

NRG Energy Center Phoenix: Going strong and growing

Marking its 17th anniversary, the system reports on how it has continued to thrive and expand amid constant change.

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All successful businesses understand the importance of anticipating and managing change, and NRG Energy Center Phoenix is no different. Now beginning its 17th summer season providing chilled-water service to downtown businesses and iconic buildings, the Phoenix district energy system has experienced significant change since beginning operations in 2001. Yet the system has remained focused on its customers, providing reliable and cost-competitive chilled-water service as the temperature every year soars to over 120 degrees F. The system's longstanding operating philosophy, "Excellence in Everything We Do," assures that all activities consider safety, security, reliability, environmental compliance, quality, responsiveness, efficiency and cost-effectiveness while managing constant changes in the business.

HOW IT BEGAN

In January 1999, APS Energy Services (an unregulated subsidiary of Pinnacle West Capital Corp., owner of Arizona's largest electric utility) performed an energy audit on the one-year-old Bank One Ballpark, home of the Arizona Diamondbacks Major League Baseball team. The audit results showed that while the facility was operating at peak efficiency, the majority of its 8,000 tons of installed chiller capacity remained unused. Full capacity was tapped for only about 25 games a year, and economies of scale could be realized by combining the underutilized 8,000-ton chiller plant with a new ice-storage chilled-water facility, creating the foundation for a new downtown district chilled-water system.



Photo Cygnustloop99.

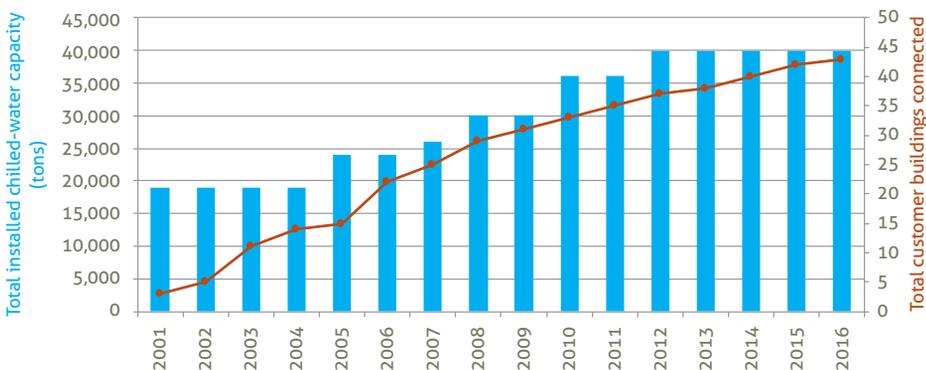
Chase Field, formerly Bank One Ballpark, site of the NRG system’s first chiller plant in Phoenix.

FIGURE 1. Arizona district energy plant growth.



Source: NRG Energy Center Phoenix.

FIGURE 2. Total installed chilled-water capacity and customer buildings connected in downtown Phoenix, 2001-2016.



Source: NRG Energy Center Phoenix.

Rich Dozer, then-president of the Arizona Diamondbacks, said at the time, “We are excited about what this project will mean to Bank One Ballpark and all of downtown Phoenix. When the ballpark was built, we projected additional economic benefits would flow to downtown as a result of the stadium’s construction. This cooling system is a prime example.”

In July 2001, Northwind Phoenix LLC, a subsidiary of APS Energy Services (now NRG Energy Center Phoenix LLC), began serving its first three district cooling customer buildings in downtown Phoenix: Chase Field, formerly Bank One Ballpark; Talking Stick Resort Arena, formerly America West Arena/US Airways Arena, home to the Phoenix Suns NBA team and then the Phoenix Coyotes NHL team; and the Maricopa County Security Building.

At that time, the system started with 19,000 tons of installed cooling capacity, including 6,000 tons of thermal ice storage, with the one plant located in Chase Field and the new ice-storage plant just south of the ballpark. (These facilities would later be named Plant 1 and Plant 3, respectively.) A total of 9,400 tons of peak cooling load (approximately 50 percent of system capacity) from the ballpark and arena was intermittent and would typically ramp up from 1,000 tons to more than 9,000 tons in less than 30 minutes. This characteristic of load swings has continued with additional customers including the Phoenix Convention Center, Comerica Theatre and Symphony Hall contributing to an additional 7,000 tons of intermittent load. This is one example of many operational changes NRG continues to manage successfully. The only constant is *change and more change*.

NAVIGATING CHANGE

Over the years, the Phoenix district energy system has experienced both internal and external changes – some that were anticipated and planned for and others that were unplanned and beyond its control. The external changes included significant and constant customer growth; customer ownership and leadership changes; economic cycles; an increased focus on sustainability and energy efficiency; and deregulation and reregulation of the electric utilities and rate structures.



