



**USAID**  
FROM THE AMERICAN PEOPLE

*Stakeholder Workshop*

# **Environmental Vulnerability in Haiti**

**Woodrow Wilson International Center for Scholars  
Washington D.C.**

## **Can Energy Crops Grown on Slopes Replace Erosion Intensive Food Crops?**

*Marc A. Portnoff*

**Carnegie Mellon Center for Advanced Fuel Technology**

**August 2, 2006**

# Talk Outline

- **Purpose and Strategy**
- **Selection of an Energy Crop**
  - **Market Conditions**
  - **Ethanol vs. Biodiesel**
  - **Biodiesel vs. Pure Plant Oil**
  - **Energy Crop Plant Selection**
- **Market Example – Jatropha Oil Fuel**
- **Policy Options**
- **Recommendations**

# Purpose

- **To assess the potential of biofuel crops to promote increased planting of perennials on slopes in place of erosion intensive food crops.**



Montrouis, Haiti

Fondation Haitienne de l' Environnement

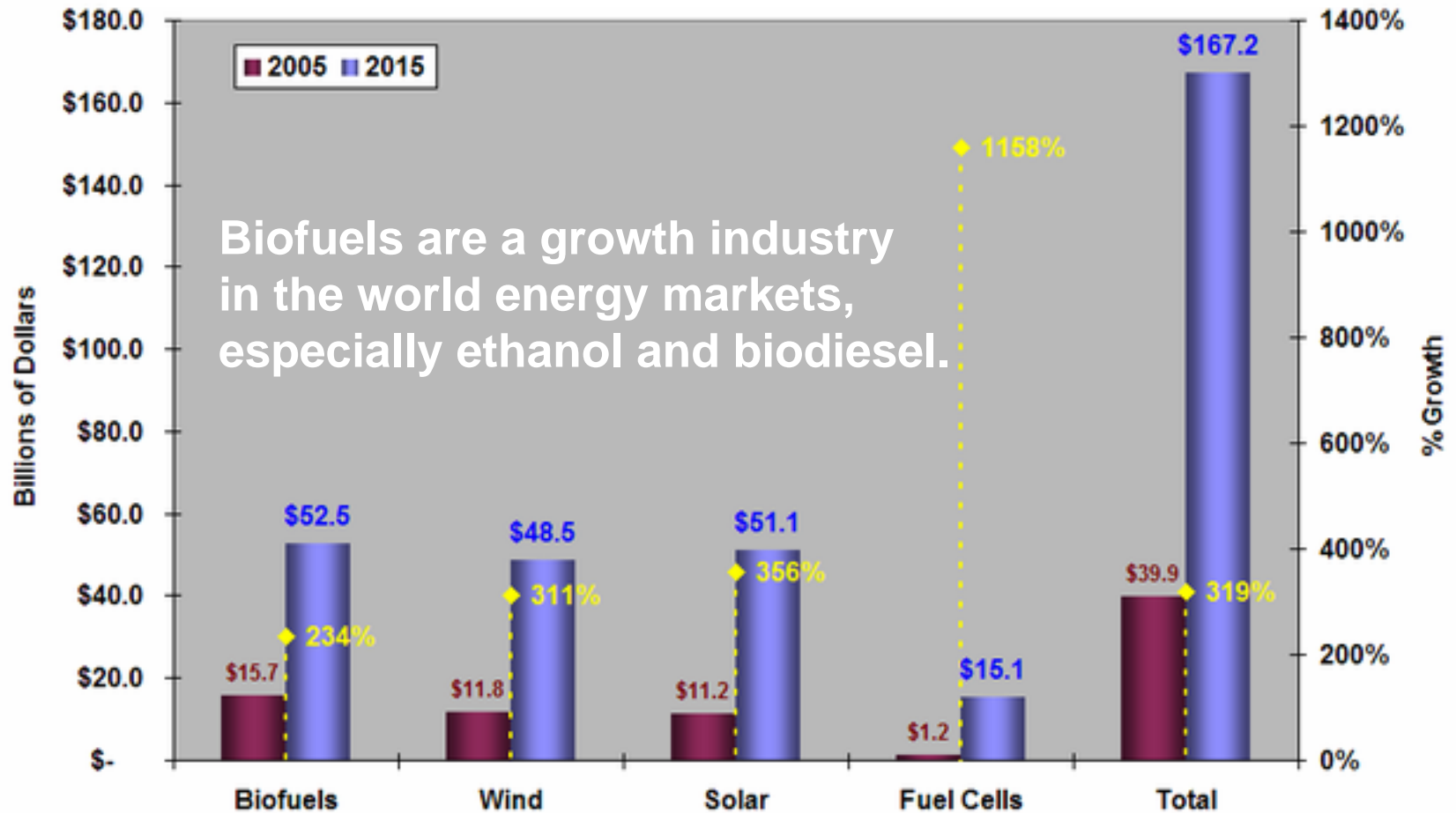
# Strategy

## Select plants:

- **with value as a fuel substitute that can provide a fair return to the local farmer and community.**
- **can be grown in selected Haitian agro-systems:**
  - **limited rainfall,**
  - **marginal lands and slopes,**
  - **minimal agricultural input.**
- **that when properly planted, are able to reduce soil erosion.**

# Selection of Energy Crop - Market Conditions

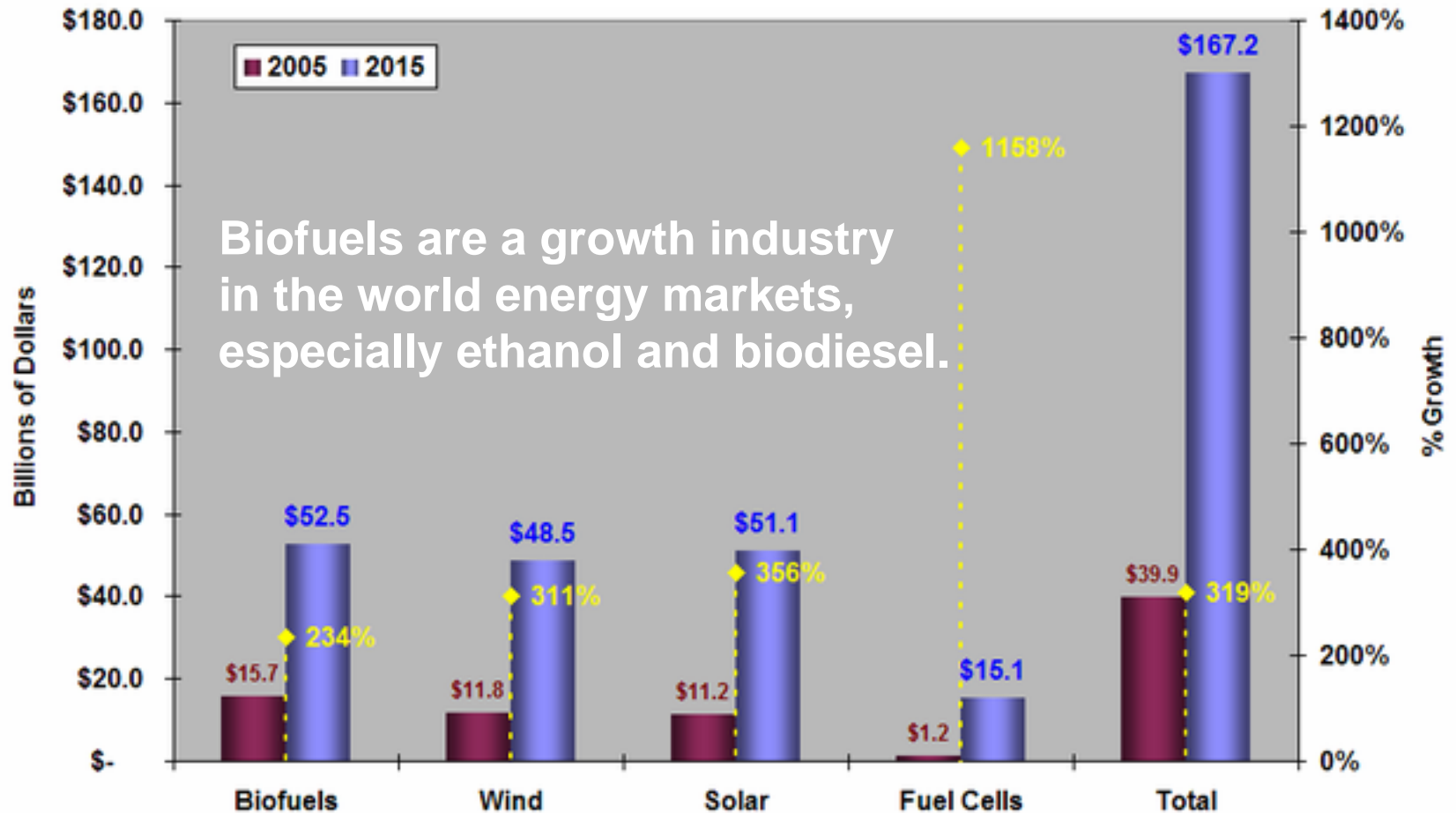
## Global Clean Energy – Projected Growth 2005 to 2015



