




## CONSTRUCTION IN

# COLOMBIA

The culmination of 15 years of planning and development, the expansion of the Refinería de Cartagena S.A. (REFICAR) refinery in Cartagena will be one of the largest industrial projects ever undertaken in Colombia. When complete, the US\$ 3.8 billion expansion will increase the nameplate processing capacity to 165 000 bpd, relieving regional refining constraints and enabling REFICAR to produce ultra low sulfur gasoline and diesel from heavy, high sulfur and high total acid number (TAN) crudes, for both domestic use and export. The project will enable the refinery to adhere to the latest emissions protocols and requirements and thus meet world class environmental standards.

REFICAR is an affiliated company of Ecopetrol S.A., the Colombian based integrated oil and gas company. The Ecopetrol group of companies has embarked on a growth strategy with key investments in exploration, production, refining and petrochemicals, as well as transportation. The investment in the REFICAR refinery project will enable Ecopetrol to quickly close in on its 2008 - 2015 goal of 650 000 bpd of refining capacity.

The project is unique, with complete engineering, procurement and construction responsibility for a multi process unit refinery awarded to CB&I as a single integrated contractor. CB&I's work scope includes grassroots refining units, utilities, and infrastructure for the new refinery, which will be constructed adjacent to REFICAR's existing 80 000 bpd refinery. In addition, the scope includes modernisation of the existing refinery to take advantage of the new complex and improve efficiencies.

An aerial photograph of a city, likely Cartagena, Colombia, with a large Colombian flag (yellow, blue, and red) waving in the foreground. The text is overlaid on the top half of the image.

# MASOUD DEIDEHBAN, CB&I, USA, AND ORLANDO CABRALES, REFINERÍA DE CARTAGENA S.A., COLOMBIA, DESCRIBE THE EXPANSION OF THE REFINERÍA DE CARTAGENA S.A. REFINERY IN COLOMBIA.

## Revamp of existing refinery

The original refinery's major process units include a crude/vacuum unit, fluid catalytic cracking (FCC) unit, Visbreaker thermal cracking unit, catalytic polymerisation unit, kerosene/jet fuel treater, and a sulfur recovery complex.

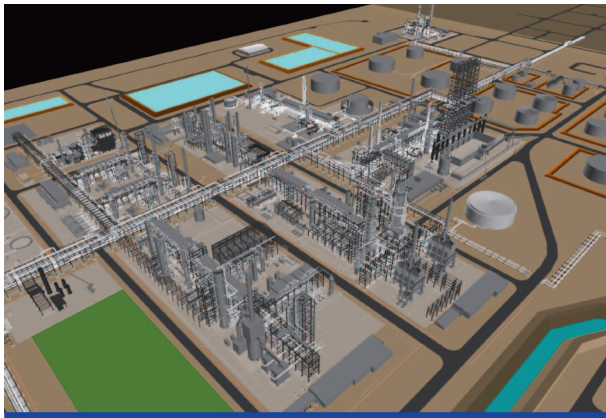
As part of the overall project, the FCC unit in the existing refinery will be modernised for conversion to either maximum light cycle oil (LCO) or maximum propylene, depending on market conditions. REFCAR's current commitment is to produce the maximum propylene, which will be used by Ecopetrol's Propilco plant across the street from the refinery. In addition, a power recovery unit will be added with the expander being used as 'green power' for the large new blower and a motor/generator that will provide additional electric power to the refinery.

The modernisation project also includes a new, relocated converter island and fractionation tower, revamp of the existing vapour recovery unit including a new debutaniser, and the addition of a new Merox™ unit. The capacity of the unit will be increased by 25%. Construction challenges to be overcome include the addition of a second pipe rack straddling the original rack to gain plot space for the new air coolers, installing a cable tray for converting the electrical system from underground duct banks to aboveground, and a large amount of additional piping.

## Scope of new refinery

In addition to the installation of a new crude and vacuum distillation unit capable of processing high sulfur, high nitrogen and high TAN crudes, the expansion plans call for the construction of infrastructure and other process units with the following design capacities and licensed technology:

- ▣ 150 000 bpd crude/vacuum unit.
- ▣ 40 000 bpd Lummus Technology delayed coker.
- ▣ 35 000 bpd UOP Unicracking™ unit.
- ▣ Two 35 000 bpd UOP Unionfining™ units.
- ▣ 35 000 UOP FCC unit (existing unit expansion).
- ▣ 20 000 bpd Merichem NAPFINING™ unit.
- ▣ 20 000 bpd CDTECH FCC naphtha hydrotreater.
- ▣ 9700 bpd UOP SHP/HF alkylation complex.
- ▣ 3000 bpd UOP Butamer™ unit.
- ▣ 4500 bpd/17.3 million ft<sup>3</sup>/d saturated gas plant.
- ▣ 8400 bpd UOP Merox™ FCC LPG treating unit.
- ▣ 4000 bpd Merichem DCU LPG treating unit.
- ▣ 7000 bpd Merichem SGU LPG treating unit.
- ▣ 270 tpd CB&I sulfur recovery complex (two SRU/TGU trains, two ARU trains, SWS).
- ▣ Two 50 million ft<sup>3</sup>/d CB&I hydrogen plants.



