degraded Pastureland:** Partnering with a leading agriculture group, the project is promoting restoration of pastureland resulting in increased soil carbon sequestration and supporting intensification of livestock production.
- **Improving Agricultural Productivity:** The project introduces precision agriculture technology and seeds and crop protection solutions to help farmers in Mato Grosso optimize crop productivity and generate GHG reductions.



- **Adopting Renewable Energy in Manufacturing:** This project adopts groundbreaking power and steam generation technologies (cogeneration) from eucalyptus and sugarcane biomass to replace fossil fuels (mainly natural gas) and significantly reduce GHG emissions at two Dow sites in Brazil.
- **Implementing Raw Material Efficiencies in Industry:** This project is working with plastic film manufacturers in five countries (Brazil, Argentina, Guatemala, Mexico and Colombia) to enable the adoption of Dow's proprietary microfoaming technology, which increases manufacturing productivity and results in lighter films. This technology reduces the GHG footprint of the film while maintaining the same functional properties for the packaging.

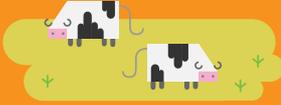


- **Focusing the Construction Value Chain on Energy Efficiency:** Engaging with the construction value chain in Brazil, Argentina and Colombia, the project encourages the adoption of polyurethane-based insulation technologies for operational and environmental benefits. Achieving significant energy savings by using these foam core panels instead of conventional block walls can reduce building operation energy costs and limit GHG emissions.
- **Reducing the Carbon Footprint of Construction Materials:** Dow worked with customers in Argentina and Mexico to modify formulations and eliminate from their manufacturing process the use of gases with high global warming potential (GWP), reducing carbon emissions embodied in construction materials.



## Rio 2016 Carbon Mitigation Project Overview

Rio 2016 and Dow have implemented eight carbon mitigation projects.

	Project name	Country	Category	Operational starting date
<b>Agriculture</b> 	Restoration of Pastureland to Improve Range Efficiency	Brazil	Recovery of pastureland and carbon sequestration in soil	November 2015
	Precision Agriculture Nitrogen Emission Management	Brazil	Agriculture productivity and optimization of fertilizer use	August 2015
<b>Industry and Energy</b> 	Aratu Biomass Cogeneration	Brazil	Renewable energy	April 2014
	Santa Vitória Cogeneration	Brazil	Renewable energy	June 2015
	Microfoamed-core Flexible Packaging Production	Brazil, Argentina, Colombia, Mexico, Guatemala	Raw material reduction	March 2016
<b>Infrastructure</b> 	PU Insulation in Construction	Brazil, Argentina	Energy efficiency	November 2015
	PU Foamed-core Door Blowing Agent Conversion	Mexico	Energy efficiency and carbon footprint reduction	June 2016
	PU Sandwich Panel Blowing Agent Conversion	Argentina	Energy efficiency and carbon footprint reduction	November 2016

## Agriculture – Incorporating Low-Carbon Farming Practices

Studies predict that as diets change and the world's population grows to 9 billion people by 2050, we will need to increase food production by at least 60 percent to meet the global demand for food. This increasing global demand for food and the need to address climate change at the same time make it urgent to protect ecosystems and use land more productively and efficiently. Our ability to apply innovation and state-of-the-art technology in agriculture and work in partnership across different sectors can help us to meet the dual challenges of producing more food while conserving natural resources and lowering GHG emissions.

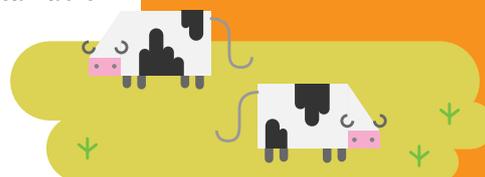
Agriculture is one of the most significant emission sources in Brazil. As disclosed in its Intended Nationally Determined Contributions (INDC) at the United Nations Climate Conference in December 2015, restoration of degraded pastureland and avoiding deforestation is an area of focus for Brazil, as it intends to reduce greenhouse gas emissions by 37 percent by 2025. The region of Mato Grosso is home to millions of hectares of land dedicated to growing soybeans and corn and herding cattle, making it an ideal region for piloting technology projects. As an agricultural hub, optimal resource management is critical to the long-term health and viability of the region.

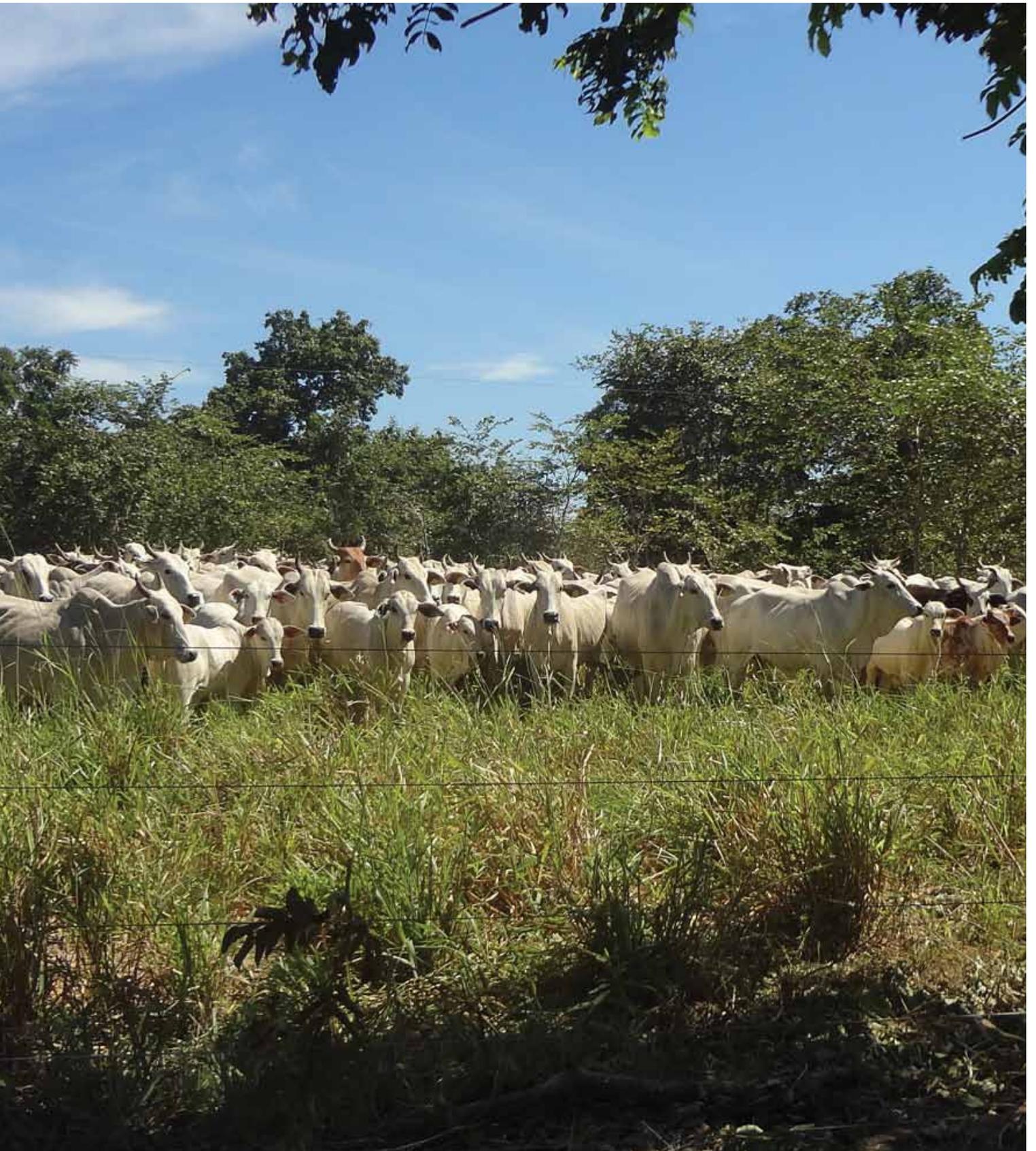
By working with farmers, nonprofit organizations and others, we can institute more sustainable agriculture practices that help boost soil productivity and increase agricultural efficiency while reducing negative environmental impacts. Besides increasing productivity, doing more with the same resources also helps address deforestation by alleviating the pressure to cut down forests to make way for pastureland. It is hoped these projects will serve as a model for more farmers to switch to more sustainable agricultural practices in the region.

