Global Biodiesel Focus 2015

Waste oils as resource of biodiesel

Roberto Vazquez
CEO, ASB Biodiesel
2nd generation biodiesel
ASB Case Model in Hong Kong
## Case Model: ASB Biodiesel (Hong Kong) Ltd

<table>
<thead>
<tr>
<th>Lead investor</th>
<th>Al Salam Bank Bahrain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Locations:</strong></td>
<td>Hong Kong, Malaysia, Singapore</td>
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<tr>
<td><strong>Production capacity:</strong></td>
<td>100,000 tons / year</td>
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<tr>
<td><strong>Technology:</strong></td>
<td>Integrated GTW, WWTP and biodiesel plant: pretreatment, high FFA esterification, distillation, biogas</td>
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<tr>
<td><strong>Feedstock:</strong></td>
<td>Waste cooking oil, gutter oil (grease trap oil), waste animal fat, other waste oils.</td>
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<td><strong>Fuel Quality:</strong></td>
<td>EN14214/ASTM 6751/China B100 standard</td>
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Biodiesel plant
2nd generation biodiesel
Feedstock
Used Cooking Oil

Potential
- 5kg/person/year

Challenges
- Illegal food recycling
- Animal feed applications
- Low entry barrier for collectors. Existing network
- Reasonably low technology requirements

Outlook
- Limited growth opportunities mature market
Grease Trap Waste

Potential
- 2kg/person/year

Challenges
- Hazardous, Basel Convention
- High acidity, high polymerization, high sulphur content.
- Low yield for illegal operation.
- Vehicle, government control: higher entry barrier for service providers
- High technology, waste water treatment and government control: high entry barrier for biodiesel producers

Outlook
- High potential limited by deployment of grease traps and local treatment

Animal fats

Potential
• Non food-feed quality: 1kg/person/year

Challenges
• Categorization
• Distributed generation of bone and meat residue
• Sulphur, polyethylene, protein

Outlook
• Limited potential at competitive price, except in very low quality streams

<table>
<thead>
<tr>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
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<tr>
<td>Energy production</td>
<td>Organic fertilizer</td>
<td>Animal feed</td>
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<tr>
<td>Incineration-Landfill</td>
<td>Biogas</td>
<td>Pet food</td>
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Animal fats: case study Spain (47M Hab)

Animal fat category 3: 385,000 tpy

Animal fat category ½: 52,500 tpy (12%)

<table>
<thead>
<tr>
<th>Raw Material (1/2)</th>
<th>Ton</th>
</tr>
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<tbody>
<tr>
<td>Carcass</td>
<td>385,000</td>
</tr>
<tr>
<td>SRM</td>
<td>83,800</td>
</tr>
<tr>
<td>Total</td>
<td>468,000</td>
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</table>

<table>
<thead>
<tr>
<th>Products</th>
<th>Ton</th>
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<tbody>
<tr>
<td>Protein</td>
<td>107,000</td>
</tr>
<tr>
<td>Animal fat (cat 1/2)</td>
<td>52,500 (11%)</td>
</tr>
<tr>
<td>Total</td>
<td>158,500</td>
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**Sludges**

Potential

- Mill effluent: 50-100 tons/month of recoverable oil

Challenges

- Existing collector network, some with shore tank (bulk delivery), but generally distributed
- High PFAD price has driven other high FFA material cost up
- High technology requirements: FFA, sulphur and oxidized/polymerized

Outlook

- High potential, if supply chain is rationalized
Sources in Hong Kong

Potential
- 3,600 TPD food waste in Hong Kong

Challenges
- Technology development
- Efficient segregated sourcing
- Variable lipid content
- Valorization of protein and carbohydrate

Outlook
- High potential, with sufficient scale

Source: Lipids from food waste as feedstock for biodiesel production: Case Hong Kong
Sanjib Kumar Karmee and Carol Sze Ki Lin, lipid technology September 2014, Vol. 26, No. 9
2nd generation biodiesel
Supply Chain
Supply chain