Source: Clean Energy Trends 2006

## Selection of Energy Crop - Market Conditions

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**Public policy and tax support have fueled the world demand for home grown biofuels.**

## Why do governments support biofuels with tax incentives?

### Biofuel Benefits:

- **Home Grown – promotes energy independence**
- **Promotes rural economic and agricultural development**
- **Renewable energy source (sustainable)**
- **Reduces greenhouse gas emissions**
- **Reduces public health risks associated with air pollution**
- **Can be used with the existing petroleum infrastructure**

**Selection of Biodiesel over Ethanol  
in the context of this assessment**

- **Market Consideration: Haiti uses twice as much diesel as gasoline and diesel is used for both electricity production and transportation.**

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- **Bigger infrastructure barriers:** Economy of scale requirements for Fuel ethanol feed and facility are 3 to 10 times larger than for biodiesel.
- **Current Price Support Structure:** Food sugar provides better returns than sugar used to produce ethanol.
- **Haitian Stakeholders:** Concerns were raised by about growing food crops for fuel.

# Selection of an Energy Crop – Biodiesel vs. Pure Plant Oil

## Vegetable or Plant Seeds

i.e. Peanut, Coconut, Palm, Castor, Jatropha

### Jatropha



### Palm



### Seeds



# Selection of an Energy Crop – Biodiesel vs. Pure Plant Oil

**Vegetable or Plant Seeds**  
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**Oil Extraction & Refining Process**



