

# Case note

## MEGADRIVE-LCI soft starter increases profitability of oil refinery

The high costs of operation for the two 5500 kW motors, that operate the hydrogen compressors, led PEMEX to invest in a more efficient and cost effective solution. Thus, PEMEX decided to retrofit the existing motors with two MEGADRIVE-LCI soft starters from ABB. This solution reduced the operation costs and increased the profitability of the oil refinery.



View of PEMEX's Madero refinery

### Background

The Madero refinery, located on the left bank of Panuco River in Ciudad Madero, Tamaulipas, is one of six PEMEX oil refineries in Mexico. It dates back to 1918, and its 22 refining plants process 186'000 barrels of crude oil each day.

### Challenge

In September 1995, the refinery was about to celebrate the start-up of two 7300 hp motors that were to operate hydrogen compressors. But when the motors were started direct-on-line (DOL), four of the refinery's generators went down and the entire refinery lost power. Although the motors were properly designed and installed, the starting load was too high for the refinery to support. The original specifications had not required any soft-starting device for the motors and no one had expected that the motors would pull such a high starting load.

### Hydrogen compressors

The hydrogen compressors are a necessary component of the refinery's processes – not only are they needed for the plant's process, the compressors also feed hydrogen to three other plants in the refinery.

### Highlights

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- Increased profitability
- Reduced operating cost
- Higher availability of the plant's power grid
- Minimized production loss
- Longer lifetime of equipment
- Reduced maintenance cost
- Peace of mind

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View of motor and compressor (5500 kW)

### Production stop

To start the motors DOL and operate the compressors, a systematic sequence of events had to be coordinated. PEMEX organized a team that included 30 PEMEX employees and the local power company.

Whenever one of the motors was to be started DOL, the members of the PEMEX team were called into the refinery, the local power company was contacted to supply a power boost and the three down-stream plants stopped production and ceased pumping their products.

Once this was coordinated, the frequency between the motor and the grid had to be synchronized manually. The entire process of starting one motor took anywhere from 30 minutes to 3 hours, and the high energy consumption required to start a motor dictated that only one motor could be started, limiting the plant to only one compressor at a time.

Ing. Gregorio Navarro, Engineering Specialist for Construction, was in charge of the coordination team and the first person contacted when it was time to start one of the motors.

“At 2 am when one of the motors needed to be started, I was the one who received the call to come in and start the coordination,” Ing. Navarro said. “The operation of the motors cost PEMEX time, money and peace of mind.”

### Solution

It was these costs of operation that led Ing. Navarro to investigate a more efficient solution. He knew that a drive solution was possible, but no one had installed such a large soft-start drive for retrofit with existing motors in Mexico before.

### Trust is key

In 1996, PEMEX formed the Operation & Design Improvement (MDO) task force with the goal to improve operation practices. Employees were invited to participate in the improvement process.

Ing. Jorge Vargas, Chief of the Production Unit, led the MDO task force for the Madero refinery in 1996 and sponsored a project to find a drive solution for starting the compressor motors. The PEMEX team was looking for a profitable solution from a trusted supplier. The Mexican engineering company Inconsur was on site during the initial motor start-up and witnessed the refinery’s difficulties when starting the motors DOL. The close relationship with PEMEX positioned Inconsur as the first external supplier to learn of the drive project.

