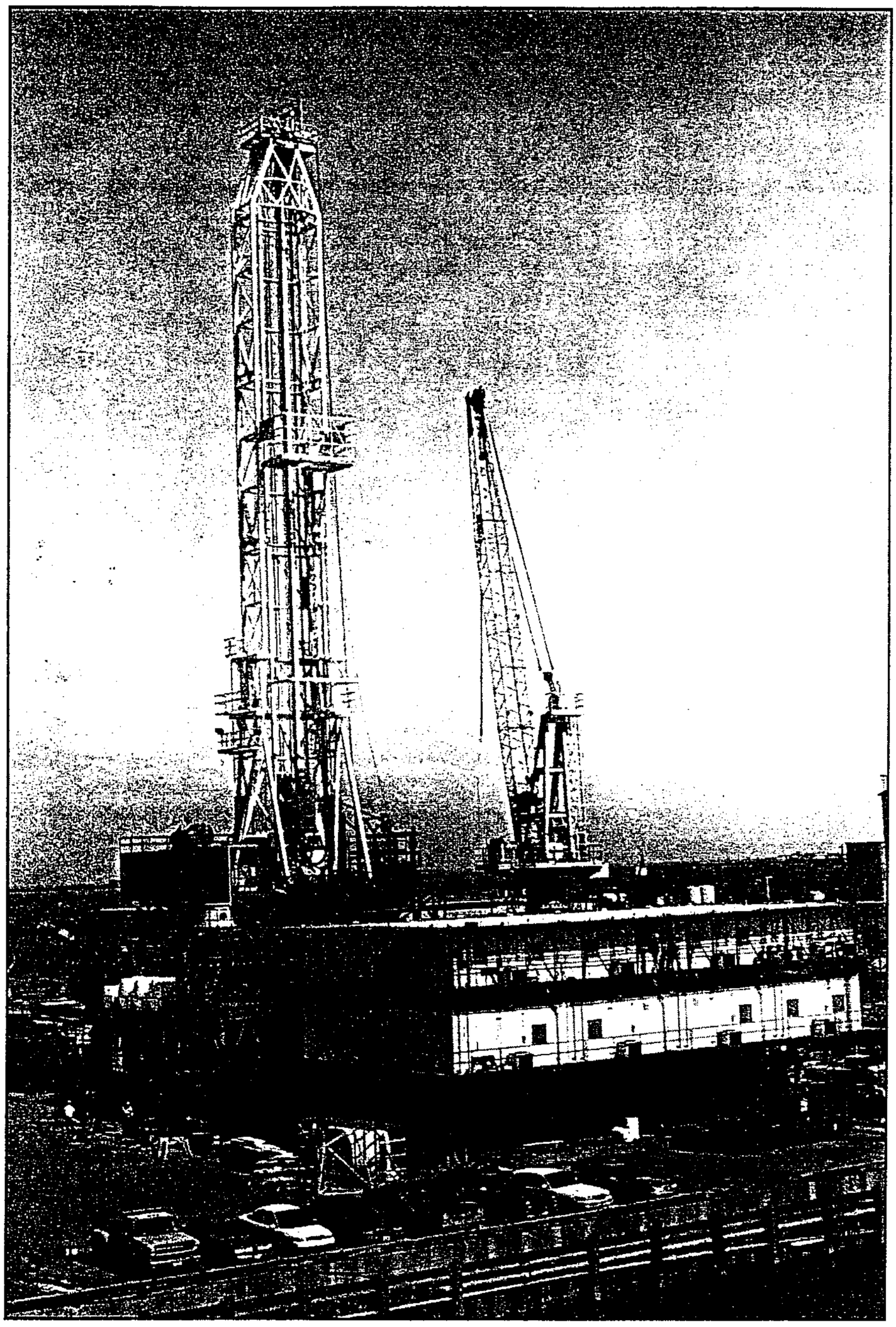

The Sundowner 801 platform drilling rig, shown during rig-up and testing in the Galveston, Texas fabrication yard prior to shipment to Trinidad to work under contract to British Gas in the Dolphin field project. Three, 12-cylinder, turbocharged EMD 645 series engines, fitted with dual-fuel components from Energy Conversions, drive Baylor generators to provide power for this rig.

DUAL-FUEL ENGINES FOR OFFSHORE DRILLING

By Bruce Wadman

SUNDOWNER Offshore Services, of Houston, Texas, is applying dual-fuel conversions of Electro-Motive diesel engines in a new offshore platform diesel-electric drive drilling rig. For this application, three rebuilt, 12-cylinder, turbocharged EMD 645 series engines were supplied by Stewart & Stevenson from the company's facility in Harvey, Louisiana.

