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TODAY'S BOILER

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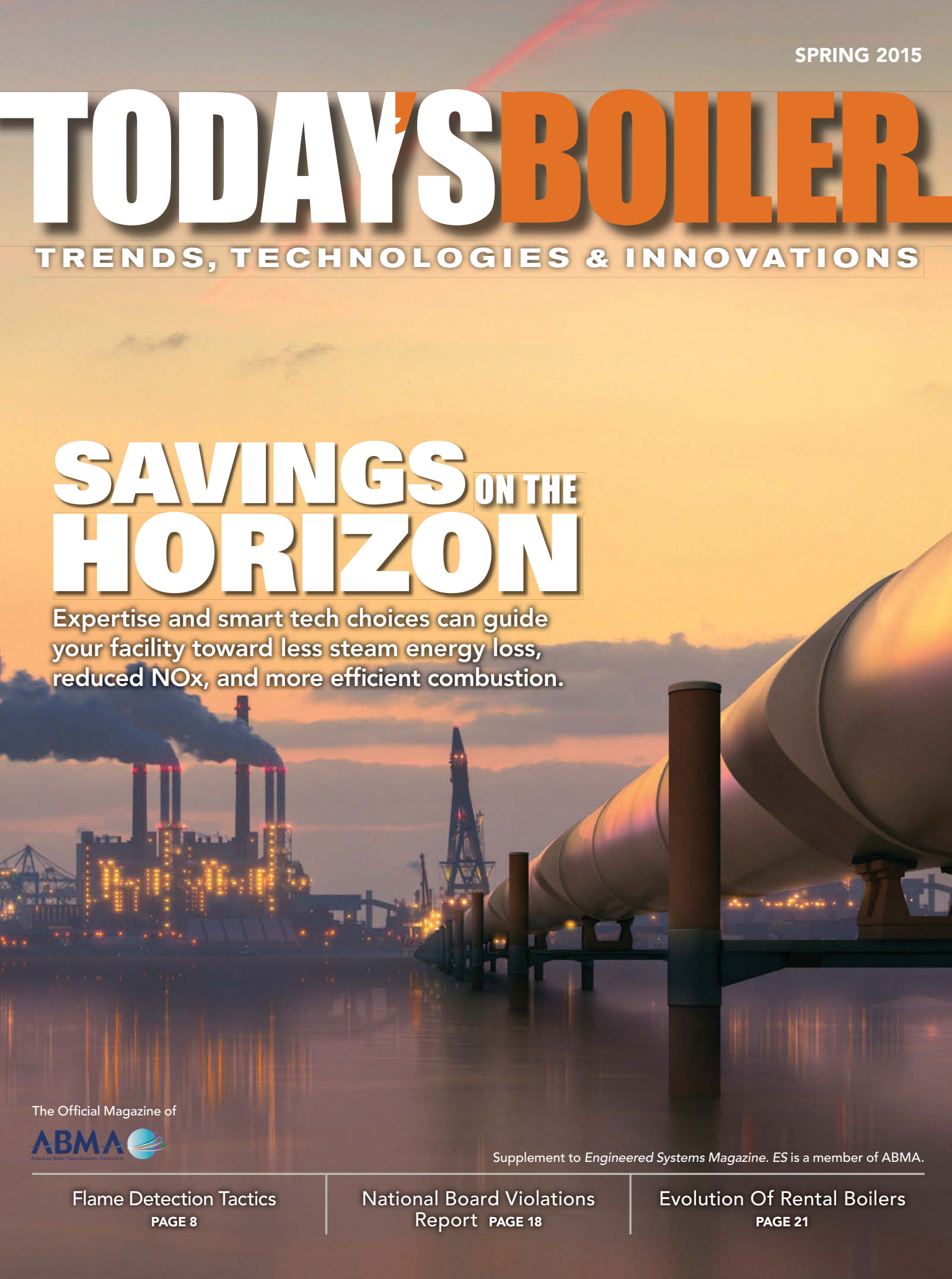

SAVINGS ON THE HORIZON

Expertise and smart tech choices can guide your facility toward less steam energy loss, reduced NOx, and more efficient combustion.

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INSIDE TODAY'S BOILER

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BY **LARRY DAY**

THE EVOLUTION OF RENTAL BOILERS

An observation by Gordon E. Moore in 1965 stated that over the history of computing hardware, the number of transistors per square inch in a dense integrated circuit doubles every two years. Moore's Law as it is better known today, has been the driving force of high tech growth, ingenuity, and production in every segment of the world's economy today. The rental boiler industry, though not nearly as quick to employ major technological advancements, has also experienced major growth in the design, operation, and performance of rental boilers. The drivers in this evolution have been rapid availability demands, larger capacity needs, stringent emission reductions, and increased efficiency requirements.

