



# Tulane Engineering Forum

15 April, 2011

- 
- **Nucor**
  - **Nucor Steel Louisiana LLC**
  - **DRI Technology**

# Nucor Overview

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- **Steel Mills** **26.7 Million Tons**
  - Hot rolled sheet, bars, structural, plate
- **Steel Products** **4.7 Million Tons**
  - Steel Joists, Steel Deck, Cold Finished Bars, Steel Buildings, Rebar Fabrication, Mesh & Metal Grating, Fasteners
- **Raw Materials**

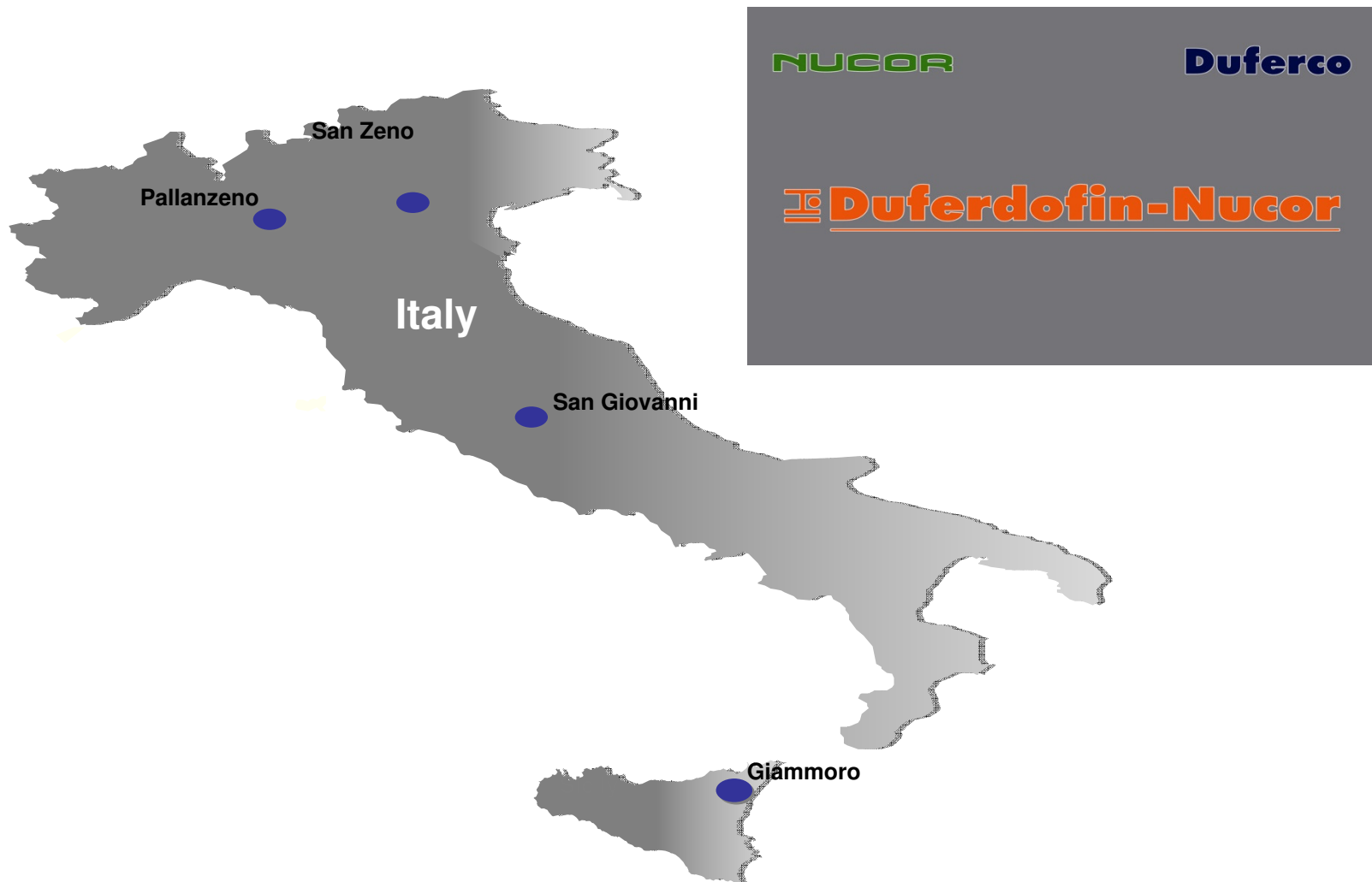
# Nucor Steel Mills



**13 Bar Mills**  
**4 Sheet Mills**  
**2 Structural Mills**  
**2 Plate Mills**  
**2 Castrip Plants**

# Growth Platform – International

## Duferdofin-Nucor beams & long products joint venture



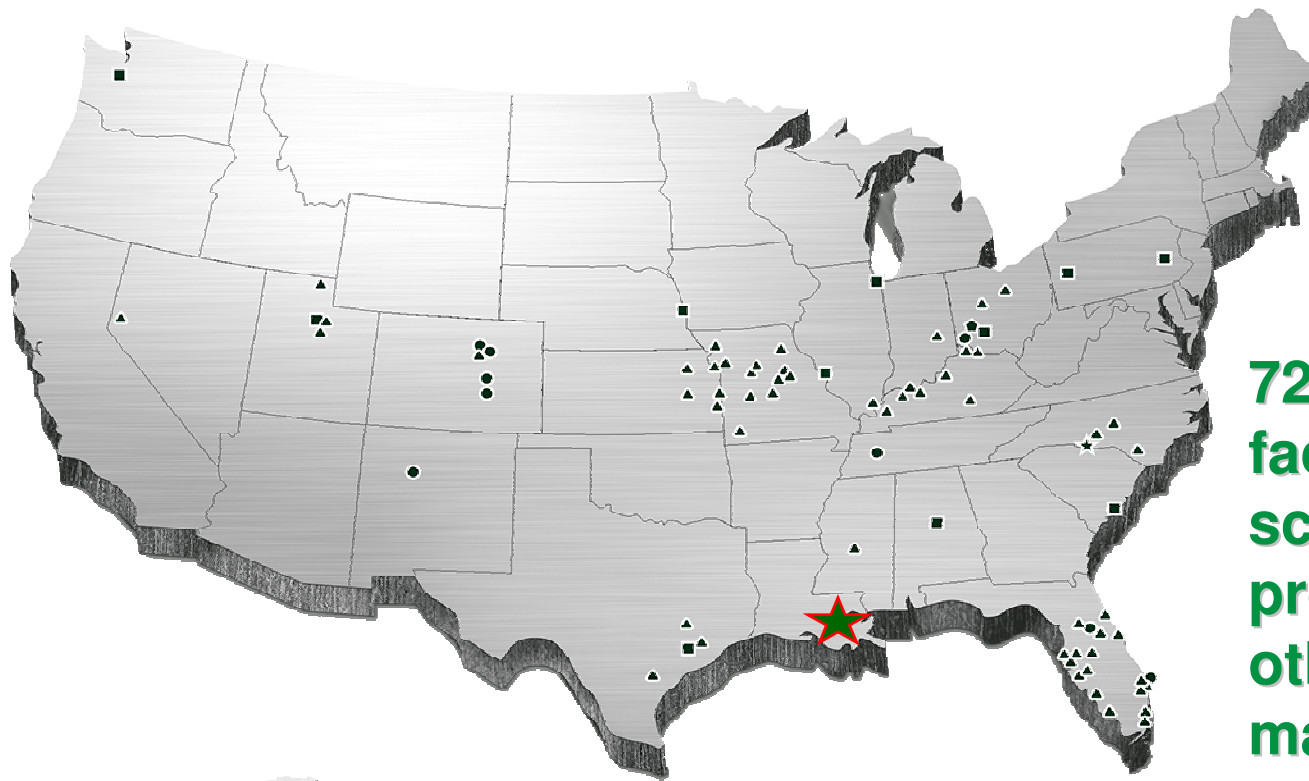
# Nucor Steel Products



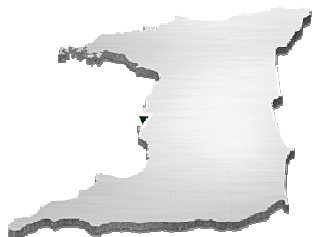
**128 operating  
facilities in the  
U.S. & Canada**

NUCOR

# Nucor Raw Materials



**72 operating facilities – scrap processing & other raw materials services**



**Trinidad DRI Facility**



# Nucor Steel Louisiana LLC

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- **\$750 million direct reduced iron (DRI) facility**
- **2.75 million tons annual capacity**
- **First phase of a multi-phase plan**
- **Next step in implementation of raw materials strategy**
- **Leverages strong skill set established by our Nu-Iron Team at our 1.8 million-tons-per-year DRI plant in Trinidad**
- **Long-term supply of attractive-cost natural gas secured**