**Manual**

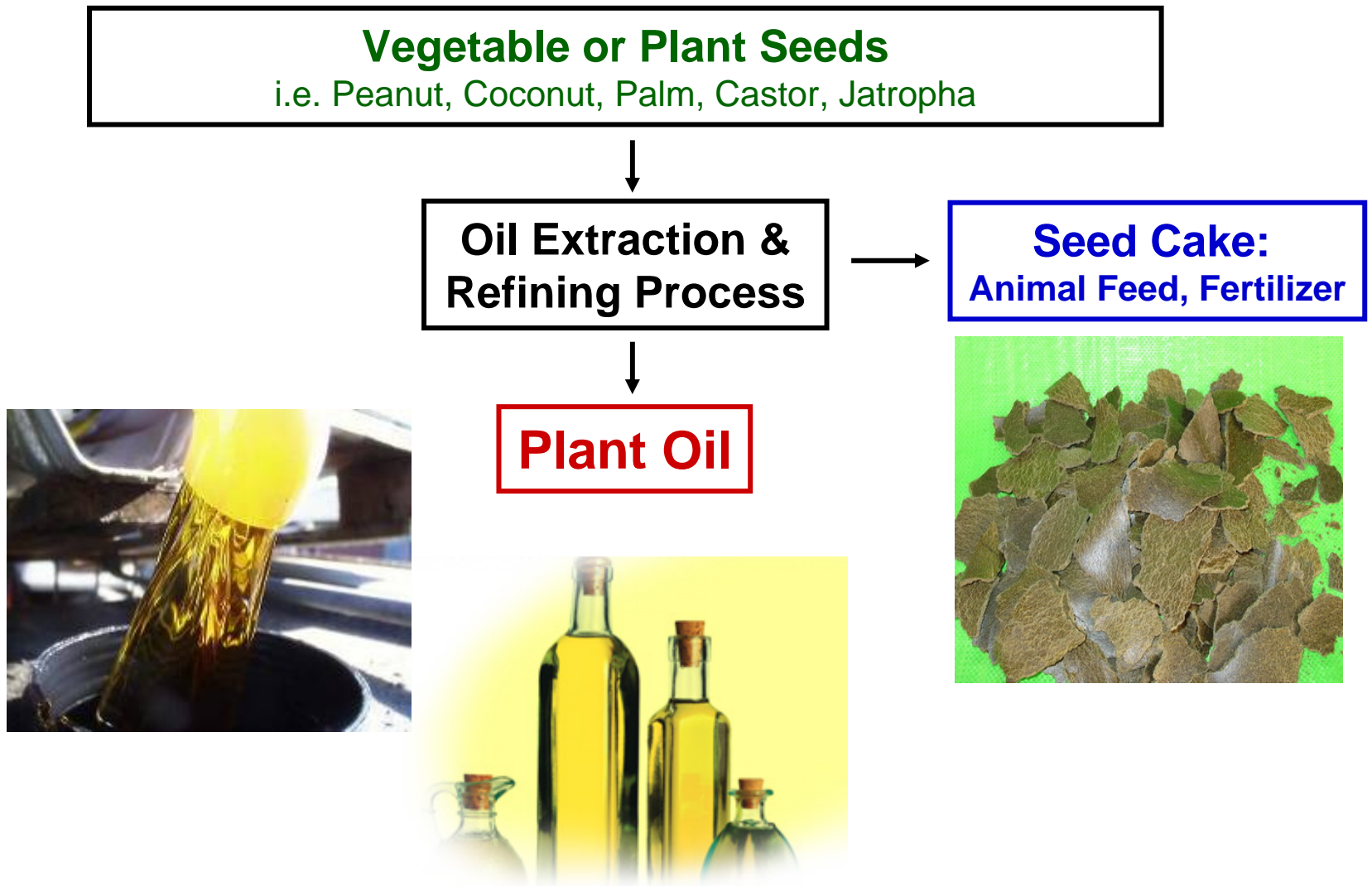


**Small Industrial**  
Motor Driven - 100 kg/hr

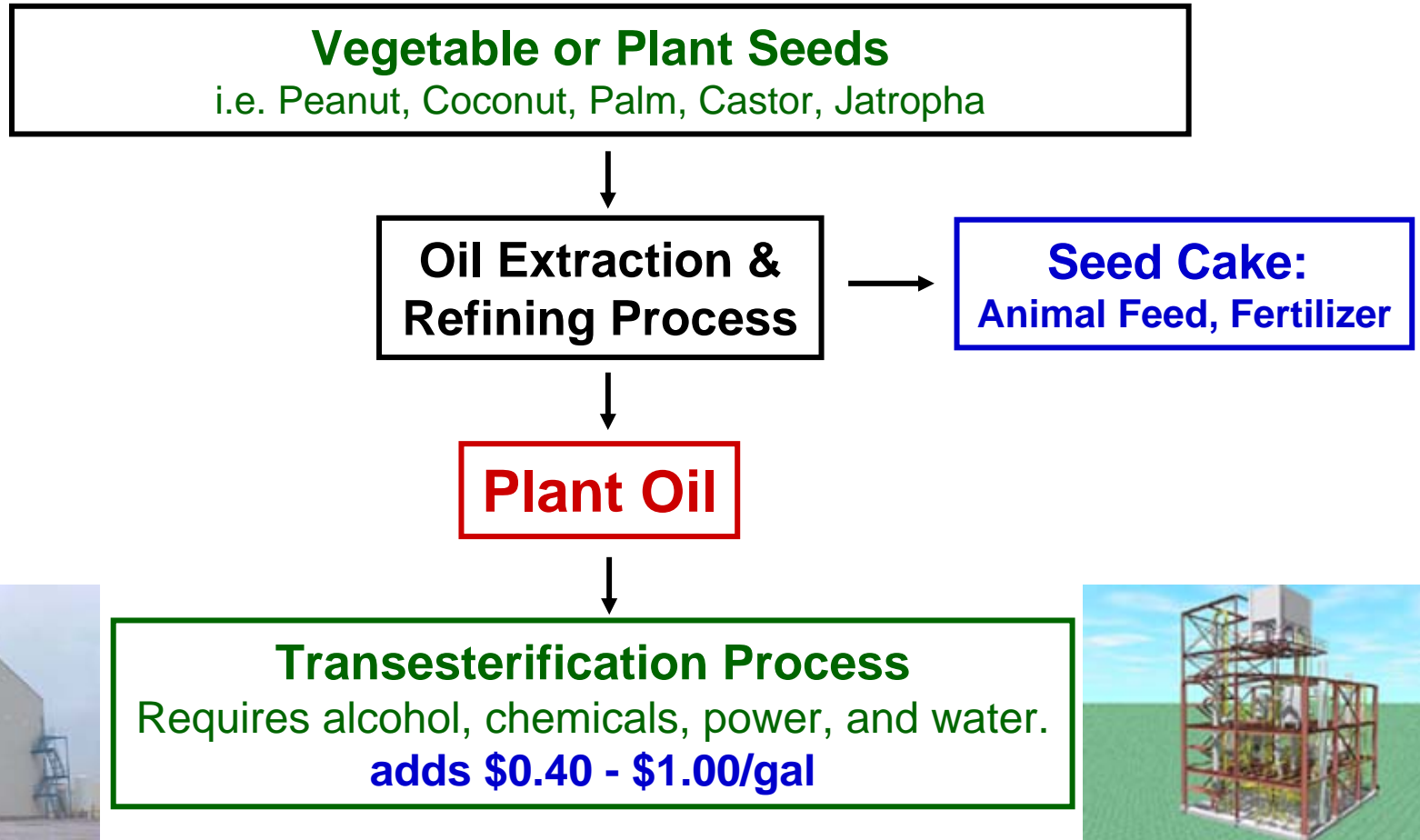


**Industrial**  
8,000 tons/day