During the rebuilding process, the engines were converted with a new dual-fuel system from Energy Conversions, of Tacoma, Washington, U.S.A. This dual-fuel system was initially applied by Energy Conversions in locomotive applications, in an ongoing application evaulation program with the Burlington Northern railroad. A dual-fuel conversion generator set also has been applied with the U.S. Navy.

This is the first application of these dual-fuel engines in an offshore electric drive drilling rig application. Paul Jensen, president of Energy Conversions, tells us that these engines develop the same power output as their straight diesel counterpart. They generally operate with between 5% and 10% diesel pilot oil, with the balance of the fuel charge being natural gas — all operating on the compression ignition combustion process.

We talked to Jim Armstrong, vice president of Sundowner, concerning the rationale for applying dual-fuel engines in offshore drilling. Armstrong told us it is a simple matter of reducing fuel costs for the drilling rig customer. In this case, the new offshore drilling rig is being contracted to British Gas for 545 days to drill a number of natural gas wells in an offshore field near the island of Trinidad in the southern Carribean.

Armstrong said that the first gas well will be drilled using diesel fuel and subsequent wells will be drilled using the gas fuel that becomes available. Armstrong estimates that using the natural-gas fuel in the dual-fuel engine configuration will save between US$3000 to US$4000 per day in fuel costs compared to diesel fuel, or well over US$1 million for the entire drilling contract period.

Since the customer commonly pays for the cost of fuel and transporting it to the drilling rig, Sundowner is offering a distinct cost reduction in using the dual-fuel engine concept.

Sundowner was recently acquired by Nabors Industries, a major drilling contractor with mostly land-based drilling rigs; and this acquisition moves Nabors aggressively into the offshore arena as well. Sundowner has specialized in innovative offshore drilling rig design aimed at reducing drilling costs to the customer, and much of their activity has been concentrated in workover rigs for offshore platforms as well as offshore drilling rigs.

Sundowner has designed a modular system where the drilling or workover rig consists of individual modules that can be lifted by a 30-ton capacity crane. Armstrong tells us that the primary advantage of this module concept is the

ability to offload and assemble the rig on an offshore platform in a single day. This is how Sundowner coined their name — by being able to assemble an offshore workover or drill rig by sundown.

The dual-fuel engine idea is also typical of this company's concern with applying engine power most efficiently and productively for its customers. The new drilling rig, identified as Rig #801, was assembled in Galveston, Texas and represents an approximate US$50 million investment. The rig was tested prior to shipment to the drilling site last October. The three EMD main engines on the rig generate 150 kW per cylinder in the dual-fuel configuration, and are capable of operating with less than 5% diesel pilot oil, Armstrong explains.

From the 5372 kW total power available from the three engines, generally 2238 to 2984 kW is used in normal drilling activities.

The engines drive Baylor generators at 900 r/min. A digital GE SCR system feeds power to the d.c. electric drilling motors.

In commenting on dual-fuel engine tests, both at the Stewart & Stevenson Louisiana facilities and in initial drilling rig tests, Armstrong noted that 1600 kW output was reached on about 8% diesel pilot oil at full output. The dual-fuel engines are a little bit slower in response than the straight diesel engines, so some control modifications were made to the Woodward governing system to allow for smooth performance in the engine electric drilling rig application environment.

Sundowner is so pleased with this dual-fuel concept offshore drilling rig that another rig, #802, is being built with dual-fuel engine generator units for an electric drive offshore platform drilling rig. In this case, three eight-cylinder turbocharged EMD 645 series engines are being rebuilt in the dual-fuel configuration by Stewart & Stevenson, again with the Energy Conversions dual-fuel components. These consist primarily of new cylinder heads to include the gas admission valves for each cylinder, solenoid actuated gas admission valves for each cylinder along with accompanying manifolding, electronic control system including air/fuel ratio control and new pistons for the 12.5:1 compression ratio.

These eight-cylinder engines will be rated 1194 kW each for a total of 3580 kW in the drilling rig. Armstrong explained that both these drilling rigs can drill to at least 7620 m depths, but will be mostly used at 3048 to 3658 m depths.

Armstrong further noted that only 6.2 bar, relatively low-pressure gas, is required to meet the gas fuel pressure needs of these dual-fuel engines. There should be little, if any, need for additional compression of fuel gas to meet engine fuel pressure specifications. Of course, the gas taken from the gas well must be appropriately scrubbed and filtered as necessary to provide clean and dry gas fuel to the engines. Armstrong also expects to receive benefits in terms of lower overall engine maintenance costs of the dual-fuel units, but only time will tell in this regard.

Today's technology is allowing the development of dual-fuel engine configuration for a variety of applications. Energy Conversions, Stewart & Stevenson, and Sundowner are taking full advantage of this opportunity to provide significant fuel cost savings compared to diesel in the offshore drilling and workover rig environment. ■

CIRCLE 90 ON READER SERVICE CARD