**Figure 1.** Model of REFCAR refinery expansion showing the plot plan for the new process units.



**Figure 2.** Local workers receiving training in skilled trades prior to the start of construction at the REFCAR refinery expansion project.

- ▣ Utilities/infrastructure: power/steam generation and distribution; raw and wastewater treating; spent caustic treating and cooling water system.

These new facilities will incorporate the latest safety and environmental control technologies adhering to the more stringent of IFC guidelines or Colombian National Standards. The refinery expansion is being designed to maximise personnel safety, automation and operational reliability. Figure 1 is a computer generated model of the new refinery.

## Craft training

The project is expected to have a peak construction work force of 6000 craftsmen installing 165 000 m<sup>3</sup> of concrete, 31 000 t of structural steel, 640 000 m of pipe and more than 4.8 million m of cable and wire.

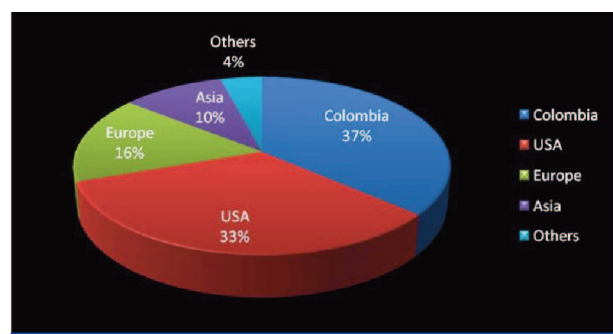
To support the project two craft training centres have been opened in Cartagena, with the objective of creating a pool of trained local craft workers with the basic skills necessary for the safe, efficient and successful construction of the project. The curriculum adopted for use in the programme is called the 'Contren Learning Series' developed by the National Center for Construction Education and Research (NCCER). The trained craft workers will supplement experienced local craftsmen and other country nationals during construction.

The training staff employed are all qualified craftsmen with a minimum of 10 years experience. Approximately 3900 workers will be trained in the following disciplines:

- ▣ Carpentry.
- ▣ Scaffolding.
- ▣ Concrete finishing and masonry.
- ▣ Millwright.
- ▣ Structural and reinforcement ironworking.
- ▣ Boilermaker.
- ▣ Industrial welding.
- ▣ Insulation.
- ▣ Pipefitting.
- ▣ Painting.
- ▣ Electrical and instrumentation.

More than 600 workers in key trades have already completed training courses in anticipation of construction needs (see Figure 2). Together REFCAR and CB&I will be developing a whole new generation of craftsmen who will be prepared not only to support this project but the ongoing development of this region in Colombia as an import/export hub.

## Corporate social responsibility (CSR) initiatives



**Figure 3.** Geographic distribution of anticipated procurement expenditures for REFCAR refinery expansion project.

Given the dimensions of the project, one of the largest ever in Colombia, local suppliers are keen to become involved. To help meet their expectations, REFICAR has developed a CSR strategy focused on four main areas:

- ☐ Employment generation and enhancing working skills.
- ☐ Promotion of economic development.
- ☐ Social intervention.
- ☐ Environmental protection.

Three main principles form the foundation for initiatives developed under the project's CSR strategy. First, residents of Cartagena will have first priority, a mandate that is shared by CB&I and put into practice in all activities for training, recruiting and procurement processes. Second, any initiative will be made in alliance with other organisations from the public sector (national and local level), the private sector and/or community based organisations, so as to maximise the impact and multiply REFICAR's financial funding. Special emphasis has been made by REFICAR to align its CSR initiatives with Cartagena's Municipal Development Plan to ensure relevance and completeness. Third, all initiatives should be in line with the core values of the project.

During this first stage of the project, the main emphasis has been on informing all stakeholders about the project and the opportunities for training and future employment. Nearly 5000 people from all over Cartagena have participated in informational meetings

organised by CB&I with the support of its allied institutions. The community is gaining an understanding of what the project means, its requirements, its potential influence, and how it is being implemented. Most importantly, local residents are being afforded the opportunity to participate and become part of the process.

In terms of procurement, the project team is striving to maximise purchase of materials, equipment, supplies and services from Colombian sources. Figure 3 shows the anticipated geographic distribution of procurement activities.

## **Current status of the project**

CB&I is executing the engineering and procurement out of its Houston office, with resource support from its other global technical centres. Detailed engineering and procurement activities are under way. Current construction activities include site preparation, reroute of existing pipelines, and installation of temporary facilities. The target completion for construction and erection of the new refinery units is February 2013.

When complete, the expanded REFICAR refinery will enable Colombia to reduce imported products, satisfy domestic demand for fuel, and provide surplus for export of high quality products tailored to the demands of the international market. With underlying tenets such as economic development, implementation of international environmental standards, and employment generation, the completed expansion project will make the REFICAR refinery one of Latin America's top refineries. 