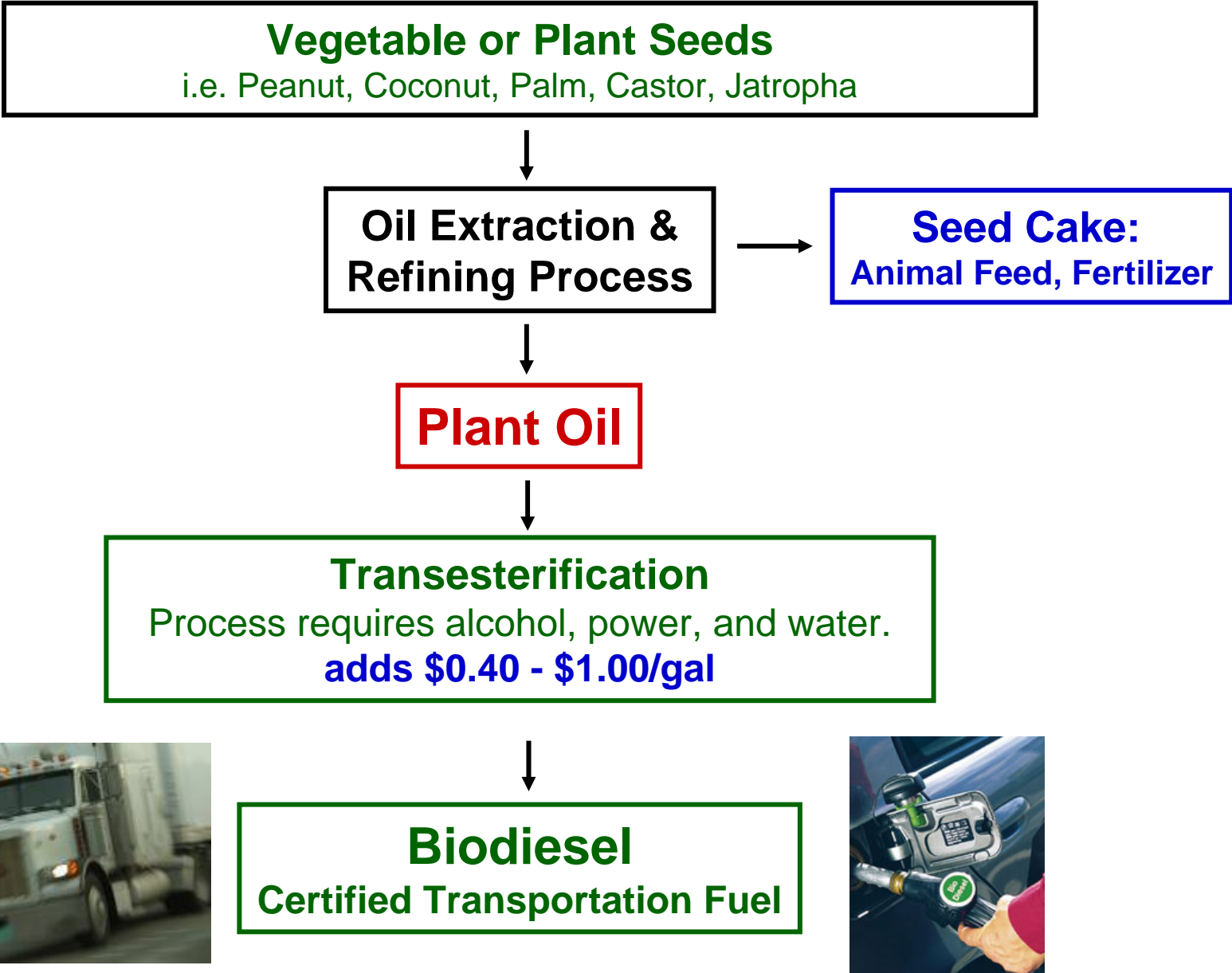
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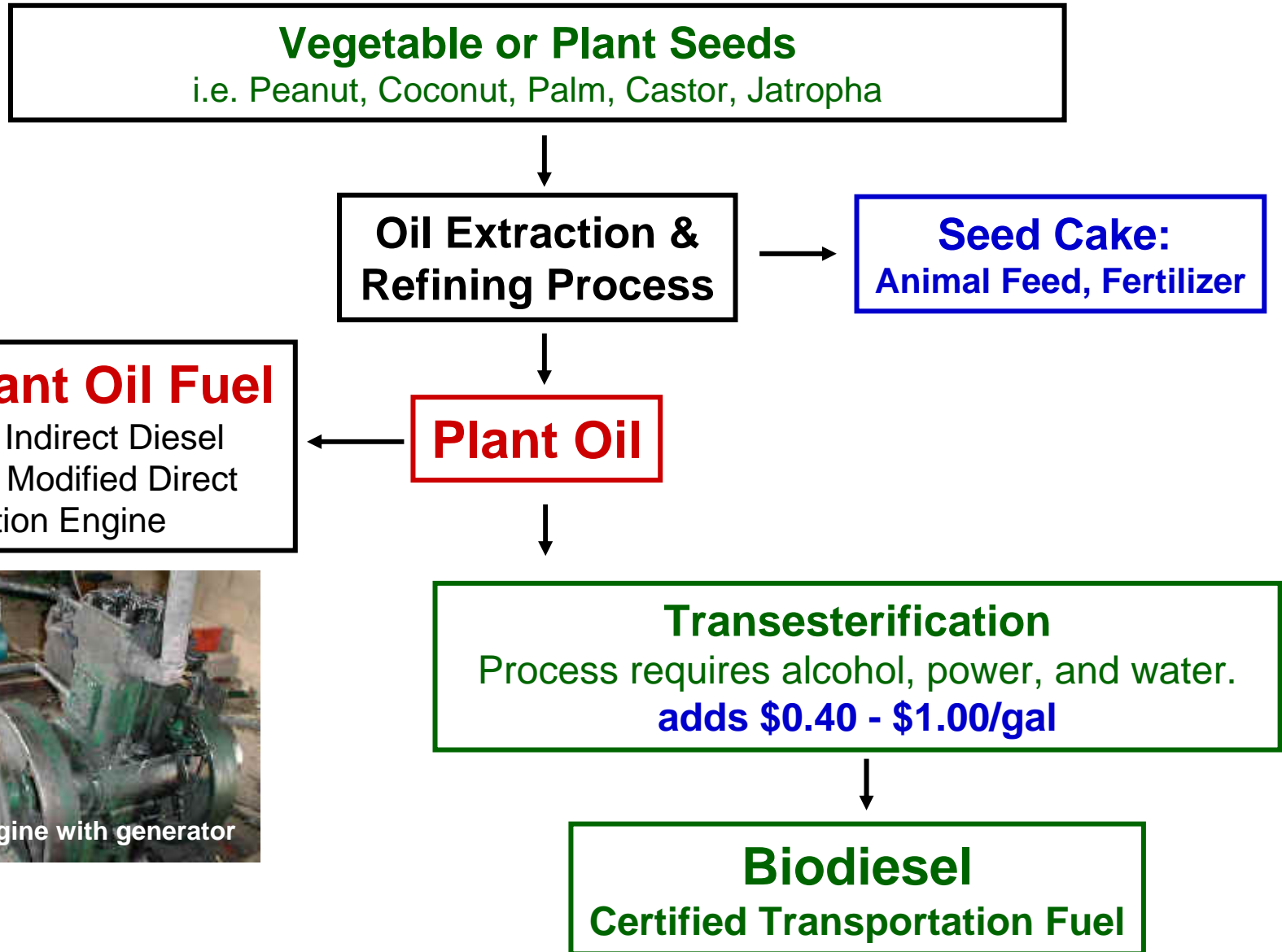
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**Vegetable or Plant Seeds**  
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**Oil Extraction & Refining Process**

