

## Shell's billions to convert Brazilian biomass into fuel

Oil giant Royal Dutch Shell in February announced a \$12 billion joint venture with Brazilian sugarcane-to-ethanol producer Cosan. In a deal that could lead to large-scale production of advanced biofuels, Shell will contribute its Brazilian fuel distribution network and \$1.6 billion in cash, and Cosan, headquartered in Sao Paulo, will devote about two billion liters production capacity per year, with plans to scale up.

The deal represents big oil's largest move into ethanol. But what's got technology analysts particularly excited is the potential for Shell to apply next-generation biofuel technologies to Cosan's production capabilities. Shell says it will contribute to the venture its equity interests in two advanced biofuel developers: Codexis and Iogen, in which the oil giant has 14.7% and 50% stakes, respectively. "This move is a fully integrated play for Shell," says David Berry, a partner with Flagship Venture in Cambridge, Massachusetts.

Codexis, based in Redwood City, California, is developing enzyme products to use as biocatalysts to convert biomass into fuels. The company uses systems biology and gene-shuffling techniques to direct organisms to produce enzymes, such as cellulases, with the desired catalytic activity. Ottawa, Ontario, Canada-based Iogen is developing a cellulosic biomass-to-ethanol conversion process that combines thermal, chemical and biochemical techniques. The companies' technologies enable a wider range of biomass to be converted into fuel, which can create efficiencies when applied to cheap feedstocks and large production processes like Cosan's. "The processing issue is close to being solved by companies like Codexis, so you want access to places with biomass," says Mark Bünger, a biofuels analyst at Lux Research in San Francisco. "There are not many places in the world where feedstocks are cheaper than they are in Brazil."

Shell and Cosan say the deal announced in February is a nonbinding memorandum of understanding and that they intend to negotiate a binding agreement after completing due diligence and regulatory approvals. "It's a good deal for Cosan," says Marco A.P. Lima, director of the Brazilian Bioethanol Science and Technology Center in Campinas. "And I think it is good for Brazil."

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Brazil's 30-year-old ethanol fuel program is based on cheap-to-cultivate sugarcane. The new deal for advanced biofuels is for technologies applied to cellulosic biomass.