**High Acidity**
- Meat and bone residue
  - Rendering plant
  - Container
  - Shore tank (bulk)
  - Container

- Pond (PO mill)
  - Truck collection
  - Collector
  - Local process (GTO)
  - Container

- Grease trap (restaurant)
  - Collector
  - Local process (GTO)

**Low Acidity**
- UCO Restaurant
  - Collector
  - Depot
  - Container

- UCO Restaurant
  - Collector
  - Depot
  - Container

- Meat and bone residue
  - Rendering plant
  - Container

Biodiesel plant
2nd generation biodiesel
Process Design
Production Process Overview (1) – Input and Outputs

- GTW
- Waste Animal Fat
- Other Waste Oils
- UCO

- Grease Trap Waste Treatment
- UCO/Fat Treatment Unit

- Acids
- KOH
- Methanol

- Biodiesel refinery

- Biodiesel
- Glycerine
- Bioheating Oil
- Fertilizer
Production Process Overview (2) – Input and Outputs

Water and Solids Pre-treatment

Non-catalytic Esterification

Acid-Based Esterification

Trans-esterification

Methanol

Acids

KOH

Biodiesel

Bioheating Oil

Fertilizer

Glycerine

Biodiesel Distillation

Biodiesel Purification

Glycerine Purification
Production Process Overview (3) - Re-use of By-products for energy

Waste Oil → Grease Trap Waste Treatment → UCO/Fat Treatment Unit → Biodiesel refinery

Waste Water → Waste Water Treatment Plant

Oil → Bioheating Oil → Biodiesel

Biogas

Energy for biodiesel manufacturing process
Environmental and social impacts of 2nd generation biodiesel
**Food safety**

At best, poured down the **drains** or dumped in the trash for **already-packed landfills**.

At worst reprocessed, and are channeled **back into the food supply**.

- **December 2012**: a dozen Hong Kong **restaurants** were found to be using cooking oil made from “gutter oil” containing carcinogen **benzo(a)pyrene**.

- **September 2014**: Another gutter oil scandal: **non edible lard** from Hong Kong into **bakery** that was subsequently distributed in Taiwan and Hong Kong.

Reprocessed cooking oil can increase changes of heart disease and diabetes, has implications for Alzheimer Disease and can have adverse impacts on children development.
Biodiesel from waste has low GHG compared to biodiesel from crop oils due to reduced emissions from cultivation, processing.

Source: EU Renewable Energy Directive Annex V
ASB has a sophisticated sustainability management system:

- Keeps trace of the kind of waste and the country of origin
- Allows actual calculations of carbon footprint based on real feedstock/transport/conversion inputs
- Strict mass balance
- Externally audited
- Recognized in Europe (Renewable Energy Directive) by all oil companies
Biodiesel from Waste - Towards a Circular Economy

Recovered

Converted to high value product

Reduced emissions
(roadside and GHG)

Re-used as Biodiesel
2nd generation biodiesel
Economic Development
**Biodiesel and economic development**

Since the 2010-2011 policy address of former Chief Executive Donald Tsang Yam-kuen, New Energy Technology has been a target for development.

Key infrastructure in HK:

- Sludge Incinerator
- Organic waste treatment facilities
- MSW waste to energy

The biodiesel plants in Hong Kong:

- Are integrated in the community, with important value remaining in HKSAR through payments to restaurants and collectors
- Technology platform for future environmental developments
Hong Kong is particularly subject to fluctuations in the international energy prices: ranks 99th out of 129 jurisdictions measured by the World Energy Council:

ASB Biodiesel alone can supply every diesel vehicle on Hong Kong's roads with enough biodiesel to replace 10 percent of the fossil diesel used in every diesel vehicle on the roads.
Waste based biodiesel

Conclusions
Profitability

Lot Size MT

Technology

FW
GTO
PSO
NE AG
AO/PFAD
AF
UCO
PO