Photo Gage Skidmore.

The Phoenix Convention Center, both a customer and the site of NRG chilled-water and ice-storage Plant 2 as the system continued its growth.

Within the Phoenix district energy business, the most significant change has been the constant growth of the downtown district cooling systems and the expansion of plant operations throughout Arizona. Two years after the Phoenix downtown system began operations in 2001, the Tucson Convention Center combined heat and power plant was developed, 100 miles from Phoenix. This was the catalyst to begin to leverage the company's operations and maintenance staff across multiple plants. Figure 1 shows a timeline of additional plants across Arizona that NRG now operates – at Arizona State University (ASU) Tempe and the ASU Polytechnic campus in Mesa; for the city of Tucson Police and Fire Station; and at the Phoenix Convention Center to expand the capacity of the downtown district cooling system.

During this growth of new plants throughout Arizona, the downtown Phoenix district cooling system also steadily grew and saw new customer buildings added each year. Figure 2 details the increase of installed chilled-

water capacity and the total number of customer buildings connected each year from the system's inception in 2001.

In this same period, other changes external to the business continued. They included the most recent economic downturn – Arizona was significantly impacted due to overbuilt real estate – that slowed new building development. Also, as more emphasis was placed on sustainability and efficiency, along with regulatory changes in the electric utility industry and utility rate tariffs, the Arizona district energy systems saw both opportunities and threats in managing operations in the most cost-effective and environmentally responsible manner.

Finally, many gas and electric utilities or their affiliate companies have focused or are beginning to focus on what they consider their core business, resulting in the divestiture of their "non-core" enterprises. When deregulation of the electric utility industry began in the late 1990s, many unregulated electric utility affiliates invested in additional services to bundle or complement com-

modity electricity sales and, in many cases, developed new district energy businesses. An example was the Phoenix district energy business formed during the onset of deregulation in Arizona: It was when deregulation did not take hold that the business was sold to NRG Thermal in 2010. This was an unexpected change but looking back was a boost to the business given district energy was among NRG's core businesses.

GROWING PAINS IN DOWNTOWN PHOENIX

The continued increase in the downtown Phoenix system's loads and capacity had challenged the business in many ways. With any system, the timing and location of new loads are not always when and where anticipated. This caused the downtown system to have hydraulic constraints and stranded capacity. Ice storage provided relief by operating the district cooling loop at 34 F to reduce pumping, but it resulted in reduced efficiency and higher electric demands from melting more ice than planned, thus increasing production costs. A solution was always known: Extend the pipeline to complete a loop and eliminate the long run of pipe, but the company preferred to make capital expenditures only when a new customer building was connected, to provide a return on that investment. As system capacity constraints increased, a new building (the Maricopa County Building) committed to connect to the system at the constrained portion of the distribution, providing the economic return needed to extend the pipeline and freeing up much-needed capacity and generating operational savings.

As growth continued, the Phoenix Convention Center Plant Phase One was completed in 2005 with 5,000 tons of total chilled-water capacity, including 2,000 tons of ice storage. The entire plant (later named Plant 2), now at full capacity with a total of 21,000 tons of installed chilled-water capacity including 6,000 tons of ice storage, was completed in five phases. The final and most challenging expansion was completed in 2012, installing 36,000 ton-hr of additional ice coils in the existing tank where Plant 2 is under a city street and all materials and

equipment had to be brought through the Convention Center exhibit hall. The current plant manager was the construction manager during this period, and his investment in understanding plant operations allowed him to successfully manage the ice storage expansion project, even while the plant remained in operation and the logistics issues with the Convention Center were resolved.

By then, the downtown Phoenix system itself was complex, with three interconnected plants – two with thermal ice storage tanks at different elevations, requiring the management of water flows between plants. In the first 10 years of operation during which the business was experiencing the highest growth in its history, there was greater reliance on outside parties to perform maintenance and repair duties. As business expansion slowed, more work was performed by the plant staff resulting in lower costs, timely predictive maintenance and improved quality.

ARIZONA EXPANSION

Figure 1 describes the significant business expansion that has occurred since

2001, resulting in changes such as increased staffing levels at dispersed locations, further spreading support resources across multiple facilities throughout Arizona. Economies of scale have been realized by utilizing employees across all or some of the systems. Maintenance, engineering, sales and customer service and back office staff support each location, while operations staff from different plants back up and support each other during times of need. Remote monitoring is also extensively used to operate plants as appropriate.

In 2010, when NRG acquired the Arizona business and brought positive change, it further supported the system’s operational philosophy of “Excellence in Everything We Do.” Meanwhile, the transition was seamless to customers because the same staff was providing the same reliable service to which customers had become accustomed. NRG brought an enhanced rigor to safety, security and environmental practices along with experts in these disciplines and others that support its nationwide fleet – skills that most local Arizona businesses did not have.

