RICARDO G. CARLSTEIN
dickcarlstein@fibertel.com.ar

DECENTRALIZED PRODUCTION OF BIODIESEL

Since making biodiesel is a rather simple process, hundreds of craftsmen and tinkerers have undertaken its production; however, results have not always been positive, and over the years small scale biodiesel production has gained the reputation of unreliability, insofar as quality is concerned.

In the year 2000, a low-cost reactor appeared in the market, using a new protocol, based on higher reaction temperatures, and the use of pressure to eliminate alcohol boil-off.

This new protocol – known as **"HTP" (High Temperature Pressurized)** - delivers conversion levels equal or superior to the larger commercial units, while simultaneously eliminating the need to wash the biodiesel, and its concurrent effluent generation.

HTP units are presently being manufactured in UK, Canada, Costa Rica, Brazil, Uruguay, and Argentina; by local companies, under license; their market share increases as more local licensees undertake their manufacture.

The analysis that follows compares the economic, financial, and social advantages of centralized large scale, effluent generating commercial plants, vs. decentralized small scale, effluent-less **HTP** plants.

The **HTP** plant taken as an example is a **BIO400-MkV / BIOADD400-MKII** unit manufactured in Costa Rica, with a production capacity of 1,600 liters/24 hours, equivalent to 445 tons/year (500,000 liters/year). The cost ex-works of this unit is **Euros 8,970.00**, including residual alcohol removal, and centrifuge clarifier/one micron polishing/filtering ancillary units. .

The centralized large scale, effluent generating commercial plant taken as an example is an **ENERGEA** with **CTER (Continuous Transesterification Reactor)** protocol, manufactured in Austria, with a production capacity of 20,000 tons/year (22,470,000 liters/year). The cost ex-works of this unit is **Euros 4,850,000.00.**

The information used in this analysis is the one provided by the manufacturers of these plants.

A. ANNUAL INSTALLED CAPACITY COST

1) **ENERGEA /CTER**: € 4,850,000.00 ÷ 20,000 = **€ 242.50 PER TON CAPACITY/YEAR.**

2) **BIO/HTP**: € 8,970.00 ÷ 445 = **€ 20.16 PER TON CAPACITY/YEAR.**

For the same investment, the **BIO/HIP** type plant offers 12 times the production capacity of the **ENERGEA/CTER** type plant.

If the cost of one **ENERGEA/CTER** plant **(€ 4,850,000.00)** were invested in **BIO/HTP** units, the resulting production capacity would be **240,000 tons/year**, instead of **20,000 tons/year**.

For a 20.000 tons/yr capacity, the investment required in **BIO/HTP** plants would be **Euros 403.000,00** vs. **Euros 4.850.000.00** for an **ENERGEA/CTR** plant.

B. BIODIESEL QUALITY

Both the **BIO/HTP** type plants, and **ENERGEA/CTER** type plants deliver biodiesel compliant with **EN1424 / ASTM-D-6751-3** standards.

It should be noted that out of the 26 parameters contemplated on the **EN14214** norm, by far the most strict of existing biodiesel standards, only 5 (five) are a function of the transesterification process itself, the rest being a function of the feed-stock, and post-process.

C. ENERGY INPUT

1) **ENERGEA/CTER**: 90 - 120 watts/liter of finished biodiesel.

2) **BIO/HTP**: 50 - 80 watts/liter of finished biodiesel.

D. FEEDSTOCK REQUIREMENTS

1) **ENERGEA/CTER**: Vegetable oil, methanol, potassium hydroxide, sulfuric acid, nitrogen, saturated steam, de-mineralized water, compressed air 10 Nm^3/hour, cooling water.

2) **BIO400/HTP**: Vegetable oil, methanol, sodium hydroxide, compressed Air 0.1 Nm^3/hour.

E. EFFLUENTS

1) **ENERGEA/CTER**: 411 kilos of effluents every 1.000 kilos of finished biodiesel.

2) **BIO400/HTP**: Zero effluents.

F. LABOR INPUT FOR 20,000 TONS/YEAR PRODUCTION

1) **ENERGEA/CTER**: 15 people, equivalent to 54 Minimum Wages.

2) **BIO/HTP**: 45 people, equivalent to 45 Minimum Wages.

G. PAY-OUT PERIOD: 20.000 TONS/YEAR @ € 80.00/TON NET PROFIT

1) **ENERGEA/CTER**: 29.1 months.

2) **BIO/HTP**: 2.5 months.

H. I.R.R.: 20.000 TONS/YEAR @ € 80.00/TON/YEAR NET PROFIT

1) **ENERGEA/CTER**: 33%

2) **BIO400/HTP**: 397%

I. LOGISTICS

1) ENERGEA/CTER: The logistics of a centralized **ENERGEA/CTER** type plant are similar to the logistics of the vegetable oil industry, in which feedstock originating in numerous farms is transported to the main process facility. Sub-products from oil extraction are in turn re-distributed to the animal feed market, while the oil is processed, packaged, and distributed to the consumer market. The energy used in transportation of the oilseed, sub-products, and primary product is substantial.

2) **BIO/HTP**: The logistics for the decentralized **BIO/HTP** type plants are similar to that of the dairy industry; multiple production units combine oilseed production, crushing, and making biodiesel, making use of by-products on-site, and selling the biodiesel directly to users, wholesalers, or blenders.

J. LOCAL ECONOMY REPERCUSSION

1) **ENERGEA/CTER**: The **ENERGEA/CTER** type units are manufactured in Austria, and its purchase involves obtaining foreign currency, and a dependency in after sales service, and in maintenance. Its purchase involves capital transfer from the purchasing country; money invested in **ENERGEA/CTER** type units is transferred to another country's economy and is not re-cycled within the community that generates it.

2) **BIO/HTP**: The **BIO/HTP** type units are designed to be manufactured locally, saving foreign currency, creating direct and indirect manufacturing jobs, while generating technological independence, both external and internal. Their manufacture allows for assignment of resources in a rational fashion, with chronograms adapted to the available capital available, without the need of contracting further debt. Money invested in **BIO/HTP** units returns to the community that generates it.

"...When the PROALCOHOL program was initiated (in Brazil), it was said that it would be a bonanza for the North East region, where sugar cane was traditionally cultivated. It was also said it would have a great social impact, creating a million jobs in small decentralized alcohol distilleries. What in fact happened was that PROALCOHOL only benefited the manufacturers of large alcohol plants, and corporate growers of sugar cane, and alcohol distillers. This generated greater social exclusion, with an increase in the number of itinerant workers, while at the same time arable land previously used for growing food was converted to sugar cane production. It is fundamental, therefore, that we take this into account, and avoid repeating the same mistake by supporting biodiesel programs that only stimulate the concentration of wealth, with the inevitable increases in social exclusion...." Federal Deputy Ariosto HOLANDO (PSDB-CE)-"BIODIESEL E INCLUSÂO SOCIAL"-BRASILIA, 2004.