“Agriculture plays a key role in the Brazilian economy and is also one of the largest sources of GHG emissions. By helping farmers adopt improved technologies and management practices, we can increase productivity while lowering greenhouse gas emissions and reducing further deforestation for farming.”

**Welles Pascoal**

President, Dow AgroSciences Brazil







## Project at a Glance

### **Encouraging the Recovery of Degraded Pastureland**

**Project Name:** Restoration of Pastureland to Improve Range Efficiency

**Location:** Mato Grosso region in Brazil

**Project Description:** Soil carbon sequestration

**Project Start:** November 2015

**Crediting Period:** 5 years

**Partner:** The Roncador Group and 24 partner farms

**Why Beyond Business As Usual:** Business-as-usual cattle ranching practices in the region continue to lead to degradation of the pasture. Field observation and soil sampling carried out by technical experts determined that existing ranching practices caused a significant part of the pastureland within the project to operate at low productivity. This project will increase the Soil Organic Carbon (SOC) stocks through the restoration of degraded land. The project will also generate emission reductions, as cattle spend less time on each farm and reach their commercial target weight faster.

## Project Summary

Brazil's beef production industry is second only to the United States and is an important contributor to food security and the economy. However, cattle production also is a significant contributor to GHG emissions, generating more greenhouse gases than other sectors, such as transportation.<sup>10</sup>

Implementing sustainable agricultural practices sequesters carbon in the soil, reducing atmospheric CO<sub>2</sub>, while also boosting livestock productivity. In turn, raising more cattle on less acreage helps to alleviate the pressure for deforestation in Brazil. In the long term, permanence of the carbon captured in the soil will depend on the maintenance of the private land by farmers. Given the economic attractiveness of the activities being implemented, farmers who continue with the improved agricultural practices are expected to realize significant advantages over time.

The project aims to reduce GHG emissions by restoring more than 50,000 hectares of degraded pastureland in Brazil with weed control to manage competing plants, seed solutions to improve pasture capacity and advanced livestock management practices to take advantage of the improved capacity of the land. Soil sequestration is improved when invasive species are removed with tailored and proven weed-control solutions. In addition, applying inputs to correct the degraded soil and replanting with native seeds help improve land quality. These restoration activities are being carried out in coordination with enhanced cattle and herd management techniques, such as strategic herd rotation and management of herd genetics.

Dow AgroSciences Brazil partnered with Roncador Group – a country leader with more than 30 years of experience in agriculture, livestock and mining in the Midwest and Southeast regions of Brazil – to provide expertise and technologies to farmers in the Araguaia Valley region in the state of Mato Grosso. Roncador is operating a “model farm” through 2020. The farm will serve as a “living lab” to demonstrate the environmental and productivity benefits of land restoration and strategies for sustainably intensifying livestock production. For example, livestock is managed to mimic the herding and grazing patterns of wild ruminants. Animals are moved so that vegetation is not overgrazed, and grazing stimulates biological activity in the soil. Building on the learnings from the model farm, the program is expanding to other participating farms within the region.

“This is the most complex project in the portfolio we have validated, and although it is a societal type of project, it will be the boldest one since it introduces many new elements from the technology and methodological perspectives.”

**Braulio Pikman**

Senior partner, Environmental Resources Management (ERM)

Science and technology are key to the project. Through this initiative, Dow and Roncador are introducing participating farmers to carbon-tracking methodology to quantify emission reductions. The project leverages a partnership with Embrapa, Brazil's leading state-owned agricultural research corporation (belonging to the Brazilian Federal Government), to design pilot projects and quantify carbon sequestration under different soil and herd management conditions. Dow also is working with the World Resources Institute (WRI) to increase adoption of a tool derived from the Greenhouse Gas Protocol that enables ranchers to determine the inventory of carbon emissions on their farm.

Soil Organic Carbon (SOC) stocks were sampled at the model farm for the purpose of baseline establishment and were used as indicators of degradation for the ground assessment of participating farms. The monitoring of the SOC stocks in time will determine the level of sequestration promoted by the project. The technical team also visited each farm to determine the amount of cattle currently supported by the farms and the ages of the individual cattle. Validation and verification of the project is based on field-based diagnostic assessments carried out by the project's technical experts.

The project benefits farmers while supporting Brazil in its climate goals in alignment with the Low Carbon Agriculture Plan (ABC). By restoring degraded pasturelands and implementing advanced agricultural strategies, farmers are able to intensify livestock production by raising more cattle with the same resources, improve their income and help contribute to the low-carbon legacy of the Rio 2016 Games.

<sup>10</sup>Source: FAO report, “Livestock's Long Shadow – Environmental Issues and Options,” 2006. Found at: <http://www.fao.org/docrep/010/a0701e/a0701e00.HTM>.



## Project at a Glance

### **Improving Agricultural Productivity Through Precision Farming**

**Project Name:** Precision Agriculture Nitrogen Emission Management

**Location:** Mato Grosso region in Brazil

**Project Description:** Optimization of fertilizer use

**Project Start:** August 2015

**Crediting Period:** 5 years

**Partner:** Farmers Edge and seven partner farms

**Why Beyond Business As Usual:** Prior to the implementation of the project, commercial farming operations in the region were utilizing conventional approaches to fertilizer management, including fixed-rate application. Dow is partnering with Farmers Edge, a leader in precision agronomy, to provide precision agriculture and variable rate technology and expertise to farmers in Mato Grosso. The aim of the project is to optimize use of synthetic fertilizer to reduce nitrous oxide (N<sub>2</sub>O) emissions per unit of crop when compared to other commercial farming operations in the region. The emissions reductions occur as a result of precision farming techniques and technologies that optimize nitrogen application in order to improve the crop yield during the project period when compared to the baseline period.

## Project Summary

Precision agriculture aims to lessen farm environmental impacts by adjusting production inputs, such as fertilizer, to specific conditions within each area of a field. Participating farmers have access to technologies such as satellite imagery, precise harvest and profit maps, soil sampling, weather monitoring, and detailed review of cropping plans and goals with variable rate technology experts. This helps farmers make informed decisions related to seeding, growing and harvesting phases, optimizing the use of inputs and reducing GHG emissions. For example, systematic soil samples and laboratory analysis help farmers understand the variability in soil fertility within a field. That information is used to generate site-specific maps of the soil nutrient properties. Farmers then can use this information to determine at what rates to apply the fertilizer for optimal crop yield specific to the site.

Using precision agriculture techniques and variable rate technologies is expected to result in overall lower rates of synthetic fertilizer application, leading to a reduction in emissions of nitrous oxide. Improved fertilizer management also reduces the amount of fertilizer runoff and nitrate that leaches into groundwater per tonne of crop. This reduces the negative impacts to both air and groundwater. In addition, increasing yield helps meet market needs with less land and, as a result, minimizes the need for the expansion of agricultural lands into areas of native vegetation and protected lands.

Dow is also offering seeds and crop protection solutions to farmers to optimize production and increase yields. Project implementation started in August 2015 and spans 25,000 hectares across seven farms to cover two crop seasons – one summer crop (soy) and one winter crop (corn, cotton or sunflowers). Carbon emission reductions will be tracked based on productivity increase and optimization in the use of fertilizers and fuel.

The objective is to help farmers produce more with less, and increase yield through advanced and more sustainable agricultural practices, while reducing GHGs. Climate benefits will be realized over five years and attributed toward the mitigation of the associated emissions of the Rio 2016 Olympic Games.



