Seafood Processor Keeps Cool **Economically** With Gas Engine-Driven Refrigeration System with Heat Recovery

Like other California energy customers, the Aquamar, Inc., seafood processing plant in Rancho Cucamonga was jolted by enormous increases in the cost of electricity during the state's "power crisis" two years ago.

And like many forward-thinking businesses, the company found a solution: natural gas.

Located 50 miles east of Los Angeles, the Aquamar plant transforms frozen pollock from Alaskan waters into familiar red-and-white imitation crabmeat, also known as *surimi*. Aquamar is the third largest surimi processor in North America.

To preserve its freshness and flavor, the product must be chilled quickly after cooking and processing, and kept cold as it is shipped to grocery stores and restaurants across the continent. All this essential refrigeration costs serious money, particularly if it operates on electricity.

Representatives from Southern California Gas Co., a division of Sempra Energy, showed Aquamar officials how they could save tens of thousands of dollars annually on their electric bill by adding a natural gas engine/compressor unit to their existing refrigeration system during a recent plant expansion.

"With the cost of electricity starting to skyrocket, we offered them a more economical way of generating their cooling," says Benjy Nepomuceno, a SoCalGas engineer and account executive. "They were in the process of expanding. Adding more electrical load would have sent their electric demand rates much higher."

The new gas unit, a 225-hp Caterpillar engine with a Frick ammonia compressor, was added to the plant's cooling system two years ago. The system's older components include a 150-hp high-side electric motor-driven compressor, a 100-hp booster electric motor-driven compressor for the blast freezer, and a 125-hp single-stage electric motor-driven compressor for the refrigerated warehouse.

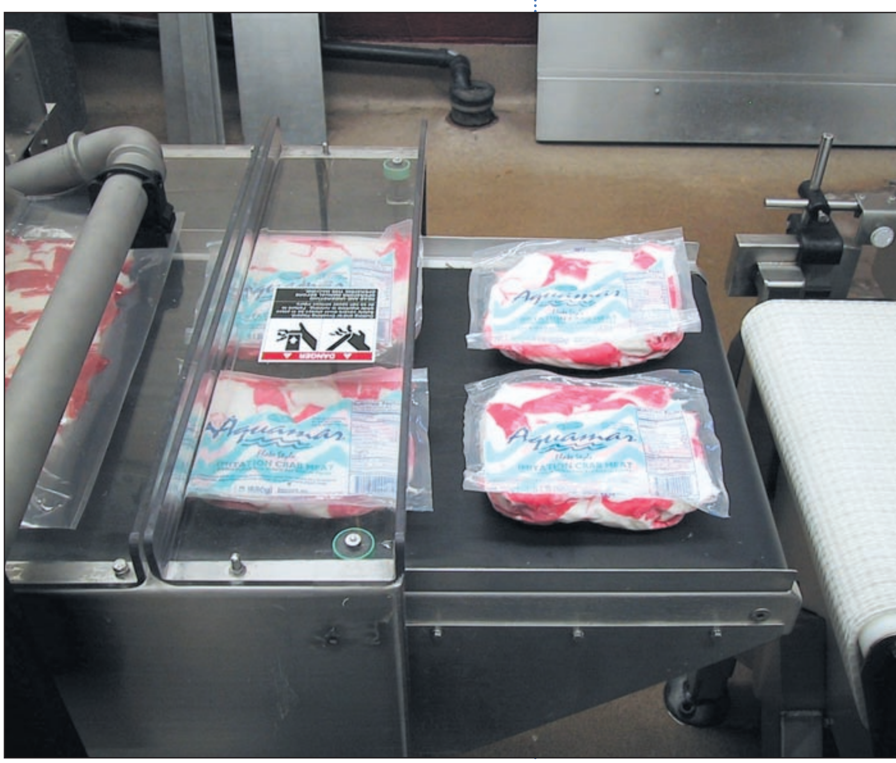
The gas engine-driven refrigeration system utilizes a plate-frame heat exchanger to recover heat from the engine jacket water. To maximize the heat recovery potential, the heat exchanger is located between the engine and the rooftop radiator. This provides the highest temperature glycol for heat recovery purposes.

