

FIRE & ICE

The Energy Cycle

that Powers

Thailand's Economy

Thailand's industrial success is fueled by decentralized energy generation, which in turn relies on Siemens' SGT-800 gas turbines. In addition to electronics, the frozen food industry is a key energy consumer with its insatiable need for ice.

Text: Clark Shimazu Photos: Hans Sautter



Over the past two decades, the Amata industrial zones in Thailand have served as the model for the country's industrial transformation from exporter of raw materials and food products into world-class supplier of machinery, consumer electronics and high-tech components. The rapid modernization is based on a single factor: natural gas reserves in the Gulf of Thailand. The discovery of high-quality methane under the seabed in the late 1970s led to the opening of new gas-fired power plants, a trend that continues to this day. The latest is the Amata B.Grimm facility in the Amata City Industrial Estate in Rayong, some 150 kilometers southeast of the capital Bangkok. Here, two combined cycle cogeneration power



“We don't have waste heat here.”

Cherdchai Yiwlek, Engineer, Amata B.Grimm

plants, equipped with four Siemens gas turbines, sparkle in the tropical sunlight. A first impression of the labyrinth of tubes, steel towers and steam-spewing safety valves is of vast metalwork as iconic as a Baroque-era pipe organ, even if the music is a cacophony of buzzing, rattling and clanging. At the center of this temple to progress stands Cherdchai Yiwlek, the engineer who supervised the construction of three Siemens-equipped plants for Amata B.Grimm. Standing tall, engineer Cherdchai points at a pipe that emerges from beneath the ground. “This is where the gas comes into our plant.” Just meters behind him, the water that surrounds gas shipments is drained, and then the methane branches out into feeder lines for the two combined cycle cogeneration plants, which each contain a pair of Siemens SGT-800 gas turbines with 50 megawatts output, and one SST-400 steam turbine.

Cogeneration Concept

“The exhaust heat from the gas turbine is routed into a heat recovery steam generator unit to use the thermal energy for steam production to rotate an SST-400 steam turbine, which adds another 40 megawatts of electrical power to our output. Finally, the leftover steam is sent down a fat pipe to a nearby factory.” The heat is used to melt and mold material for industrial products. “We don't have waste heat here,” Cherdchai exclaims. “For us, steam is money.”

The reuse of heat exhaust from a gas turbine, which otherwise would be lost up a chimney, is the basis for cogeneration. Using steam generated by the hot-gas turbine exhaust gases to heat buildings is becoming more prevalent across the cold climes of Europe and North America. Tropical Asia has yet to take the next leap of logic of using energy from “waste” heat to run indoor air coolers, which is technically feasible with existing technology. Cogeneration boosts fuel efficiency, the foremost priority on Cherdchai's mental list. This is because the price of gas is rising faster than electricity tariffs, putting profit margins under pressure.



Water drips from the ice blocks produced at the ice factory in Rayong, one of the businesses supplied with energy from the Amata B.Grimm facility.

“The smaller and highly efficient Siemens turbines, installed in parallel units, enable us to shut down one set during off-peak hours, reducing losses,” he explains. “The other benefit is that we can scale up power output from other units whenever the grid suffers a blackout so that our customers' factories can continue without outage.”

“Siemens turbines also have the best performance in reducing NO_x (nitrogen oxide) emissions – lower than government regulations and even less than our own, stricter targets,” he adds. “This is important for obtaining regulatory approval for new power plants, because many communities are concerned about the impact of air pollution on health.”

As is the case with most privately held small power producers, Amata B.Grimm Power usually operates inside an industrial park in need of on-site energy supply. Being close to the end user cuts long-distance transmission losses. Cherdchai adds that surplus power can be sold under contract to the national grid distributor Electricity Generating Authority of Thailand (EGAT). Most of that power remains inside the booming export-oriented economy of Rayong province, southeast of Bangkok.

Speed Depends on Teamwork

Preeyanart Soontornwata, President of the Amata B.Grimm Power Group, the leading small power producer in Thailand, is exceptional for an executive in ▶



Four SGT-800 gas turbines and two SST-400 steam turbines at the new combined cycle power plant in Rayong's Amata City Industrial Estate create power for regional economic development.



“Our major concerns are efficiency and the environment.”

Preeyanart Soontornwata,
President, Amata B.Grimm Power Group

the energy industry. Unlike most of her male counterparts, she is not an engineer or geologist but a financial expert, with an MBA in finance from top-ranked Chulalongkorn University. Rising to the top from her position as chief financial officer, her priorities are centered on fiscal soundness, detailed research and team building, which are all vital during this phase of rapid growth for the private-run small power producer sector.