## Industry and Energy – Saving Emissions by Saving on Materials and Cultivating Renewable Energy Sources

When consumers walk the aisles of stores, they often don't think about how a product was manufactured. Yet every new shirt made, cell phone produced and packaged good purchased results in tangible energy and materials spent. Producing more requires more energy and usually means burning more fossil fuels, which also leads to releasing more CO<sub>2</sub> and other greenhouse gases.

Improving industrial processes can save not only on energy and materials spent, but on GHG emissions produced, too. For example, lighter-weight packaging uses less material in manufacturing and saves on fuel in transport, resulting in a reduced carbon footprint per packaged product. Plus, less material results in less waste at end of life.

At the same time, cultivating clean, renewable energy sources to power our factories also reduces the carbon intensity of manufacturing. The industrial sector is both a large energy consumer and a producer of products that reduce energy use. Adding renewable energy to manufacturing processes is one way that industry can help secure a future of sustainability, growth and long-term competitive advantage. However, the challenge, especially for manufacturers, is to find commercially viable means of producing alternative energy sources on a large scale that can operate continuously.

With two pioneering projects, Dow has entered into a steam purchase agreement with Energias Renováveis do Brasil (ERB), a Brazilian biomass power developer, to supply two of its chemical plants with steam from renewable biomass. By focusing on satisfying the needs of consumers with more efficient technologies manufactured with a lower carbon footprint, we can help balance economic progress with sustainability.

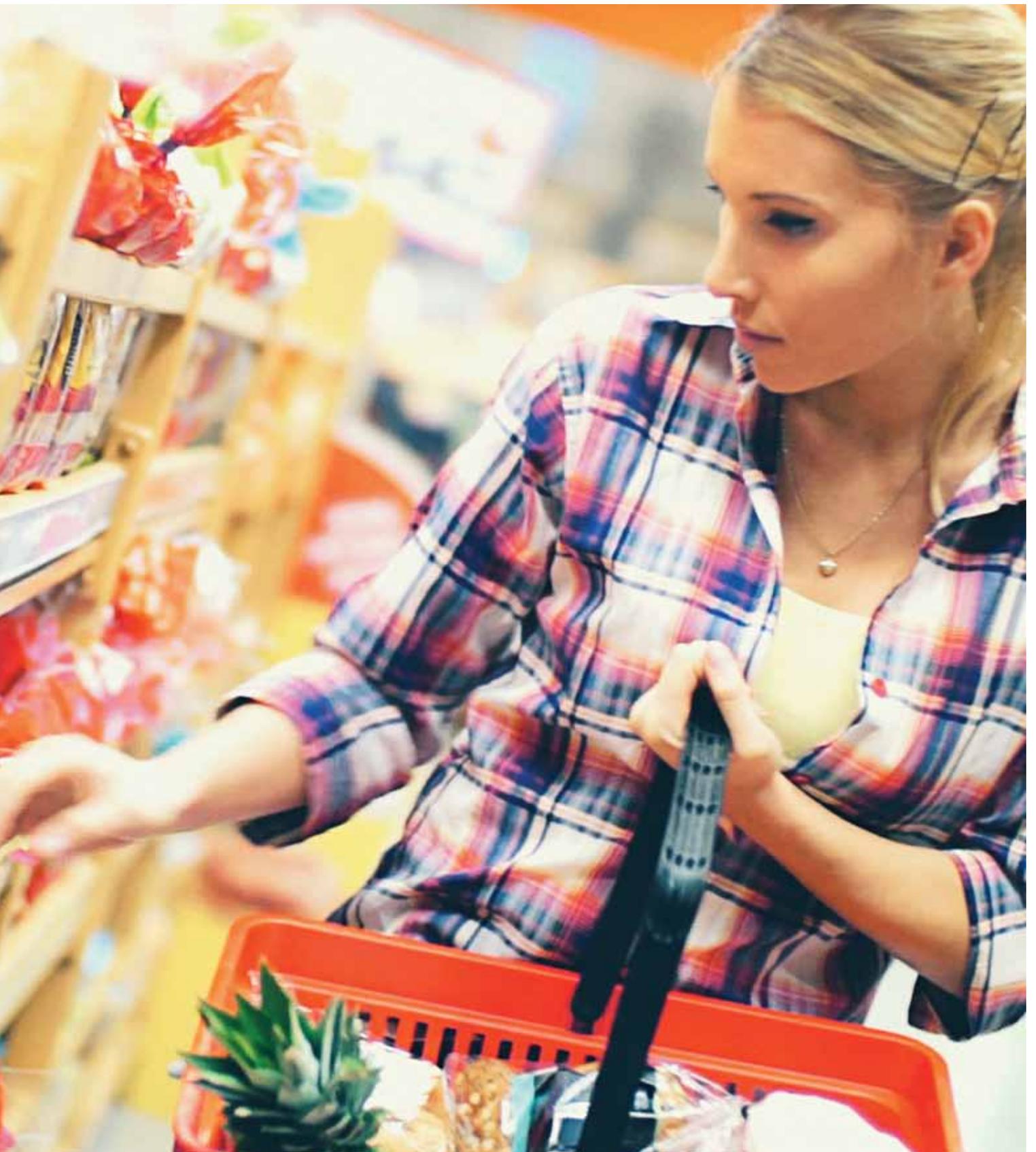


“Through our science and technology and through our operations, we are committed to bringing solutions to enable a lower-carbon society and a more sustainable energy future.”

**Claudia Schaeffer**

Latin America energy director, Dow







## Project at a Glance

### **Pioneering Biomass Energy Technologies in the Chemical Sector**

**Project Name:** Aratu Biomass Cogeneration

**Project Location:** Candeias, State of Bahia

**Project Description:** Renewable Electricity and Steam Generation from Eucalyptus Biomass

**Project Start:** April 2014

**Crediting Period:** 10 Years

**Partner:** Energias Renovaveis do Brasil (ERB)

**Why Beyond Business As Usual:** The project activity reduces emissions of GHG by avoiding electricity and steam generation from fossil fuel sources, and the consequent CO<sub>2</sub> emissions. Using biomass provided by dedicated farmlands or purchased from sustainable sources helps decrease impact on deforestation. Producing biomass for use at a continuous operation cogeneration plant is not a common practice in Brazil, and to maintain a continuous supply of steam to the Dow petrochemical plant, a unique boiler technology was implemented that is a first of its kind in the region. In addition, because the majority of the ERB plantations are implemented on lands that were abandoned in the baseline condition, there is a beneficial land use change associated with this project that is beyond business as usual. Reforestation of abandoned lands results in carbon sequestration and restoration of previously degraded soils and vegetation cover.



### Project Summary

This project increases the amount of renewable power that is being consumed by Dow operations by replacing natural gas with a renewable, biogenic source. The project helps to displace part of the load of five existing natural gas boilers in the Aratu Industrial Complex in Brazil with steam generated from a cogeneration system that uses biomass chips from a eucalyptus forest plantation in a sustainably sourced area. The biomass-fired boiler reduces the load across all natural gas-fired boilers at various times. GHG emissions are reduced and a clean source of electricity is fed back to the grid from ERB power plants. In addition, growing biomass on dedicated sustainably sourced plantations or from sustainably sourced suppliers constitutes a renewable energy source.

In order to maintain a continuous supply of steam to the Dow petrochemical plant, bubbling fluidized bed (BFB) technology was selected as the most appropriate boiler

technology for this project. The boiler is relatively unique as it is smaller than most boilers for this type of operation and consequently modifications were required in order to maintain continuous operation. Thus, the project can be considered as first of its kind for the State of Bahia.