**Seed Cake:**  
Animal Feed, Fertilizer

**Pure Plant Oil Fuel**  
Use with Indirect Diesel Engine or Modified Direct Injection Engine

**Plant Oil**

**Transesterification**  
Process requires alcohol, power, and water.  
adds \$0.40 - \$1.00/gal

**Biodiesel**  
Certified Transportation Fuel

***Pure plant oil fuel provides the most value added to the local farmer!***

## Selection of an Energy Crop – Biodiesel vs. Pure Plant Oil

### *Pure plant oil can be used for:*

At the village level: electric power generation for grinding mills, seed pressing operations, and pumping water for crop irrigation.

Running  
modified  
diesel  
engines



Cooking



Soap  
making



Lighting



## Selection of an Energy Crop – Biodiesel vs. Pure Plant Oil

**Plant Oil Based Fuels** are recommended over **Biodiesel** in the context of this assessment

- Biodiesel production adds another layer of technology and facility infrastructure.
- Biodiesel producers will seek to depress the prices of plant oil (e.g. **buy low, sell high**). This reduces the return to the local farmer unless they own the biodiesel production facilities.

# Energy Crop Plant Selection

Plant Type	Oil Yield (Kg Oil/Ha)
Soybean *	375
Rapeseed *	1,000
Corn	145
Cashew Nut	148
Rubber Seed	217
Cotton	273
Coffee	386
Rice	696
Tung Oil Tree	790
Sunflower	800
Cocoa	863
Peanut	890
Castor Bean	1,188
Jatropha	1,590
Avocado	2,217
Coconut	2,260
Oil Palm	5,000

**Yield values are higher than expected for crops planted on marginal lands and slopes.**

\* Non-native plant shown for comparison

Joshua Tickell, From the Fryer to the Fuel Tank, 2000

# Energy Crop Plant Selection Criteria

- **Indigenous Perennial**
- **Requires minimal agricultural inputs**
- **Adaptable over a wide range of rainfalls and elevations**
- **Grows on marginal lands and slopes**
- **Minimizes erosion and soil depletion**
- **High seed oil concentration**
- **High seed cake value**
- **Potential for genetic improvement and agronomic inputs**
- **Accommodate small scale seed oil extraction equipment**

# Energy Crop Plant Selection



## Jatropha curcas



Gwo Mèdsinye



- ✓ • **Indigenous Perennial**
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- ✓ • **30 wt% Seed oil concentration**
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# Energy Crop Plant Selection



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# Jatropha Living Fence on Slopes Ti Bois (Arcahaie) Haiti, May 2006



NGO PRODESELA/Caribbean  
Harvest Demonstration Project

*Jatropha curcas*  
Gwo Mèdsinye



Medicinal uses  
Mystical powers

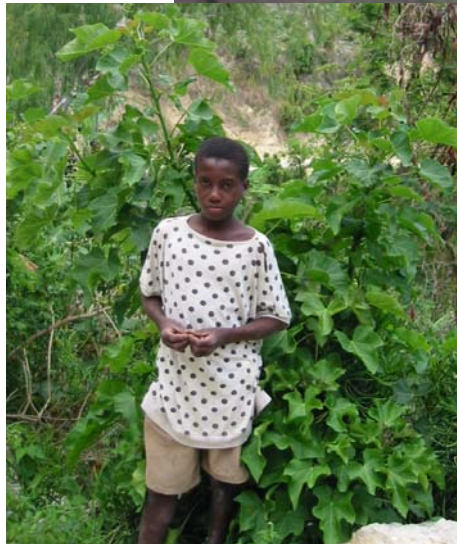
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The Private Sector has  
expressed great interest  
in Jatropha biodiesel!