“Whenever we invest in a new project, our team studies every aspect in deep

detail. Our major concerns are efficiency and the environment, which are decisive for revenues and our customers as well as for gaining regulatory approval for a new plant,” she explains. “Our choice has been the 50-megawatt version of the Siemens SGT-800 for overall quality and greatest efficiency.” Under her helm, Amata B.Grimm has 16 power plants on the registry, 6 of them already operating and 4 under construction. She has no intention of slowing down. “Over the next five years, our combined output is targeted to ▶

Shaping Thailand for over a Century

B.Grimm was founded in **1878** as **Bangkok's first pharmacy** by Bernard Grimm and his associate, Erwin Müller, and quickly took on every challenge thrown its way – from importing earthmovers to operating a telegraph system **supplied by a company called Siemens**. With the royal support of modernizing ruler Rama V, B.Grimm enjoyed fortuitous beginnings, and is today not only the longest-running German business, but also the **oldest private company in Thailand**.

After the halcyon days of old Siam, things haven't been so easy, says Harald Link, CEO of the present-day B.Grimm Group. “My grandfather Adolf Link, a pharmacist from Lübeck, came to Bangkok in 1903 to join B.Grimm.” He famously imported telephone equipment and **arranged the first call between Thailand and Germany**. The outbreak of World War I, however, saw the Link family detained in a prison camp in India. Still believing in Thailand, **Adolf Link returned in 1920 to start over** – only to be caught up in the disastrous events of World War II.

After the war the family-owned business slowly reemerged and on a visit to Thailand in 1978, a century after the founding of B.Grimm, grandson Harald discovered for himself **the magic of this tropical realm**. At the time the Thai economy was lifting off on a continuous growth curve. The company's greatest works have since included the **construction of the Bangkok SkyTrain system (BTS)**, together with Siemens, and the Metro (MRT).



“My grandfather came to Bangkok in 1903 to join B.Grimm.”

Harald Link, CEO B.Grimm Group

In the late 1990s, the company formed its **Amata B.Grimm Power Group**. “The first power plant was difficult because we built it during the worst year of the Asian financial crisis, 1998,” recalls Link. B.Grimm has since diversified into **air-conditioning and refrigeration systems**, as well as transportation, health-care and infrastructural projects. On a lesser scale, B.Grimm also entered a joint venture to assemble the ubiquitous tuk-tuks, **the three-wheeler taxis that symbolize Thailand**. Tourists and locals may not realize it, but the bustling Bangkok they know has been and remains a work in progress of B.Grimm.



The power produced from fire and steam in the cogeneration plant is used at the ice factory in Rayong to freeze water.



The large blocks of ice are crushed and transported to the port to cool seafood, preparing it for export.





Engineer Cherdchai Yiwlek supervised the construction of the plant. His prime concern: fuel efficiency.



The SGT-800 gas turbine is the centerpiece of the power plant, ensuring highest efficiency and lower emissions.

rise from 2,000 to 5,000 megawatts,” she discloses. “Some of that increase will be based in neighboring countries, a trend being pushed by the ASEAN group’s plan for a new Asian Economic Community that launches on January 1, 2015.”

Above all, Preeyanart is renowned for her financial wizardry. In 2013, Amata B.Grimm Power issued an infrastructure fund on the Bangkok stock exchange, structured much like a corporate bond, which enabled investors to invest in a specific power plant in return for dividends. The innovative fundraising method, only the second of its type after the fund for construction of the Bangkok SkyTrain system, eliminates the higher financing cost of private equity. After the first was oversubscribed by local investors, B.Grimm now has the confidence to push ahead boldly with its plant expansion drive.

Ceaseless Growth of Demand

Energy expert Praipol Koomsup watches female workers gracefully gliding gigantic blocks of ice onto a truck, as if their task were a Winter Olympics sport. These translucent monoliths are produced by humming compressors under the floorboards of a huge open factory. “Just one of these family-run ice houses consumes vast amounts of electrical power,” notes the Professor of Energy Economics at the prestigious Thammasat University. “In tropical societies like Thailand,” he says, “the difference between the modern era and the past can be summarized in one word: ice.”

Across lands that have never seen snow or frost, the cool trio of ice-making, refrigeration and air-conditioning – the rarest of luxuries just a generation ago – have since become a basic necessity for nutritious diets, a comfortable existence and sustained economic growth. The destination of these oversized cubes is Rayong Lagoon, where fishermen crush ice to preserve the freshness of their daily catch of squid, mackerel, anchovies and bream. At the teeming harbor with its hundreds of colorful wooden trawlers, gangs of workers unload and sort varieties of fish for different markets, local and foreign. Scoops of crushed ice,

glittering like diamonds, are tossed on boxes of mackerel aboard a truck headed to a gigantic frozen seafood processing plant at the Amata City Industrial Estate.