# Plant Location – St. James Parish La





# NSLA Layout



# Engineering

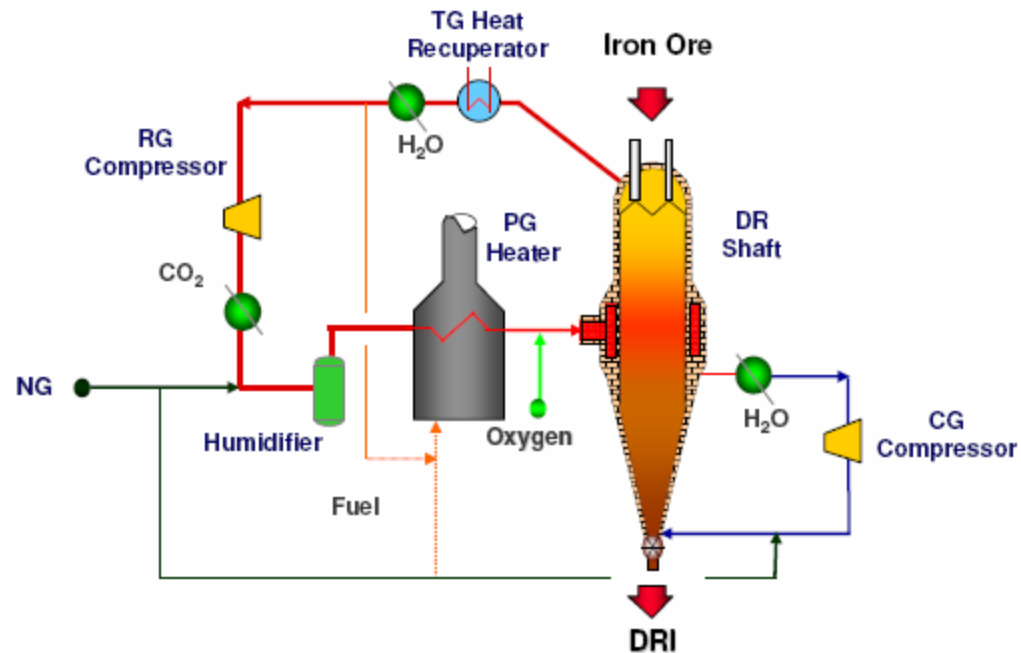
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- Port – floating dock
- Material Handling – pipe conveyor
  - 3.75 M tpy iron ore pellets
  - 2.5 M tpy DRI out
- DRI Process – HYL
- Construction Engineering
  - Reactor vessel 900 metric tons
  - Soil condition

# DRI Technology

## ZR Process

### General scheme configuration



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**ENERGIRON**  
THE IMPROVED DIRECT REDUCTION TECHNOLOGY

# DRI Technology

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## ZR Process Scheme

### Basic Principles

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- The ZR process allows the reduction of iron ores without the use of a reformer by taking advantage of the fact that metallic Iron is a very good catalyst for natural gas reforming.
- The reduction zone of the DR shaft is used to perform simultaneously the Reduction of the Iron Ore and the reforming of natural gas.
- When natural gas reforming takes place under a limited amount of steam, some carburization of the catalyst will occur.
- In the case of the ZR, since the catalyst is the DRI, carburization is intentional and controlled.
- The rate of carburization can be controlled by adjusting the content of steam (humidity) present in the gas stream.
- In the ZR process the carburization of the catalyst (DRI) takes place at high temperature resulting in the formation of Iron Carbide  $\text{Fe}_3\text{C}$ .

# DRI Technology

## ZR Process Scheme

Features: “In-situ” Reforming and Reduction

### IN-SITU Reforming:

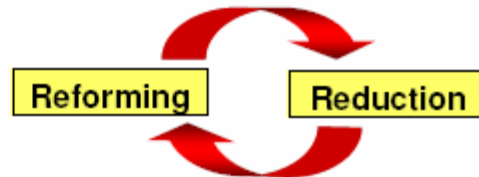
- Conditions for natural gas reforming:
  - ✓ presence of Oxidants and hydrocarbons ( $\text{H}_2\text{O} + \text{CO}_2 + \text{C}_n\text{H}_{2n+2}$ )
  - ✓ high temperature
  - ✓ presence of catalyst

### Iron Oxides Reduction:

- The conditions for the reduction of iron oxides are:
  - ✓ presence of reductants
  - ✓  $(\text{H}_2 + \text{CO})/(\text{H}_2\text{O} + \text{CO}_2) \gg 1$
  - ✓ high temperature
  - ✓ presence of iron oxides

In the reactor reduction zone all these conditions are present, making possible the “in-situ” reforming and reduction simultaneously.

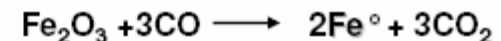
Iron Ore



### In-situ Reforming



### Reduction



### Carburization



# Nucor Steel Louisiana LLC

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- Mission
- 150 Teammates
- Start-up 2013





Thank You!