

THREE-PHASE ROTARY SEPARATOR TURBINE

BENEFITS

Projected savings, industry-wide:

- Energy savings of 3.8 billion kWh per year, equivalent to 38 trillion Btu per year
- Waste reductions (platform costs) of \$9.9 billion
- CO₂ emissions reduced by 2.2 million tons per year
- Lowers the need for natural gas turbines
- Reduces the need for water treatment equipment

APPLICATIONS

This rotary separator technology has wide reaching benefits for both the petroleum and chemical industries.

Both major and independent companies stand to benefit.

NEW TECHNOLOGY SEPARATES GAS, OIL, AND WATER FROM OFFSHORE OIL AND GAS OPERATIONS BY USING PREVIOUSLY WASTED PROCESS ENERGY TO GENERATE POWER

Douglas Energy Company and Multiphase Power and Processing Technologies (MPPT) are demonstrating at a land-based production field and on an offshore production platform, a three-phase rotary separator turbine (RST3). The device introduces a highly efficient and compact method for separating gas, oil, and water during production operations, while generating substantial power from previously wasted process energy.

Traditional centrifuge technology requires outside energy to fuel the motors that propel a centrifugal drum, where oil and water are separated. After separation occurs, solids remain inside the drums, which require costly periodic cleaning. Another approach uses huge vessels that rely on gravity to perform the separations. However, the separations are often incomplete and energy is wasted.

The new RST3 system effectively separates solid waste, oil, gas, and water, while harnessing expansion energy from the pressure reduction that occurs after the oil, gas, and water mixture is brought to the surface from offshore wells. This creates a clean power source that accelerates the rotating portion of the RST3 unit, where the mixture is separated more efficiently than by traditional methods. The new process often creates net energy for other offshore oil platform operations, reducing the need for electricity produced from natural gas turbine generators.

THREE-PHASE ROTARY SEPARATOR (RST3)



Flow rate = 1000 Barrels/day; 8 inch Diameter
6-30 ppm oil in water; 40-80 ppm water in oil - measured at design point

The RST3 system weighs less than one-tenth that of a typical gravity three-phase separator and it creates its own source of clean power.



Project Description

Goal: Demonstrate the RST3 technology at a Chevron on shore production field and on a Marathon offshore platform with a unit that separates 5,000 barrels of oil, gas, and water per day. Separator turbines will be manufactured for commercialization by Multiphase Power and Processing Technologies.

The new system weighs one-tenth that of conventional gravity separators, offering significant weight and space savings to offshore production operations. RST3 achieves efficient results by harnessing expansion energy from the pressure reduction that occurs after a mix of oil, gas, and water is brought to the surface from wells. The traditional throttling or choke valve can be replaced by two phase nozzles, which expand the energy released by the pressure letdown. The nozzles produce a high-velocity stream of the mixture that achieves isentropic expansion. When properly applied to the RST3 separator drum, the high velocity stream causes the drum to rotate at a high speed. The resultant centrifugal force created inside the separator offers highly efficient separation of gas, oil, and water. Once separation is complete, the gas and respective liquids are removed in separate passages. The purity of water processed by this system exceeds all known offshore discharge standards. Electricity may also be generated through this process by way of a generator that is connected to the revolving separator drum. For high gas-oil ratios, the total efficiency of the separating turbine may approach 60 percent, while the efficiency for low gas-oil ratios may be 35 to 40 percent.

Substantial energy, economic, and waste savings are projected with this system. A high pressure, offshore, 102,500 barrel per day operation was studied and the RST3 systems were projected to save 1,740 billion Btu per year, corresponding to a reduction of 147,000 tons of CO₂. Cost savings over a 10-year platform operation period are projected to be \$197 million.

Douglas Energy is demonstrating this new technology with assistance from Multiphase Power and Processing Technologies; the California Energy Commission; Chevron Production Technology; a joint industry group comprised of Chevron, Marathon, Shell, British Petroleum, and Texaco; and the NICE³ Program in the Department of Energy's Office of Industrial Technologies.

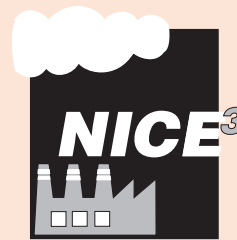
Progress and Milestones

- RST3 field unit design completed in December 2000.
- Field package design completed in January 2001.
- RST3 and field package manufacture and qualification completed in April 2001.
- Field performance tests completed in June 2001.
- Long term operation completed in December 2001.
- Final report completed in March 2002.

INDUSTRY OF THE FUTURE—PETROLEUM

Petroleum is one of nine energy- and waste-intensive industries that is participating with the U.S. Department of Energy's (DOE) Office of Industrial Technologies' Industries of the Future initiative. Using an industry-defined vision of the petroleum industry in the year 2020, the industry and DOE are using this strategy to build collaborations to develop and deploy technologies crucial to the industry's future.

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NICE³—National Industrial Competitiveness through Energy, Environment, and Economics: An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry. This grant program provides funding to state and industry partners for the first commercial demonstration of energy efficient and clean production manufacturing and industrial technologies.

PROJECT PARTNERS

California Energy Commission
Sacramento, CA

Chevron Production Technology
Lost Hills, CA

Douglas Energy
Placentia, CA

Joint Oil Industry Group composed of
Chevron, Marathon, Shell, British
Petroleum, and Texaco

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For project updates,
visit our home page at
www.oit.doe.gov/nice3

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