The steam produced by the eucalyptus cogeneration plant powers the manufacture of raw materials for high-value sectors such as automobiles and infrastructure. The project processes eucalyptus biomass provided by dedicated farmlands owned by ERB or maintained by the company in partnership with rural producers on the northern coast of Bahia – meeting the criteria set forth in the Timber Standard for Heat and Electricity. The project is also reforesting approximately 5,000 hectares of degraded lands in Bahia. In addition, this project is generating in excess of 12 MW of electricity that is fed back to the distribution grid, energy equivalent to the consumption of a small city with approximately 230,000 inhabitants.



## Project at a Glance

### **Pioneering Biomass Energy Technologies in the Chemical Sector**

**Project Name:** Biomass Santa Vitória Cogeneration Project

**Location:** Santa Vitória, State of Minas Gerais

**Project Description:** Renewable electricity and steam generation from sugarcane bagasse biomass

**Project Start:** July 2015

**Crediting Period:** 10 Years

**Partner:** Energias Renováveis do Brasil (ERB)

**Why Beyond Business As Usual:** Residual biomass is used to generate steam for the industrial process. In addition, a turbine produces electric energy in excess of what is needed to supply the industrial process and, hence, a large part of the electricity generated is exported to the grid. The project is the first in Brazil to employ a new business model to efficiently generate electricity, steam and water for an ethanol plant.



### Project Summary

The primary objective of the Santa Vitória cogeneration project is to help meet Brazil's rising demand for energy while contributing to environmental, social and economic sustainability by increasing the share of renewable energy in total electricity consumption for Brazil. The power plant, located in the city of Santa Vitória and operational since July 2015, produces steam and energy from sugarcane bagasse, generating clean, renewable energy for Dow's sugarcane-to-ethanol operations. The plant produces 38 MW of power, meeting all the energy needs for Dow's operations in Santa Vitória and producing excess energy for exporting to the power grid. Additionally, Dow and ERB are piloting a program with The Nature Conservancy to identify priority land bank areas for conservation to ensure the protection and restoration of vital forests in the region. The plant operates a large nursery supporting sugarcane species and local reforestation producing an average of 500,000 seedlings per year.

This is a first-of-its-kind project in Brazil. Typically, ethanol production companies are owners of the utility plant and generate electricity internally as a byproduct from ethanol and sugar production, their core business. In the case of the

Santa Vitória cogeneration project, ERB uses sugarcane bagasse to efficiently generate clean, renewable electricity for an ethanol plant. In this project, electricity production is the core business, making it a new business model in Brazil. The installation of a condenser independent from the ethanol plant operations and a highly efficient boiler contribute to the project's efficient performance.

Emissions reductions are calculated from multiple sources, including biomass processing, reforestation and cogeneration. While these projects were planned ahead of Dow's commitment to Rio 2016 as the Official Carbon Partner, the decisions made in these projects were clearly beyond business as usual. In addition, Dow has spent considerable time and resources in validating these projects within its Framework with an independent third party. Moreover, Dow is creating traditional carbon credits for the Santa Vitória project using the Verified Carbon Standard (VCS). Dow has pledged these benefits to be used for mitigating the direct footprint of Rio 2016 and therefore will not use them for its own reporting purposes. Together, Dow's cogeneration projects help demonstrate the viability of using renewable energy at scale while also creating benefits for the local economy and community.



## Project at a Glance

### **Implementing Raw Material Reductions in Industry**

**Project Name:** Microfoamed-core Flexible Packaging Production

**Location:** Brazil, Argentina, Colombia, Mexico and Guatemala

**Project Description:** Materials reduction

**Project Start:** March 2016

**Crediting Period:** 10 Years

**Partners:** Film manufacturers Valfilm, Petropack, Folmex and Plastilene as well as equipment manufacturer MuCell Extrusion

**Why Beyond Business As Usual:** The project is the first of its kind in the Americas. Microfoaming is a newly patented Dow technology for flexible packaging production. Despite its clear advantages over incumbent technologies, its market adoption is currently limited, with no plastic converters in South, Central and North American regions using the microfoaming equipment. Identified barriers were the economic costs of conversion and perceived risks associated with adoption of this new technology.

## Project Summary

Over the past decade, the packaging industry has continued to become more efficient, and research and innovation continue to reduce film thickness as a way to reduce the environmental footprint of packaging. The microfoaming technology project is a clear example of how Dow, a global leader in flexible packaging, is leveraging the power of the Olympic Games to bring innovation and lower-carbon solutions to the packaging industry. Powered by Dow's partnership with the Rio 2016 Olympic Games and commitment to its sustainability goals, Dow has an opportunity to extend this new packaging solution to Latin America customers and accelerate the adoption of smarter packaging technologies in the region.

Microfoaming is a licensed technology developed by Dow to meet market demands for solutions that reduce weight and increase efficiency of plastic films and flexible packages. The technology enables density reduction, or lightweighting, in coextruded films through a physical foaming process. This new physical foaming process uses gas injection to create gas bubbles in the middle layer of a multilayer film, reducing the amount of resins used while maintaining the thickness and mechanical properties of the packaging film. As a result, the packaging film, although lighter weight, still meets the desired physical and processing requirements.

Dow is partnering with strategic customers in Brazil (Valfilm), Argentina (Petropack), Mexico (Folmex), Colombia and Guatemala (Plastilene), as well as MuCell Extrusion LLC, an equipment manufacturer for extrusion solutions and Dow's exclusive partner for the foamed film technology. This collaboration will ensure broad application of the technology throughout Latin America.

Technical and business teams from Dow and Mucell worked with the film producers to remove the barriers for adoption. The lack of market history behind microfoaming, the financial risk of changing the equipment, and a negative perception of film-foaming processes based on past experiences with chemical foaming in plastics created a significant barrier to introducing this advanced technology. In light of these facts, and considering the non-existing market penetration, the adoption of microfoaming under this project can be considered as first of its kind for the Americas.

The resulting GHG emissions are based on reduction of material required to produce functionally equivalent packaging film. MuCell will play an ongoing role in monitoring project activities for each plant to support the monitoring of avoided GHG emissions.



## Infrastructure – Saving Emissions by Improving Resource Productivity

Buildings are the largest energy-consuming sector in the world, accounting for more than one-third of total final energy consumption, and are an equally important source of carbon dioxide emissions. With the largest Latin American economy by GDP, Brazil is home to the region's primary construction sector. As an industry with a significant carbon footprint, construction represents a key opportunity for carbon mitigation efforts.

Designing buildings with better insulation reduces the demand on heating and cooling systems, thereby reducing the buildings' energy consumption along their lifetime. By adopting more energy-efficient building technologies, we can pave the way to reduce emissions now and well into the future. At the same time, installing cost-effective technologies such as insulation can have the immediate effect of cost savings and better climate control for greater comfort.

Dow also is working with customers that manufacture polyurethane-based foam insulation products for the building and construction industry to convert their formulations to blowing agents with a low-carbon footprint. By avoiding the release of greenhouse gases such as HCFCs<sup>11</sup> or HFCs<sup>12</sup> into the atmosphere, this conversion greatly reduces the GHGs embedded in construction materials such as insulation panels and doors.

On the most basic level, resource efficiency is about doing more with less. By focusing on technologies that help balance economic progress with sustainability, we can build a bridge to a low-carbon future.

“Greater building energy efficiency is critical for managing energy resources and supporting a lower-carbon future. Identifying the barriers that prevent wider adoption of energy-efficient technologies and working across the construction value chain to overcome these barriers will help unlock the economic and environmental potential of energy efficiency.”

### Jane Palmieri

Business president, Dow Building & Construction, and industry chairman of the board for the Alliance to Save Energy

<sup>11</sup>Hydrochlorofluorocarbons  
<sup>12</sup>Hydrofluorocarbons







## Project at a Glance

### **Promoting Energy-Saving Building Technologies Across the Construction Value Chain**

**Project Name:** Educating the Value Chain About Polyurethane (PU) Insulation in Construction

**Location:** Brazil, Argentina and Colombia (anticipated first half of 2017)

**Project Description:** Energy efficiency

**Project Start:** November 2015 (Brazil); February 2016 (Argentina and Colombia)

**Crediting Period:** 10 years

**Partners:** Danica-Zipco, Isoeste and MBP-Isoblock in Brazil; Acerolatina, Friostar, Plaquimet and Sipanel in Argentina

**Why Beyond Business As Usual:** Engaging stakeholders in discussions about the economic and environmental benefits of energy-efficient insulation implemented at levels beyond regulated minimums is a beyond-business-as-usual practice that seeks to overcome barriers for adoption across the value chain.