Given that one of NRG’s core businesses is district energy, the company had an increased interest in furthering its investment to expand the Arizona footprint.

STABILITY THROUGH CHANGE

Through the changes NRG has experienced in Arizona, the key to stability and successful growth has been a focus on the mantra “Excellence in Everything We Do.” This approach has been maintained from the time the first plant was built and went into operation in 2001, and it remains today. It’s been applied to all parts of the business, whether the design and construction of a plant, operations of a system, or the sales and customer service to grow the business.

IT IS UNDERSTOOD THE BUSINESS WILL NOT EXIST IF CUSTOMERS DO NOT HAVE 100 PERCENT CONFIDENCE IN THE RELIABILITY OF SERVICE.

While operations staff has changed over the years, the company continues hiring based on both technical and interpersonal skills while maintaining a focus on safe and reliable service. It is understood that the business will not exist if customers do not have 100 percent confidence in the reliability of service, particularly during trying weather conditions such as the frequent lightning and dust storms Arizona experiences every summer as monsoon season arrives in July. Customer service and community relations are invaluable, and with a small staff, all employees are expected to communicate with customers; and customers themselves are encouraged to visit the plant. NRG has also established a hotline number for customers, and staff are alerted when a hotline call is received or an operating threshold has been exceeded at a customer building. The flexibility of the operations staff to integrate and support operations and maintenance across plants, apply technology to provide remote operations and share resources has helped to reduce costs and provide a scalable platform for further expansion.

Suppliers are also an important part of the business and contribute to its

System snapshot: NRG Energy Center Phoenix	
	Chilled-water system
Startup year	2001
Number of buildings served	43
Total square footage served	More than 13.6 million sq ft
Total plant capacity	40,000 tons (3 plants) including 12,000 tons of ice storage
Number of chillers	17
Fuel types	Electric
Distribution network length	3.5 trench miles
Piping type	Insulated steel (welded)
Piping diameter range	18 to 30 inches
System pressure	100 psig
System temperatures	39 F supply/54 F return
System water volume	2.7 million gal (includes thermal energy storage tanks)

Source: NRG Energy Center Phoenix.

success. Many suppliers have provided products and services to the Phoenix system from the start. They are extremely knowledgeable about its systems, understand its requirements and priorities and have demonstrated their commitment over many years. NRG is committed to developing partnerships with these suppliers versus maintaining a more typical “arms-length” vendor relationship.

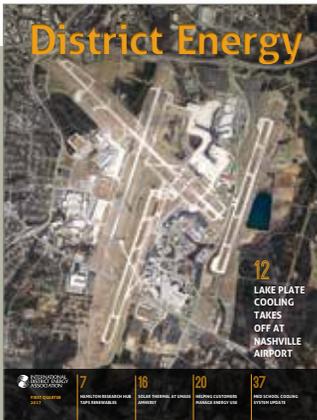
Finally, company culture has been consistent over the years with a focus on ensuring safety and reliability while providing a cost-effective service. As was mentioned earlier, when NRG acquired the Phoenix district energy system, it expanded the capabilities and expertise of all aspects of the business and operations. Although acquisitions can be an unsettling time for employees, NRG made the transition as smooth as possible for both employees and customers. What never wavered was the value placed on employees and the importance of communicating frequently and often.

FUTURE OF CONTINUED CHANGE AND GROWTH

Looking back in time and assessing the consistent growth that has occurred through both good and bad economic times, NRG sees a bright future for ongoing expansion of the Phoenix district energy system, along with other opportunities in Arizona. Projections show that more capacity will be needed soon in downtown Phoenix, and NRG has already been scouting locations for a Plant 4. NRG will continue to place an emphasis on energy efficiency and sustainability, and remote operations will continue to be a tool used to achieve economies of scale across the company’s plants. Continued access to capital to invest in the most cost-efficient equipment and technology to expand and connect future customer buildings is critical. The most valuable resource will be continuing to leverage NRG’s expertise in the district energy industry from the nationwide fleet of systems that it owns and operates. 



Jim Lodge, PE, is vice president, strategy and business development, at NRG Thermal. In this role, he oversees the company’s district energy development efforts, both the growth of existing NRG district energy systems and the development and acquisition of new systems. Prior to joining NRG Energy in 2010, as president of APS Energy Services Co., Lodge was the key principal who formed and developed Northwind Phoenix LLC in 1998, now providing district cooling service as NRG Energy Center Phoenix to over 13 million sq ft of customer buildings in downtown Phoenix. Lodge is a graduate of the University of Illinois at Urbana-Champaign with a degree in electrical engineering, and he received an MBA in finance from Arizona State University. He serves on IDEA’s Executive Committee and is a registered professional engineer.



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