Coconut Methyl Ester (CME) combustion booster, emission buster,

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**Concerns with Diesel**

**Diesel Fuel**: contains high molecular weight carbon.

<table>
<thead>
<tr>
<th>No. of Carbon:</th>
<th>C4</th>
<th>C5</th>
<th>C6</th>
<th>C8</th>
<th>C10</th>
<th>C12</th>
<th>C14</th>
<th>C16</th>
<th>C18</th>
<th>C20</th>
<th>C22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiling Pt, °C</td>
<td>0.5</td>
<td>69</td>
<td>98</td>
<td>151</td>
<td>196</td>
<td>235</td>
<td>287</td>
<td>316</td>
<td>332</td>
<td>380</td>
<td>393</td>
</tr>
</tbody>
</table>

Diesel Oil (ADO, IDO)

Root of incomplete combustion & emissions

**Diesel Engine**: prone to carbon depositions.

- In Chamber
- Intake Valve
- Clogged Injector
- Abnormal spray

Root of incomplete combustion & emissions
**CME Cures Root of Diesel Emissions**

<table>
<thead>
<tr>
<th>Boiling Pt. °C</th>
<th>Medium Chain Saturated</th>
<th>Long Chain Saturated</th>
<th>Mono &amp; Poly Unsaturated</th>
</tr>
</thead>
<tbody>
<tr>
<td>151</td>
<td></td>
<td>253</td>
<td>332</td>
</tr>
<tr>
<td></td>
<td></td>
<td>287</td>
<td>346</td>
</tr>
<tr>
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<td>393</td>
</tr>
</tbody>
</table>

- Powerful Solvency of medium carbon chain...
  - Dissolves asphaltenes.
  - Dilutes viscous long chain carbon.
  - Decarbonizes combustion chamber & valves.
  - Declogs fuel injectors.
Philippine Experience with CME

Neat diesel without intervention. Carbon soot emission show ave opacity = 3.44

2% CME intervention. B2 mandated Jan. 2009. Ave. opacity = 0.79 k % PM reduction = 77%

5% CME Intervention B5 Mandate programmed Ave. opacity = 0.57 k % PM Reduction = 83% plus mitigating NOx
Philippine Experience with CME

CME Eliminated Smoke Belching

CME is a Quick Response to the Quest for Clean Air and Wellness of Public Health
Philippine Experience with CME

CME Complements the EU Strategy
Use of “Emission Control Devices” (i.e. DOC, DPF, and SCR) in exhaust system to eliminate emissions of CO, HC, PM & NOx. This is a “Post-Combustion Solution”

CME Strategy (a Phil. Strategy)
Serves as “Emission Control Biofuel”
It harnesses the solvency power of CME that neutralizes the root cause of emissions. This is a “Pre-Combustion Solution”
Philippine Experience with CME

CME National Benefit

**COCONUT PRODUCTION**
- Plantation/investments

**ENGINE EFFICIENCY**
- Cleans, declogs

**FUEL EFFICIENCY**
- Cetane/oxygen

**NEW MARKET**
- New Money for Coco Industry

**Export Market/Revenue**
- Boosts Agri-economy

**Absorbs CO2 from Atmosphere**

**New Biofuel**
- Efficient Combustion

**Clean Emissions**
- Reduces NOx
- Cleanses Air Pollution

**Power & Mileage Efficiency**
- Promotes Fuel economy

**Clean Air/Wellness of Public Health**
- Savings: Import Volume/Forex

**Emissions**
- Restores Health of Coco Industry

**Restores Health of Coco Industry**

**Mitigates Climate Change**

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**Energy Security**
- Alleviates Poverty

**Clean Air/Wellness of Public Health**
- Eliminates 3.55 kg Life-cycle CO2 per liter of Diesel displaced

**Savings: Import Volume/Forex**

**Chart by: RS Diaz: Asian Institute of Petroleum Studies, Inc.**
Opportunity with CME

CME blend enhances Biodiesel quality dominated by MUFA and PUFA linked to be the cause of increase in NOx emissions.

A USNREL study in 2005 linked the level of unsaturation of biodiesel as cause of NOx increase.

<table>
<thead>
<tr>
<th>Biodiesel (SME, RME, JME, Etc)</th>
<th>NOx Emission of Biodiesels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Chain saturated</td>
<td>Unsaturated</td>
</tr>
<tr>
<td>Boiling Pt. °C</td>
<td>151</td>
</tr>
<tr>
<td>Long Chain sat.</td>
<td>253</td>
</tr>
<tr>
<td>Mono &amp; Poly Unsaturated</td>
<td>287</td>
</tr>
<tr>
<td>Greater than 80% Unsaturation</td>
<td>332</td>
</tr>
<tr>
<td>Iodine No.: &gt; 100</td>
<td>346</td>
</tr>
<tr>
<td>CME</td>
<td>380</td>
</tr>
<tr>
<td>Iodine No. 10</td>
<td>393</td>
</tr>
</tbody>
</table>

LCFA

CME (C8, C14, C16)
Opportunity with CME

CME Neutralizes NOx Increase from Biodiesel

All Biodiesels Eliminate Air Pollution but not likely in others due to NOx elevation.

Diesel Emissions
1. PM + CO + HC
2. NOx + HC + PM
3. NOx + SOx
4. NOx + CO2

Effect to Environment
Air Pollution
Smog
Acid Rain
Climate Change

Effect of Biodiesel Composition for Blends

USNREL Statement: “Suggests blending of high and low iodine No. fuels may be a strategy to eliminate NOx increase - older engines” (older engines mean without emission control devices like most engines in Ph.)
NOx Reduction Strategy
Suggested in 2005 USNREL Study

Blend of High I.N. with Low I.N. plus Saturated Biodiesel

CME: I.N = 10
Biodiesel: I.N.=>100

CME: = 91% saturated

Additional features of CME are high cetane (70), Oxygenated (14%); low volatility range; high lubricity (< 300 microns); non-polar carbon.

Thank You

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