## Project Summary

More than 80 percent of the energy use of buildings throughout their life cycle comes from operating them.<sup>13</sup> Designing buildings with better insulation reduces the demand on heating and cooling systems, thereby reducing the buildings' energy consumption and associated GHG emissions along their lifetime. Dow is engaging with the entire construction value chain on the importance of integrating energy efficiency into their decision-making as an essential way to lower GHG emissions and help property owners lower their energy costs.

Building science studies and general thermodynamics have shown that insulation reduces heat transfer in or out of a building, depending on the season, and its use is an effective way to save energy. Dow polyurethane and polyisocyanurate technologies are used in the manufacturing of insulated panels. Polyurethane rigid foam is an efficient insulation material for energy-intensive applications, helping achieve significant energy savings, reducing energy costs and limiting GHG emissions from heating and cooling buildings. These include warehouses, supermarkets, commercial buildings and airports.

In November 2015, Dow launched a program in partnership with the largest PU-panel producers in Brazil: Danica-Zipco, Isoeste and MBP-Isoblock. The campaign runs through Games time and consists of interactive workshops and seminars in the four key construction markets of Recife, Rio de Janeiro, São Paulo and Belo Horizonte. Through these seminars, architects, builders and contractors have an opportunity to learn more about benefits of efficient insulation, its use and performance, including associated environmental and economic benefits. The program also has been expanded to Argentina with producers Acerolatina, Friostar, Plaquimet and Sipanel and is expected to reach Colombia through the first half of 2017.

The goal of the program is to promote the adoption of energy-efficiency measures within the built environment of Brazil. Many social and institutional barriers exist that prevent the implementation of energy-efficiency measures in existing structures, including a greater need for training and outreach to bring energy-efficient resources and innovations to market. In other jurisdictions, governments have taken steps to address this barrier. For instance, the



U.S. Department of Energy's Building America program is designed to increase the energy efficiency of U.S. retrofits. An analogous program does not exist in Brazil, and thus voluntary intervention was required to increase adoption. Dow established a carbon mitigation program with two main elements:

1. Identify an effective energy-efficient solution
2. Ensure it is implemented properly

Because insulated PU panels are not the normal building practice, there is a risk that even after education on their benefits, the builder does not use the panels. This solution does carry higher upfront costs and requires more installation skills. Also, there are split incentives as it is the building operator or owner who saves money through lower energy use, but the builder or developer carries the additional upfront costs from the energy-efficiency upgrades. By developing an education program and collaborating with respected panel manufacturers, the project reduces this risk.

To determine the impact of the technical seminars and workshops on introducing energy-efficient insulation panels to the region, Dow is surveying seminar participants to find out about new projects and activities catalyzed by the campaign. Several actual construction examples will be used to calculate the energy benefits and to assess the nationwide legacy of the project. GHG emission reduction calculation relies on assumptions around proper installation of the foam panels.

<sup>13</sup>Source: "Buildings and Climate Change: Summary for Decision-Makers," UNEP Sustainable Building and Climate Initiative, 2009.



## Project at a Glance

### **Reducing the Carbon Footprint of Construction Materials**

**Project Name:** Blowing Agent Conversion for Polyurethane (PU) Foamed-core Door Panels

**Location:** Mexico

**Project Description:** Carbon footprint reduction

**Project Start:** June 2016

**Crediting Period:** 10 years

**Partner:** Termo Puertas

**Why Beyond Business As Usual:** By actively promoting the development and adoption of more sustainable alternatives, Dow helped foam manufacturers overcome technical and economic barriers to change their foaming agent. These actions led to the accelerated phase-out of high-GHG, ozone-depleting substances and avoided the typical choice by foam manufactures to move to a high global warming potential (GWP) and zero-ozone-depleting choice of blowing agent. In the case of Termo Puertas, the insulated door manufacturer adopted a water-blown polyurethane foam that is the most environmentally sustainable blowing agent for polyurethane and is the first of its kind in the region.



### Project Summary

HCFCs as blowing agents are being phased out via Montreal Protocol requirements on ozone-depleting molecules. Due to the relative ease with which the formulation can be changed, many foam manufacturers move to HFC gases with zero ozone depletion but often high global warming potential (GWP). Working with Dow Polyurethanes' technical expertise and experience, Termo Puertas in Mexico made the commitment to convert ahead of regulatory requirements to the most environmentally sustainable blowing agent for polyurethane (PU) – water. While an alternative blowing agent is more widely accepted and would have been easier to adopt from a technical and risk perspective, the manufacturer chose to reduce long-term risk of undergoing another possible formulation conversion and achieve the “end game” of water-blown polyurethane foam.

In making the decision, Termo Puertas studied the potential benefits and challenges of moving to a new blowing agent, with the knowledge that conversion could help the company stay competitive in the marketplace and lead to new avenues for sales growth in the United States. Here, they had a key choice to make. Many other PU foam producers have moved or made plans public to

move to an HFC blowing agent to meet the regulation of the Montreal Protocol. This conversion entails a low level of short-term risk and minimal changes in production. In contrast, Termo Puertas decided to reduce potential long-term risk (from potential HFC regulation due to GWP concerns) and adopt the water-blown PU foam. The foam uses a blowing agent that is beyond any existing or planned regulation. In making the decision to convert, the foamer assumed some technical and financial risks associated with early adoption. Because other regional PU foam producers are moving to an HFC blowing agent rather than a water-based blowing agent, the project qualifies as a first of its kind in the region.

The conversion to a water-blown PU foaming process not only maintains the performance of the final product for the consumer, but also results in a significant reduction of GHG emissions. This new product will meet the performance needs of the marketplace and thus displace a large GHG emission source generated from the previous formulation. In fact, the end customer will see no difference in the low-GWP foamed-core door from the mitigation project and the high-GWP foamed-core door it replaces.



## Project at a Glance

### **Reducing the Carbon Footprint of Construction Materials**

**Project Name:** Blowing Agent Conversion for Polyurethane (PU) Sandwich Panels

**Locations:** Argentina

**Project Descriptions:** Carbon footprint reduction

**Project Start:** November 2016

**Crediting Period:** 10 years

**Partner:** Friostar

**Why Beyond Business As Usual:** Due to the Montreal Protocol phase-out, the PU foam marketplace is in a transition phase, with some foamers delaying capital costs by either maintaining their HCFC blowing agent or adopting special drop-in blends of HFC. Friostar purchased the necessary equipment to convert to a definitive solution that addresses both the ozone-depletion and global warming concerns.



### Project Summary

In anticipation of the potential regulatory constraints, foam manufacturer Friostar decided to evaluate alternative technologies to make its products. This included several formulations of alternatives to HCFC- 141B. Dow worked with Friostar in Argentina to convert to a lower-GHG-emitting product for the production of its sandwich insulation panels – ahead of regulatory requirements and also avoiding the option of a HFC blowing agent with a high global warming potential (GWP).

Starting in Q4 2015, the company partnered with Dow to develop a foam formulation to enable the safe use of cyclopentane as the blowing agent. Unlike some other chemicals used in insulation, cyclopentane does not contain HFCs, and its use results in significant reductions in equivalent CO<sub>2</sub> emissions. In addition to formulation changes, engineering and fire safety

modifications to an existing cure oven were made to accommodate the new blowing agent, which, like many gases, is a flammable material in its pure form. Finally, to accommodate production of foam with the low-carbon-footprint formulation, a new production line was ordered and installed. While cyclopentane is competitively priced and relatively easy to produce when compared to other insulation foams, Friostar did assume the cost of retrofitting its existing production facilities and integrating engineering and operational safeguards.

