

## **A 4 MWe biogas engine plant fueled by the gasification of olive oil production wastes (sansa)**

R. Bailey, Jr.<sup>\*a</sup>, M. Colombo<sup>b</sup>, W. N. Scott<sup>c</sup>

<sup>a</sup>PRM Energy Systems, Inc., 504 Windamere Ter., Hot Springs, AR 71913

Fax: 501-767-6968; [rbaileyj@prmenergy.com](mailto:rbaileyj@prmenergy.com)

<sup>b</sup>Guascor S.A., Spain; <sup>c</sup>Primenergy, LLC, USA

### **Forward**

PRM Energy Systems (PRMES) is the owner and developer of the KC-Reactor gasification technology, which has been employed in numerous applications around the globe since 1982. Primenergy is an engineering, procurement and construction company that has worked with PRMES since 1994 and holds a license to the technology for North America and several South American countries. Guascor is a Spanish manufacturer of diesel and gas engines for marine, industrial and environmental applications and holds a technology license from PRMES for several European countries.

In 1999, PRMES, Guascor and Primenergy entered into collaboration agreements for the development, testing and supply of a system that would incorporate the gasification, gas cleanup and engine generator technologies into the first commercial scale plant of its kind. As of the submission of this abstract, all of the project equipment has arrived on site and installation is proceeding. The plant is scheduled to start up in June 2001, after which time, actual operational data will be available for presentation.

### **The Rossano Calabro project**

Guascor acquired the rights, with ENEL, to produce and sell, at a premium price, up to four megawatts of electricity from a biomass plant to be located in Rossano Calabro (Cosenza – Italy). Guascor decided that the proposed biomass plant in Rossano would be an excellent opportunity to employ their engines with a gasification system, thus proving the commercial viability of such a system. Once the decision was made to use a gasification system and the PRMES system was chosen as the preferred technology, Guascor, PRMES and Primenergy began all initial phases of the project simultaneously.

Testing of the combined systems: During the initial stages of the project, Guascor shipped a model FBLD 180 gas engine generator set (nominal output of 275 kWe) and several 20-ton containers of the sansa fuel to Primenergy's demonstration facilities in Tulsa, Oklahoma. The genset was connected to an already existing model KC-8 gasifier, complete with a gas cleanup system. The sansa fuel arrived in Tulsa with the following average characteristics: LHV (MJ/kg) 15.42; 16.7 % H<sub>2</sub>O; 3.74 % Ash; 59.6 % Volatiles; 19.97 % Fixed Carbon.

The results of the testing were positive. The average composition of the anhydrous "sansa" biogas (% volume) was as follows: H<sub>2</sub> – 7%; O<sub>2</sub> – 1%; N<sub>2</sub> – 62%; CH<sub>4</sub> – 6%; CO – 8%; CO<sub>2</sub> – 13%; C<sub>2</sub>-C<sub>5</sub> – 3%; LHV 5.6-5.8 MJ/Nm<sup>3</sup>. During the first run, the engine started immediately on 100% biogas; after minor adjustments the load bank was engaged and the total plant operated smoothly for several hours, until shutdown.

Description of the plant: There are three independent systems connected to complete the plant: biomass feeding and gasification, biogas cleaning system, and biogas conditioning and electric generation system.

The biomass feeding and gasification system is composed of: three "sansa" storage bins with one day's capacity each, fuel conveyance systems, metering bin with a continuous weigh meter, model KC-18 gasifier with water cooled infeed and ash discharge conveyors, gasification air, and bed depth control mechanism with variable fuel retention capabilities.

The gas cleaning system (GCS) reduces the amount of tars, light oils and particulate in the gas. The GCS is composed of: a high efficiency cyclone, water/gas heat exchanger, scrubber, and two particle aerosol removal systems.

The biogas conditioning and electric generation systems are the final steps in the process. The gas conditioning system includes a gasometer for pressure regulation, a gas chiller for moisture reduction, and a blower for pressure stabilization. The electric generation system is composed of six Guascor gensets, model 560 FBLD, with nominal ratings for natural gas of 935 kW. Initial tests indicate that the derated output of the engines for the Rossano plant would be around 790 kW.

Operational expectations: The Rossano facility is scheduled to operate 7,250 hours per year. At normal operating levels, the gasifier will consume 4,500 kg per hour and generate a net output of 3,550 kWh.

### **Conclusions**

The 4 MWe (nominal output) biomass plant in Rossano Calabro is the first commercial example of “sansa” gasification, worldwide. The objective of the plant is to reach a conversion ratio of 1.05 kWh per 1 kg of biomass. This will be translated into a global electric efficiency of 24%. The facility will export nearly 26 million kWh to the grid and replace 7,500 TEP of fossil fuel energy per year.