“Traditionally, small fry like anchovies were sun-dried and made into fish sauce, which is used in Thai cuisine,” Praipol explains. “The introduction of ice-making and refrigeration, however, enabled Thailand to become one of the world’s largest exporters of seafood products.” At its peak, seafood comprised about a third of the nation’s exports, earning the hard currency that funded Thailand’s industrial growth. Now surpassed by high-value automobiles and electronics, seafood still garners about 8 percent of the nation’s export income.



The catch of the day at Rayong Lagoon is immediately cooled with crushed ice from the nearby factory.



Cogeneration Optimizes Gas Resources

Since **2010**, Siemens obtained orders from Thailand for more than **40 SGT-800 gas turbines**. Around **20** of these turbines have already gone into commercial operation.

The **fuel flexibility** of the SGT-800 is outstanding: It can operate on gas from the Gulf of Thailand, the low-calorific gas from the Andaman Sea, as well as on diesel, with on-load switchover between fuels.

By combining the **SGT-800 industrial gas turbine** – available with ratings of **47.5 MW** and **50.5 MW** – with the **SST-400 steam turbine**, maximum fuel efficiency is achieved.

The **cogeneration process** recovers heat exhaust for the steam-driven turbine, and reuses steam power for industrial purposes.

In combined cycle operations the performance of the SGT-800 is **best in class** for its size. All SGT-800 units are equipped with a DLE combustion system to **minimize NO_x and CO₂ emissions**.

Higher efficiency and lower emissions are convincing national regulators in Thailand to approve ever more privately operated small power plants.

Power from under the Sea

In the faint light of dawn, Praipol stands aboard one of the trawlers bobbing on the waves. “About 70 percent of electrical power in Thailand is generated by gas-fired plants, which is a huge share compared with most countries.”

“The energy cycle begins here, in the Gulf of Thailand. An undersea pipeline carries the natural gas to the huge gas separation complex on Rayong Point, where heavier components used for plastics and the chemical industry are extracted, leaving the lighter methane as a fuel for vehicles, cooking stoves and power plants,” he states.

“The separated gas is then moved through an underground pipeline over a distance of 70 kilometers to electricity generators in Amata. The energy flow returns to the coast along high-voltage lines to power the fishing fleets and seafood industry,” Praipol explains. “A new and larger cycle then begins with the export of products to the global economy. Hard currencies come back in the other direction, driving Southeast Asia’s rapid development.”

His thoughts on energy and economics thus take a philosophical turn, in ►



Frozen seafood still accounts for 8 percent of Thailand's exports. The brightly colored fishing boats in Rayong Lagoon leave the port at night, hoping for a good catch.



“Fuel efficiency is more important than ever.”

Praipol Koomsup, Professor of Energy Economics, Thammasat University



a ballet-like pas de deux of sea and land, producer and consumer, heat and cold, yin and yang, fire and ice.

The New Asian Community

This energy cycle, uniting the regional and the global, knows no boundaries. Even before next year's official declaration of a new ASEAN Economic Community (AEC), a free trade zone of ten member states, Thailand's energy sector is already interconnected with its neighbors. Andaman Sea gas shipments and coal-fired electricity arrive from Myanmar, and Thailand is involved in joint oil-and-gas development with Malaysia. Thai power plants supply electricity to parts of Myanmar, Laos and Cambodia. The regional pact is arriving just in the nick of time for the Thai power industry. “The gas reserves of the Gulf of Thailand are not infinite so new exploration and joint production agreements need to be worked out with Cambodia, Myanmar and Vietnam,” Praipol warns. “Output here is expected to decline within 10 to 15 years from now. That makes fuel efficiency more important than ever.” “The advent of AEC will accelerate power consumption, due to rising prosperity and industrial growth, so averting energy shortages is an im-

portant priority,” Praipol asserts. “With all the world's equipment suppliers and power producers gearing up for the onset of AEC, the winners will be whoever can burn gas with greater efficiency and guarantee performance over a longer lifetime.” The race is on. ■

Thailand-based **Clark Shimazu** writes about science and environment issues for the *South China Morning Post*, *Yazhou Zhoukan* magazine and *New America Media* in San Francisco as well as several online media outlets.

Powering Thailand's Regions

Learn about the cycle of heat and ice in the Rayong region as filmmaker Dissspong Sampattavanich follows energy expert Praipol Koomsup for one day.



→ siemens.com/living-energy/fire-and-ice

→ Living Energy at