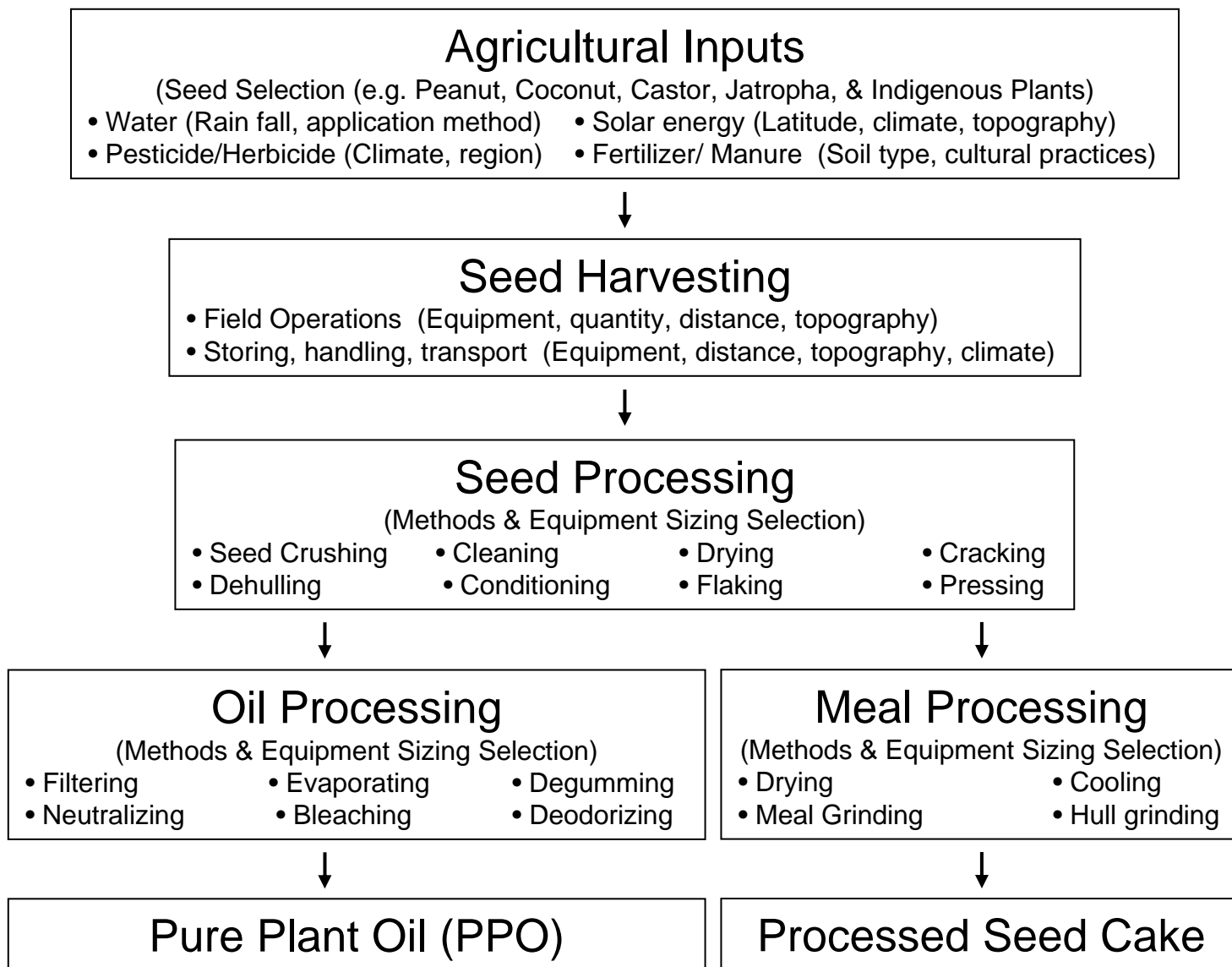
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# Market Example – Jatropha Plant Oil Fuel



# **Market Development Example**

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Based on the following assumptions for marginal lands:

- Jatropha are planted one meter apart, or 1000 plants/km
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- **EDH currently purchases petroleum diesel in bulk at \$2.30/gal.**

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**At this price,  
a good return to entire value chain is possible!**

# Summary

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**But where to start? Plant oil based fuels**

**Why? There is a need:**

- **To build up a supply of plant oil.**
- **To establish the appropriate local-scale seed oil processing centers.** (not just jatropha, but other plants for other markets)
- **To establish value added markets for the seed cake** (e.g. fertilizer, boiler feed, charcoal substitute).

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**From a solid agricultural base,  
a successful biodiesel industry  
can be established.**

# Policy Options

- **Tax exemptions for biofuels**
- **Tax penalties for petroleum fuels**
- **Require biofuel blends**
  - **Electric Power production**
  - **Transportation fuels**
- **Tax policy to promote diesel over gasoline use**

## **Recommendations (1 of 2)**

- 1. USAID/Haiti Mission should work with existing Haitian stakeholders to define an action plan for biofuels.**
- 2. Pure plant oil fuel should be encouraged first before biodiesel and ethanol production.**
- 3. Plant Oil Fuel markets that directly benefit small farmers should be promoted:**
  - Agricultural risk assessment**
  - Plant breeding and genetics assessment**
  - Assessment of small scale, seed harvesting and processing technologies**
  - A market campaign focused on the sale of plant oil fuel to local electric power utilities**
  - Seed cake market development**
  - Promotion of local investment in biofuels**

## **Recommendations (2 of 2)**

- 4. Develop new markets for plant oils at the village level.**
  - Mill grinding and seed operations**
  - Irrigation**
  - Lighting**
  - Cooking**
  - Soap production**
  
- 5. Provide training at all levels of plant oil production.**
  
- 6. Encourage the newly elected Haitian government to consider tax policies that promote biofuels, including pure plant oils, biodiesel, and ethanol.**

**Thank you for your kind attention**

*Biofuels for Haiti*