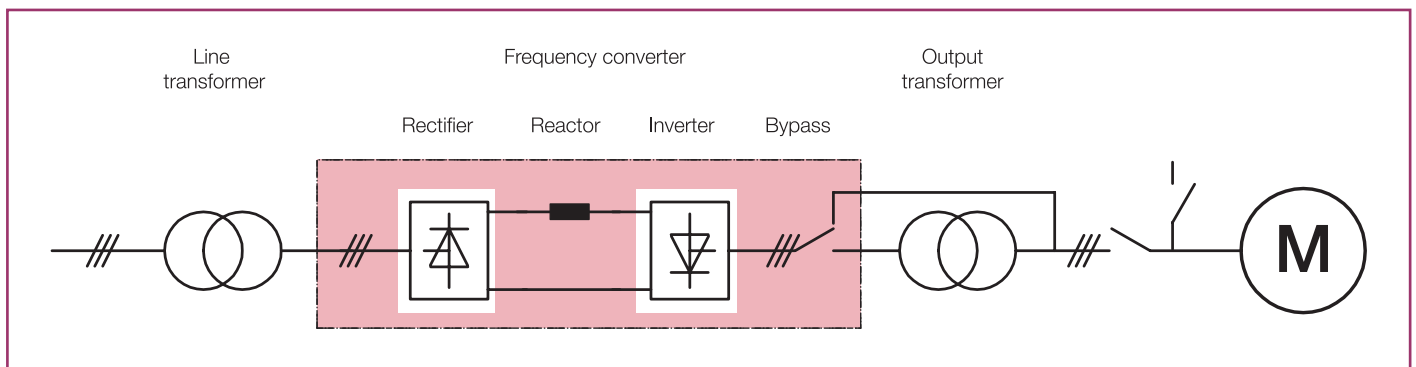
### Technological leadership

Ing. Efrain Rodriguez, Director General of Inconsur, met with PEMEX engineers and the MDO task force to gather the specifications for the project. Inconsur then presented the case to ABB’s product development team, which then designed a soft-starting solution for PEMEX.

A major challenge was to customize a solution that would also allow PEMEX to start the motors DOL in case the drive would fail.

From the suppliers who attended PEMEX’s international bidding, only ABB met all technical requirements.

PEMEX was confident that ABB’s MEGADRIVE-LCI solution would provide a cost-effective and efficient solution. “The customization was challenging and only ABB was able to provide a solution. They were convinced that they could deliver the ideal solution for PEMEX,” said Ing. Navarro.



6/6 pulse MEGADRIVE-LCI converter

## Benefits

### Fast delivery, instant results

PEMEX, Inconsur and ABB cooperated closely and 11 months after the order was placed, ABB's MEGADRIVE-LCI was engineered, delivered, installed, commissioned and ready for start-up.

"The start-up was amazing," proclaimed Ing. Ricardo Garza, Chief of Electrical Maintenance. "With one button, everything started perfectly without problems. The MEGADRIVE-LCI can even start the two motors in sequence. This is the solution to many problems!" After three years of difficulties and inconveniences with DOL starts, PEMEX finally had a solution. The successful project was also a very big achievement for the MDO team as it was the largest budget ever to be sponsored at the local level without the involvement of PEMEX corporate.

### Increased profitability

With the MEGADRIVE-LCI installed, the refinery started to see an immediate increase in profitability. Production no longer needed to stop at the three down-stream plants and their product pumping was no longer interrupted.

"The ABB MEGADRIVE-LCI gave us confidence in our production," said Ing. Navarro. "Now, we only need to push one button to start the motors."

"We can now start and stop the motors four times a day. Before, we could only operate one compressor at a time, due to the energy needed to start the motor," he said. "Now we can start both motors sequentially with one soft-starter drive and operate both compressors at the same time!"

### Reduced maintenance cost, increased lifetime of equipment

The MEGADRIVE-LCI soft starter eliminates starting current peaks which reduces the stress on motors. This resulted in reduced maintenance cost and an increased lifetime of the equipment.

### Highly reliable operation

More than 10 years later, ABB's MEGADRIVE-LCI soft starter is still running smoothly and without problems.

### Customer satisfaction

Ing. Vargas states: "The ABB MEGADRIVE-LCI gave PEMEX flexibility and security of operations. Gone is the fear of having to shut down the compressors for maintenance or production changes, because the motors can be re-started quickly and easily without losing production."

## The MEGADRIVE-LCI soft-starter offers many benefits, including:

- More than 30 years operation experience in different applications
- Configurations for variable speed drives and soft starters
- Air- or water-cooled
- Highest reliability and availability
- Highest efficiency > 99%
- Fuseless design
- Encoderless control
- Lowest lifetime cost
- Greatest transformer flexibility
- Every drive tested in factory
- Full compliance with international standards



### MEGADRIVE-LCI key data

Inverter type	6/12-pulse Load Commutated Inverter (LCI)
	Air cooling: 2 - 31 MW
Power range	Water cooling: 7 - 72 MW (higher on request)
Output voltage	2.1 - 10 kV
Maximum output frequency	60 Hz (optional 120 Hz)
Converter efficiency	Typically > 99%
Type of motor	Synchronous motor

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