The goal of both projects is to encourage manufacturers to convert their thinking – and their formulations – to create processes and products with reduced emissions and hence a lower carbon footprint. Participating manufacturers helped to support the mitigation of Rio 2016 emissions, while also securing the long-term competitiveness of their products.

## Ownership and Application of Climate Benefits<sup>14</sup>

In order to avoid double counting and clearly define the ownership of the GHG reductions, or climate benefits, from the mitigation projects, Dow entered into contractual agreements with all relevant project actors. These agreements unequivocally attribute the GHG-mitigation results to the Carbon Partnership Program of Dow and the Rio 2016 Organizing Committee and prohibit project participants from reporting, monetizing, transferring or using the climate benefits in any other way within the agreed carbon crediting (realization period) of the projects.

In the partnership between Rio 2016 and Dow, two types of carbon impacts are being addressed:

1. Direct emissions for hosting and staging the Games – Principal Sphere
2. Associated spectator emissions – Societal Sphere

Including emissions that are both directly influenced and/or controlled by the event and emissions that are indirectly controlled or influenced by the event provides a holistic approach to the accounting and gives the broadest assessment of the total impact of the event.

The Framework broadly identifies two climate benefit types, deriving from projects implemented under the Framework:

1. Principal Climate Benefit Units (PCBUs)
2. Societal Climate Benefit Units (SCBUs)

The functional difference between these two types of units is characterized by how they are calculated (level of accuracy) and by how Rio 2016 and Dow intend to apply the benefits against the carbon impacts of the event.<sup>15</sup>

PCBUs have a higher degree of accuracy (as reflected by the higher level of auditing requirements) and are the only units that can be used to mitigate direct emissions for hosting and staging the Games. In this way, the owned emissions of Rio 2016 must only be mitigated using PCBUs. It is also acceptable to expand beyond the Principal Sphere and apply PCBUs to the Societal Sphere.

Societal Climate Benefit Units may only be related to climate impacts in the Societal Sphere or associated emissions of Rio 2016. Associated emissions include spectator-related emissions, such as transport and catering.

Below is a table of the verified forecast<sup>16</sup> of climate benefits that are projected to be generated from the portfolio of mitigation projects throughout the realization period.

- A total of more than 2.2 million tonnes of third-party-verified climate benefits is forecast to be generated throughout the realization period.
- Dow has committed to deliver PCBUs of 500,000 tonnes of CO<sub>2</sub>e to address the emissions under the direct control of the Rio 2016 Organizing Committee.
- In addition, PCBUs beyond 500,000 tonnes of CO<sub>2</sub>e and all SCBUs will be attributed to realize Rio 2016's Societal Goal of generating an additional 1.5 million tonnes of CO<sub>2</sub>e to address associated emissions.

### Climate Benefits Forecasted Through Project Realization (tonnes of CO<sub>2</sub>e)

<b>Principal Climate Benefit Units</b>	<b>684,591</b>
<b>Societal Climate Benefit Units</b>	<b>1,519,671</b>
<b>TOTAL FORECAST</b>	<b>2,204,262</b>

<sup>14</sup>Climate benefit is the reduction of GHG emissions due to specific initiatives undertaken by an organization.

<sup>15</sup>A more in-depth description of PCBUs and SCBUs is provided in the Framework.

<sup>16</sup>Actual performance results may differ and are subject to risks, variables and uncertainties involving partnering businesses and other factors.



## Education – Inspiring Action for a More Sustainable Lifestyle

Today's society is faced with multiple, interconnected problems, such as climate change, food and water shortages, and challenges brought about by population and demographic shifts. The talent power needed to solve our global challenges will come from men and women armed with STEM skills – advanced knowledge of science, technology, engineering and mathematics. Using the power of the Olympic Movement, Rio 2016 seeks to inspire action for a more sustainable lifestyle.

Dow, the Official Chemistry Company of the Rio 2016 Olympic Games and Official Carbon Partner of Rio 2016, has become the premier corporate partner of *Transforma*, providing programming and content focused on science and sports benefiting all educators and students participating in the program. Since the program launched in 2013, *Transforma* has reached more than 12,000 schools across all 27 Brazilian states, benefiting more than 7 million students. *Transforma* offers free tutorials and training for educators as well as curriculums and materials, sports training, school challenges, easy-to-follow instructions on sports experimentation, and content for classrooms.

Additionally, through the Company's support, *Transforma* has expanded to seven new cities, training educators in more than 420 schools and benefiting more than 181,000 students through diverse activities that include providing teachers, physical education instructors and tutors on-site training and activities. In addition, nine digital classes have been introduced to disseminate science-related content, including classes on sustainability and climate change, taught through the lens of sports. Dow's support of the program reflects the Company's belief that innovation begins with people, and that some of the smartest investments we can make as a society are in resources that help prepare the next generation of innovators in sustainability.



“By combining the power of sport with the power of science, the *Transforma* educational program is helping inspire and motivate future generations of scientists, engineers and mathematicians across Brazil.”

**Iris Tébéka**

Senior chemist, Dow Brazil





## A Sustainable Future Starts Today

Climate change is one of the biggest challenges facing humanity today, and it is clear that, as a society, we need to accelerate low-carbon growth if we are to achieve the transition to a more sustainable future. An important part of the mission of the Rio 2016 Olympic Games is to not only deliver an excellent Games with memorable celebrations, but to also promote sustainable social and urban transformations through sport. By combining the power of sport and science, the Rio 2016 Carbon Program is using the Games to catalyze both economic growth and emissions reductions. To help ensure a long-lasting legacy, we have put our focus on:

- **Partnership.** From the beginning, we realized we could not do this on our own. The Rio 2016 Carbon Partnership involves multiple players – Dow customers, other companies, farmers, scientists and technical experts, educators and NGOs. By sharing expertise, we learn from one another and are collaboratively working to influence the entire value chain to bring low-carbon technological advances to the region.
- **Innovation.** We ensured that all of the projects we considered are sustainable in the broadest sense. The projects represent voluntary GHG-mitigating initiatives that face real or perceived barriers and result in net GHG-emission reductions that are beyond comparable existing and expected market practices. Our actions offered an opportunity to deploy technologies that contribute to better growth, as well as lower carbon impact and benefits for society.
- **Positive Impact.** We focused on where the highest positive impact could be made, working with Rio 2016 and renowned international experts to identify projects that delivered substantial emissions reductions and technology enhancements in key areas. Areas such as restoring agricultural lands and increasing agricultural productivity. Accelerating the adoption of energy-efficient building materials for climate-smart infrastructure. Phasing down the use of hydrofluorocarbons with the highest climate impact. Expanding use of clean, renewable energy and low-carbon manufacturing innovations.
- **Leadership.** By showing a range of actions that can be taken today, we seek to inspire others and present a model that can help accelerate pathways to a lower-carbon future. We also believe that through educational programs such as *Transforma*, we can make a difference by inspiring the next generation of leaders.

Sport has the power to inspire us to push beyond today's boundaries, to connect people across cultures, and to influence positive change. So does science. Together, Dow and the Rio 2016 Organizing Committee are combining the power of sport and science to help deliver a Games with a lower carbon impact and to build long-lasting, positive change. Through proven technology aimed at fostering a low-carbon economy. Through partnerships that grow impact. And through leadership that is helping inspire the next generation in Brazil to come together as one team for one planet.