FROM TRAINS TO TRAILERS

The concept of the first mobile boiler took the form of a steam engine on wheels in England during the early 1800s. The engine was built around a locomotive-style boiler with horizontal smoke tubes and was mounted on four wheels. A leather belt was utilized for attachment to transportation equipment. It was not until almost one hundred years, after the joining of the first transcontinental railroad across the United States, that the defining moments of the rental boiler took flight. Companies in the 1960s, including Nationwide Boiler Inc. on the West Coast and several other major rental boiler suppliers, fulfilled the growing need for temporary boilers in industry. This newly birthed rental boiler industry helped avoid costly downtimes in emergency situations and supported equipment overhaul projects as well as seasonal production peaks in the food processing, refining, manufacturing, or district heating industries.

The mounting of large O-type package watertube boilers on permanent, highway legal trailers was first pioneered by Nationwide Boiler in 1967. The company had custom built two 20,000 lb/hr dual fuel fired watertube boilers designed for permanent mounting onto trailers, avoiding costly cranes and the untimely alternative of rail transportation. Soon the advantages of true mobile boilers took storm, and we saw increased capacities and efficiency upgrades.

In the early 1980s, stack economizers were included as supplied rental boiler equipment. These economizers worked as heat exchangers, recovering heat to be added to incoming fresh make-up water as the process of pre-heating. The industry had just begun to recognize the cost savings associated with decreased natural-gas fuel consumption that resulted from recovering the spent energy from a boiler. Typical economizers were improving boiler efficiency by as high as 6%.

In addition to increased efficiency demands, boiler design pressures and temperatures were also increasing. Driven by the demands of power-generating utilities and manufacturers with high-pressure, superheated steam requirements, boilers ranging from 250 to 750 psi were fabricated and included increased boiler capacities of 52,000 lb/hr, packaged and mounted on trailers. It would be the late 1990s before rental boiler providers would supply high-pressure trailer-mounted boilers reaching capabilities of 75,000 lb/hr in both 750°F superheat temperatures as well as saturated steam conditions. At this time, something revolutionary would enter the rental boiler market and a new concept was about to take form—the introduction of high-capacity mobile boiler rooms.

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BOILER ROOMS ON THE MOVE

The major focus of the rental industry was the production of mobile boiler rooms that incorporated a complete firetube boiler system available for quick transport and installation. These units ranged in size from 25 to 300 hp and included a feedwater pump and tank set, water softener, chemical treatment system, blowdown tank, and control center in a completely pre-piped and wired, ready to ship van.

Unlike trailer-mounted boilers, a mobile boiler room was completely enclosed and weather proofed with all auxiliary equipment required to operate as a complete steam plant. About 15 years ago, sizes quickly increased to high-capacity 650 hp mobile boiler rooms utilizing the advanced heat transfer technology of X-ID tubes and resulting in 85% higher capacity. Today, rental boiler suppliers are offering mobile boiler rooms as high as 900 hp, maximizing the space and weight restrictions of highway legal trailers.

By the mid-1990s, the world's largest trailer-mounted boiler was designed and introduced by Nationwide Boiler. Weighing over 123,000 lbs, this boiler met the demands of end-users with high capacity, saturated steam requirements. To date, this was the largest highway legal boiler, producing 120,000 lb/hr of saturated steam when supplied with feedwater at a temperature of 227°F. The system included an economizer for fuel efficiency, and a few years after debut, it was able to achieve 5 ppm NOx emissions with the addition of a selective catalytic reduction system (SCR).

TIGHTENING EMISSIONS

Boiler emissions, always a concern for end-users, took the national spotlight during the 1990s when the Clean Air Act amendments established national permit programs for stationary sources. Many regional air quality pollution control districts now had the authority to mandate restrictions of NOx and PM, driving the need of boiler owners and operators to minimize greenhouse gas emissions and other criteria source pollutants.

The West Coast experienced the most stringent pollution control. Nationwide Boiler Inc. identified the trend and became the only company to convert its entire watertube rental fleet to low NOx levels of 30 ppm, later offering ultra-low NOx 650 hp mobile boiler rooms to comply with NOx levels in the single digits. The rest of the rental boiler industry followed, but at a pace that was consistent with their local air quality board's mandates and requirements.

The rapidly evolving emission requirements in the West Coast quickly led to the development of the CataStak™ SCR system. Nationwide Boiler's first field demonstration project of an SCR system for ultra low NOx boiler performance was successfully performed in 1999 and has led to the development of SCR systems that reduce emissions to levels as low as 5 ppm. Today, the CataStak™ SCR system can be rented for any watertube or firetube boiler, and can also be applied beyond boilers to gas turbines, fired heaters, HRSG's, and other demanding applications. In addition, ammonia-free options have been developed that utilize common diesel exhaust fluid (DEF) as an alternative to ammonia.

The 21st century has marked an era of continued rental boiler efficiency and emissions improvements, as well as exceeding the limits of capacity designs. Today, the world's largest high-pressure 750°F superheat, trailer-mounted package watertube boiler, rated at 110,000 lb/hr, has been developed and is available. Weighing over 200,000 lbs and measuring over 97 ft long, this boiler is highway legal and includes the most advanced efficiency and safety controls (SIL 2 rated burner management system) the industry has to offer.

Evolution, congruent with Moore's Law, is apparent in both the high tech and boiler industry alike. Though not as fast-paced as the high tech advancements seen in recent decades, rental boilers have come a long way and will certainly continue to push the envelope in years to come. TB