Although the company initially expected to save $60,000 in electricity costs, SoCalGas pointed out that adding a heat-recovery steam generator to the two-stage ammonia

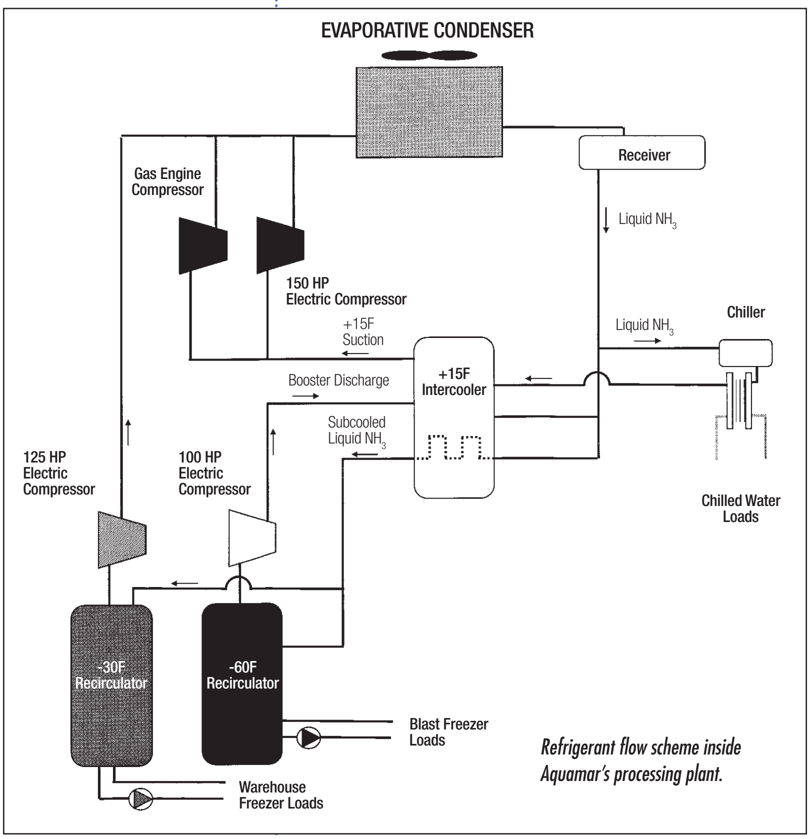
AT A GLANCE

Natural gas engine-driven refrigeration system:

- Reduces demand on power grid
- Maximizes heat recovery
- Delivers reliable power



Officials at the Aquamar Inc., seafood processing facility in Rancho Cucamonga, CA, recognized the benefits of adding a natural gas-powered refrigeration system with heat recovery.



Refrigerant flow scheme inside Aquamar's processing plant.

refrigeration system could reduce costs further. Aquamar agreed and purchased a steam generator that recovers heat from the engine jacket water and supplies it to a boiler in the form of 190°F glycol. This brought the total annual savings to $107,000 and significantly reduced payback time on the new gas equipment's $455,000 capital cost.

The payback calculation was based on a 24-hour operation with gas costing $0.50 per therm, which includes the cost of transportation.

According to a study conducted by SoCalGas, heat recovery utilization yielded annual savings of 28%, while the steam heat recovery generator added another 7%.

According to Nepomuceno, if Aquamar had chosen to add a fourth electric refrigeration unit to its system instead of one operating on natural gas, the company's monthly summer electric demand charge alone would have jumped from $10,000 to above $13,000 for each of the four months when demand charges are in effect. "It would have been a killing proposition for them," Nepomuceno says.

Second Step to Savings: Cogeneration

Impressed with the savings, Aquamar decided to take its energy-efficiency effort a few steps further.

The firm recently purchased from Gartner Refrigeration of Minnesota a 390 kW Combined

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— Benjy Nepomuceno, Southern California Gas Co.

Heat and Power (CHP) cogeneration system that will run on natural gas. Its primary component will be a Caterpillar G3412 engine designed to supply base-load electric power to the entire plant. Heat from the engine jacket and stack will be sent to a York steam absorption chiller that will use it to produce 42°F chilled water.

"Not only will they avoid using (purchased) electricity (to operate the three electric compressors), but they will generate electricity for only a third of the total cost they are paying now," Nepomuceno explains.

The Caterpillar gas engine compressor's recovered heat is used to preheat boiler feed water.

The cogeneration system will be installed later this year, according to Takahiko Iwasaki, vice president for operations at Aquamar.

"The cost of electricity is too high," Iwasaki explains, noting that cogeneration would not only reduce energy costs, but also deliver a reliable power supply. This, in turn, will reduce the risk of product spoilage due to unexpected electric power outages.

Iwasaki says Aquamar decided to turn to natural gas not only to save money, but also to diversify its sources of power.

Aquamar President Hugo Yamakawa has stated that when SoCalGas showed him the potential payback figures, switching to natural gas equipment became a "no-brainer."

SoCalGas estimates the new cogeneration system will save Aquamar another $203,000 net on its yearly electricity expenses, according to Nepomuceno.

CHP systems such as the one being purchased by Aquamar have the potential to eliminate costly electric transmission and distribution bottlenecks, reduce peak demand, and improve power reliability and quality.

More information about the Aquamar case study is available at the Energy Solutions Center:

www.energysolutionscenter.org