## Why Dow?

Why is a chemistry company talking about sustainability? The answer is simple: Because nearly everything manufactured in the world is enabled by chemistry. Four key elements helped to make Dow the ideal candidate as the Official Carbon Partner of the Rio 2016 Organizing Committee:

- **We have an extensive technology portfolio**, with an array of more than 6,000 product families that we provide to customers in approximately 180 countries around the world. Dow is one of the world's largest producers of technologies that improve efficiency. Energy-efficient building insulation, materials that enable lighter-weight vehicles, more fuel-efficient vehicles, and energy-saving water filtration technologies are just a few examples.
- **We have a local strategic presence in Brazil** that enabled us to make an impact and do it quickly. Dow has been operating in Latin America for 60 years, with local research laboratories, production plants, distribution networks and a broad customer base that was mobilized to implement lower-carbon technology projects for the Games.
- **We have substantial experience.** Dow has reduced absolute energy use by 20 percent, or 1.19 trillion Btu, since 2005, and our energy intensity as measured by Btu per pound of product has improved by more than 40 percent. Additionally, Dow has avoided more than 320 million tonnes of emissions since 1990.
- **We have a track record of success.** The "Sustainable Future" program, implemented by the Sochi 2014 Olympic and Paralympic Organizing Committee and Dow, delivered to date 2.22 million tonnes CO<sub>2</sub>e, verified by a third party, through in-country technology programs – more than six times greater than the estimated owned emissions of 360,000 tonnes CO<sub>2</sub>e.

## Glossary

**Baseline:** A scenario that represents the GHG emissions that would occur in the absence of the proposed project activity.

**Beyond Business As Usual (BBAU):** Ensures that low-GHG initiatives are not simply the byproduct of normal operations, but rather the result of innovation and change. To qualify, organizations must demonstrate they have implemented voluntary GHG-mitigating initiatives that faced real or perceived barriers and resulted in net GHG-emission reductions beyond comparable existing and expected market practices.

**Carbon Offset:** A financial instrument that represents the reduction of one tonne of carbon dioxide equivalent from the atmosphere.

**Climate Benefit:** A term that refers to the reduction of GHG emissions due to specific initiatives undertaken by an organization.

**Climate Impact:** GHG emissions that fall under the responsibility of an organization, as well as those that are impacted by the actions of an organization.

**Conservative:** Where there are uncertainties in monitored data, the values used to quantify GHG reductions should err on the side of underestimating GHG reductions.

**Counted Once:** An organization has exclusive right to the legal and commercial benefit of the environmental attribute. A carbon offset cannot be generated for emission reductions that exist as part of another program.

**Double Counting:** Two or more reporting entities take ownership of the same emissions or reductions.

**Event:** A planned occasion that results in a net increase in GHG emissions beyond the GHG emissions that would have occurred had the occasion not taken place.

**Global Warming Potential (GWP):** A measure of how much energy the emissions of one ton of a gas will absorb over a given period of time, relative to the emissions of one ton of carbon dioxide. The larger the GWP, the more that a given gas warms the Earth compared to carbon dioxide over that time period.

**Greenhouse Gas (GHG):** Emissions of greenhouse gases expressed in tonnes of carbon dioxide equivalent ("tCO<sub>2</sub>e").

**The Greenhouse Gas Protocol:** A widely used international accounting standard for businesses to understand, quantify and manage GHG emissions. The GHG Protocol is a partnership between the World Resources Institute and the World Business Council for Sustainable Development.

**Legacy:** Taking responsibility for the GHG emissions of an event builds on the legacy of past large events. Applying emissions reductions against the societal GHG impacts of an event builds on this legacy.

**Mitigation Projects:** Events that are run through the Dow Climate Solutions Framework to create cost-effective, low-carbon projects that mitigate the event footprint and allow the adoption of local, ongoing lower-carbon technologies.

**Principal Climate Benefit Units (PCBUs):** Any unit that can be applied to impacts in both the Principal and Societal Spheres. There are two sources: 1) carbon offsets and 2) Principal Emission Reduction Programs.

**Principal Emission Reduction Program (PERP):** An event owner or partner voluntarily implements a program with the intention of reducing GHGs through demonstrable and measurable climate initiatives.

**Principal Sphere:** This sphere contains Scope 1 and Scope 2 emissions and the Scope 3 emissions that are identified as measurable and under the control of an event owner or partner. This ultimately encompasses the emissions that must be reported and taken into account for any carbon neutrality program.

**Project Plans:** Forward-looking documents that are subject to review during the validation phase.

**Scope 1:** Direct GHG emissions from sources that are owned or operated by the entity. As part of the Framework, these GHG emissions are within the Principal Sphere.

**Scope 2:** Indirect GHG emissions from consumption of purchased electricity, heat and/or cooling. As part of the Framework, these GHG emissions are within the Principal Sphere.

**Scope 3:** Other significant indirect GHG emissions. Within the Framework, further guidance is given to identifying these GHG emissions and classifying them as part of the “Principal Sphere” or “Societal Sphere.”

**Societal Climate Benefit Unit (SCBU):** Emission-reducing activities that fall under Scope 3 emissions (Societal Sphere) but that are not quantifiable at the level required to become a carbon offset within the Principal Sphere. There are two types: 1) Societal Emission Reduction Programs, and 2) Emission Reductions from Product Comparisons (ERPC).

**Societal Emission Reduction Program (SERP):** An emission reduction program where the uncertainty associated with the emissions reductions precludes it from producing Principal Sphere emissions reductions.

**Societal Sphere:** This sphere contains the Scope 3 emissions that are identified as excluded or optional for inclusion in the Principal Sphere in the Scope 3 Decision Tree. This ultimately encompasses the emissions that are not necessary to report or to take into account for any carbon neutrality program.

**Validation:** The phase in which an external third party assesses the approach detailed in the Project Plan and provides a level of assurance that the approach will not lead to an overstatement of the GHG emission reductions.

**Verifiable:** To ensure that all the criteria have been met, carbon-offset projects need to be audited by an independent third party at both the validation and verification phases of project development.

**Verification:** The phase in which an independent third party checks the Project Report to ensure that the approach was completed as detailed in the Project Plan and that no qualitative or quantitative errors occurred.

**Verified Carbon Standard (VCS):** A greenhouse gas accounting program used by projects around the world to verify and issue carbon credits in voluntary markets.

## Appendix I

29 July 2016

The Dow Chemical Company  
2030 Dow Center  
Midland, MI 48647  
Attention: Michael Mazor



### **Emissions Reduction Forecast Verification Statement**

As Official Carbon Partner of the 2016 Summer Olympic Games in Rio de Janeiro, Dow has committed to deliver third-party-verified principal climate benefits of 500,000 tonnes<sup>1</sup> of CO<sub>2</sub> equivalents to address the emissions under the control of the Rio 2016 Organizing Committee ('Principal Goal'). Dow and Rio 2016 are also collaborating to generate climate benefits for an additional 1.5 million tonnes CO<sub>2</sub>e to balance associated emissions outside the direct control and influence of the Organizing Committee, *inter alia*, spectator travel, lodging and induced traffic in Rio ('Societal Goal').

Climate benefits are generated through the implementation of energy-efficient and low-carbon technologies with Dow's key customers and partners in Brazil for the Principal Goal and in Brazil and the rest of Latin America for the Societal Goal.

ERM has been selected as the third party to validate the Project Plans and verify GHG emission reductions against the Dow Climate Solutions Framework for Events v 2.0.

This Climate Benefit forecast verification statement is the sole property of Dow and can only be released on Dow's approval.

ERM has conducted an independent assessment with reasonable level of assurance to verify the forecasted generation of climate benefits through the full Dow Project Portfolio under implementation, during a maximum 10-year crediting period. ERM determined the validity as a Principal or Societal Emission Reduction Project<sup>2</sup> of each project listed in Annex 1. ERM validated the respective Project Design Documents (PDDs) and verified implementation evidences including, but not limited to:

- Clear demonstration of the additionality of the projects and fulfillment of the Beyond Business As Usual (BBAU) condition, including demonstrated technological and economical barriers, and voluntary implementation beyond comparable existing and expected market practices;
- Use of existing GHG accounting methodologies and/or protocols;
- Contractual conditions showing that the climate benefits generated by each of the projects during the crediting period will be exclusively attributed to Carbon Partnership of Dow and Rio 2016;
- Detailed conservative calculations of baseline emissions and project emissions forecasted, including specifications of equipment of baseline scenario and project scenario;
- Risk assessment, including technical and financial risks related to the operation of the projects, showing a very low level of risk and reasonable mitigation alternatives;

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<sup>1</sup>Tonne is the IPCC and UNFCCC unit of mass and equals 1,000 kg. A ton (U.S. units) equals 2,000 pounds

<sup>2</sup>As defined in Dow's Climate Solutions Framework for Events v. 2.0: <http://www.dow.com/carbonmitigation>

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- Monitoring plan intended for GHG data monitoring of both project parameters and baseline related data such that high quality, accurate data and monitored parameters are collected in a manner sufficient to calculate each project's emission quantification;
- Activity data and emission factors observed; and
- Evidences of implementation as applicable to individual projects. Examples include, but are not limited to, visual evidences documented during site visits, contractual agreements between Dow and its partners, and invoices for purchasing of new equipment or machinery.

### ***Conclusion***

After careful review, ERM found the evidences for achieving the emissions reductions predicted for projects with validation concluded as noted in Annex 1 to be satisfactory and was unable to identify any flaws in the Project Design Documents (PDDs) or any assumption that could lead to an overstatement of the forecast of future GHG emission reductions. All projects are under implementation or already operational with performance according to the expected values provided in the PDDs.

As of July 29, 2016, ERM determined that to the best of our current knowledge a total of **684,591** tonnes of CO<sub>2</sub>e from Principal Emission Reduction Projects in Brazil and a total of **1,519,671** tonnes of CO<sub>2</sub>e from Societal Emission Reduction Projects in Brazil and the rest of Latin America are expected to be achievable through the full implementation of the Project Portfolio during a 10 years' crediting period.

### ***Limitations***

This forecast verification statement has certain limitations:

- This statement incorporates our best judgement on the operation of the underlying projects and does not account for externalities that could prevent the generation of the climate benefits herein verified;
- This statement solely aims at providing our conservative expectation of performance and is based on evidences, information and data available at this time including activity data forecast and emission factors as provided in the design documents;
- ERM has adopted additional conservativeness elements in this forecast to mitigate unpredicted risks. If projects are implemented and executed according to the validated design documents the climate benefits achieved throughout the period may well exceed the herein forecasted values;
- This statement is valid for 12 months from issuance, and shall be updated taking into account the existing circumstances at the time of renewal and will include both, the actual Principal Climate Benefit Units (PCBUs) and Societal Climate Benefit Units (SCBUs) generated through the operation of the Project Portfolio verified by ERM on an *ex post* basis and the forecasted emissions reductions for the remaining period;
- The climate benefits herein incorporated must not be used to mitigate or balance specific carbon impacts until they are confirmed in a verification statement on an *ex post* basis;

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- ERM has verified the PCBUs and SCBUs forecast with reasonable skill and care, and cannot be held liable for any over-issuance of climate benefit units due to material errors, omissions and misrepresentations within the project plan of each project in the portfolio; and
- The threshold for materiality with respect to omission or misstatement concerning reported quantities is five percent.

*Note on Independence of ERM*

Environmental Resources Management, Inc. (ERM) is a leading global provider of environmental, health, safety, risk, social consulting services and sustainability related services.

Yours sincerely,



Brulio Pikman  
*Senior Partner*  
Environmental Resources Management, Inc.

## Appendix II

22 July 2016

The Dow Chemical Company  
2030 Dow Center  
Midland, MI 48647  
Attention: Michael Mazor



### Emissions Reduction ex post Verification Statement

As Official Carbon Partner of the 2016 Summer Olympic Games in Rio de Janeiro, Dow has committed to deliver third-party-verified principal climate benefits of 500,000 tonnes<sup>1</sup> of CO<sub>2</sub>e to address the emissions under the control of the Rio 2016 Organizing Committee ('Principal Goal'). Dow and Rio 2016 are also collaborating to generate climate benefits for an additional 1.5 million tonnes CO<sub>2</sub>e to balance associated emissions outside the direct control and influence of the Organizing Committee, *inter alia*, spectator travel, lodging and induced traffic in Rio ('Societal Goal').

Climate benefits are generated through the implementation of energy-efficient and low-carbon technologies with Dow's key customers and partners in Brazil for the Principal Goal and in Brazil and the rest of Latin America for the Societal Goal.

ERM has been selected as the third party to validate the Project Plans and verify GHG emission reductions against the Dow Climate Solutions Framework for Events v 2.0.

The following information was compiled by Dow and Dow's contractor and provides Rio 2016 with a comprehensive and validated overview of Dow's Carbon Mitigation efforts to date. The following information also satisfies Dow's obligations to provide Rio 2016 with validation follow-ups, as well Dow's communication obligations all as set out in various Sections of the Carbon Partnership Agreement entered into between Dow and Rio 2016. Dow is pleased to provide Rio 2016 with the following information highlighting Dow efforts and success to date in implementing the GHG Mitigation Projects.

This assurance statement is the sole property of Dow and can only be released on Dow's approval.

ERM was engaged to conduct an independent assessment of the Dow technologies listed in Annex 1 under the Greenhouse Gas Mitigation Framework for Events v 2.0 ('Framework') and to determine their validity as Principal and Societal Emission Reduction Projects. ERM also conducted an independent assessment to a reasonable level of assurance to verify the generation of Principal Climate Benefit Units (PCBUs) and Societal Climate Benefit Units (SCBUs) through the implementation of these Reduction Projects.

As of July 22, 2016, ERM determined at a reasonable level of assurance that a total of **104,155 tonnes of CO<sub>2</sub>e** from Principal Emission Reduction Projects in Brazil have been achieved through the implementation of the Project Portfolio.

The Principal Climate Benefit Units of 104,155 tonnes of CO<sub>2</sub>e were attributed to the Principal Goal. Principal Climate Benefit Units beyond 500,000 tonnes of CO<sub>2</sub>e and all Societal Climate Benefit Units will be attributed to the Societal Goal.

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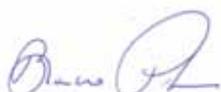
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<sup>1</sup>Tonne is the IPCC and UNFCCC unit of mass and equals 1,000 kg. A ton (U.S. units) equals 2,000 pounds

**Note on Independence of ERM**

Environmental Resources Management, Inc. (ERM) is a leading global provider of environmental, health, safety, risk, social consulting services and sustainability related services.

Yours sincerely,



Brulio Pikman  
Senior Partner  
Environmental Resources Management, Inc.

**Annex I**

Project name	Country	Category	Operational starting date
<b>Principal Emission Reduction Projects</b>			
Aratu biomass cogeneration project	Brazil	Renewable energy	April 2014 <i>(awaiting second issuance of climate benefits)</i>
Santa Vitoria cogeneration project	Brazil	Renewable energy	June 2015 <i>(under validation, first issuance of climate benefits ongoing)</i>
<b>Societal Emission Reduction Projects</b>			
Microfoamed-core flexible packaging production	Brazil, Argentina, Colombia, Mexico	Raw material mass reduction	April 2015 <i>(validated, awaiting first issuance of climate benefits)</i>
PU foamed-core door blowing agent conversion	Mexico	Carbon footprint reduction	April 2016 <i>(validated, awaiting first issuance of climate benefits)</i>
PU foamed-core panel blowing agent conversion	Argentina	Carbon footprint reduction	October 2016 <i>(validated, awaiting first issuance of climate benefits)</i>
Restoration of pastureland to improve range efficiency	Brazil	Soil carbon sequestration, carbon footprint reduction	August 2015 <i>(validated, awaiting first issuance of climate benefits)</i>
Precision agriculture nitrogen emission management	Brazil	Nitrous fertilizer optimization	August 2015 <i>(under validation)</i>
PU insulation in construction	Brazil, Argentina	Energy efficiency	November 2015 <i>(under validation)</i>

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