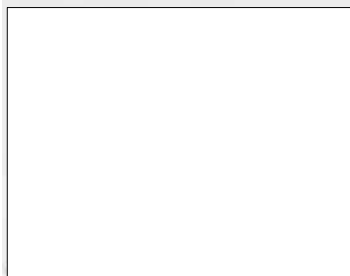


PNOC
The Energy Company
Alternative Fuels Corporation

PNOC-AFC JATROPHA ROADMAP



PNOC Energy Company



Philippine National Oil Company (PNOC)

Energy Development Corp.	Exploration Corp.	Shipping & Transport Corp.	Development & Mgt. Corp.	Alternative Fuels Corp.
Geothermal energy exploration and development	Oil and gas exploration and development	Marine transport of petroleum products & energy resources	Industrial estate development & management	Development and commercialization of alternative fuels

PNOC-AFC



- ❑ **Formerly “PNOC-Petrochemical Development Corporation” established in 1992**

- ❑ **A Government-Owned and Controlled Corporation re-mandated through Presidential Directive and officially registered with the Securities and Exchange Commission on June 13, 2006**
- ❑ **A wholly-owned subsidiary of the state-owned Philippine National Oil Company with the mandate to:**
 - **Explore, develop and accelerate the utilization and commercialization of ... and carry on the business of alternative fuels and other related activities**
 - **Engage in and carry on the business of petrochemicals in any and/or all its activities**

PNOC-AFC Industrial Park



❑ **530-hectare EcoZone**

❑ **Location:**

- **Limay and Mariveles, Bataan**
- **40 km west of Manila across Manila Bay and 140 km by land**

❑ **Fully integrated industrial complex:**

- **Raw and fire water distribution system**
- **Road network and drainage system**
- **Power distribution system**
- **1.3 km feedstock pier/jetty with 12-meter deep sea berth**

❑ **Current locators:**

- **Philippine Resins Industries Inc. (polyvinyl chloride)**
- **NPC Alliance (polyethylene)**
- **Phoenix (polypropylene)**

❑ **Future locators:**

- **Biodiesel Processing Plants**
- **Central Biofuels Terminal Facility**
- **Coal-to-Liquids Plant**



Local Demand



Year	Diesel Demand (Million Liters)*	Biodiesel Requirement (Million Liters)		
		1%	2%	5%
2006	7,479	0		
2007	7,776	78		
2008	8,065	81	161	403.25
2009	8,391	84	168	419.55
2010	8,653	87	173	432.65
2011	9,030	90	181	451.50
2012	9,411	94	188	470.55
2013	9,794	98	196	489.70
2014	10,122	101	202	506.10
2015	10,461	105	209	523.05

*AFETD-EUMB, Department of Energy

Local Supply



Company	Annual Capacity (Million Liters)
1. Chemrez, Inc.	75.0
2. Senbel Fine Chemicals, Inc.	72.0
3. Romtron Philippines	0.3
4. Mt. Holly Coco**	4.0
5. Pure Essence	60.0
6. Freyvonne Milling Services	15.6
7. Golden Asian Oil International, Inc.	30.0
8. Atson Coco, Inc.**	24.0
9. Lion Chemical Corp.**	6.0
Total Capacity :	286.9

Source: AFETD-EUMB, Department of Energy

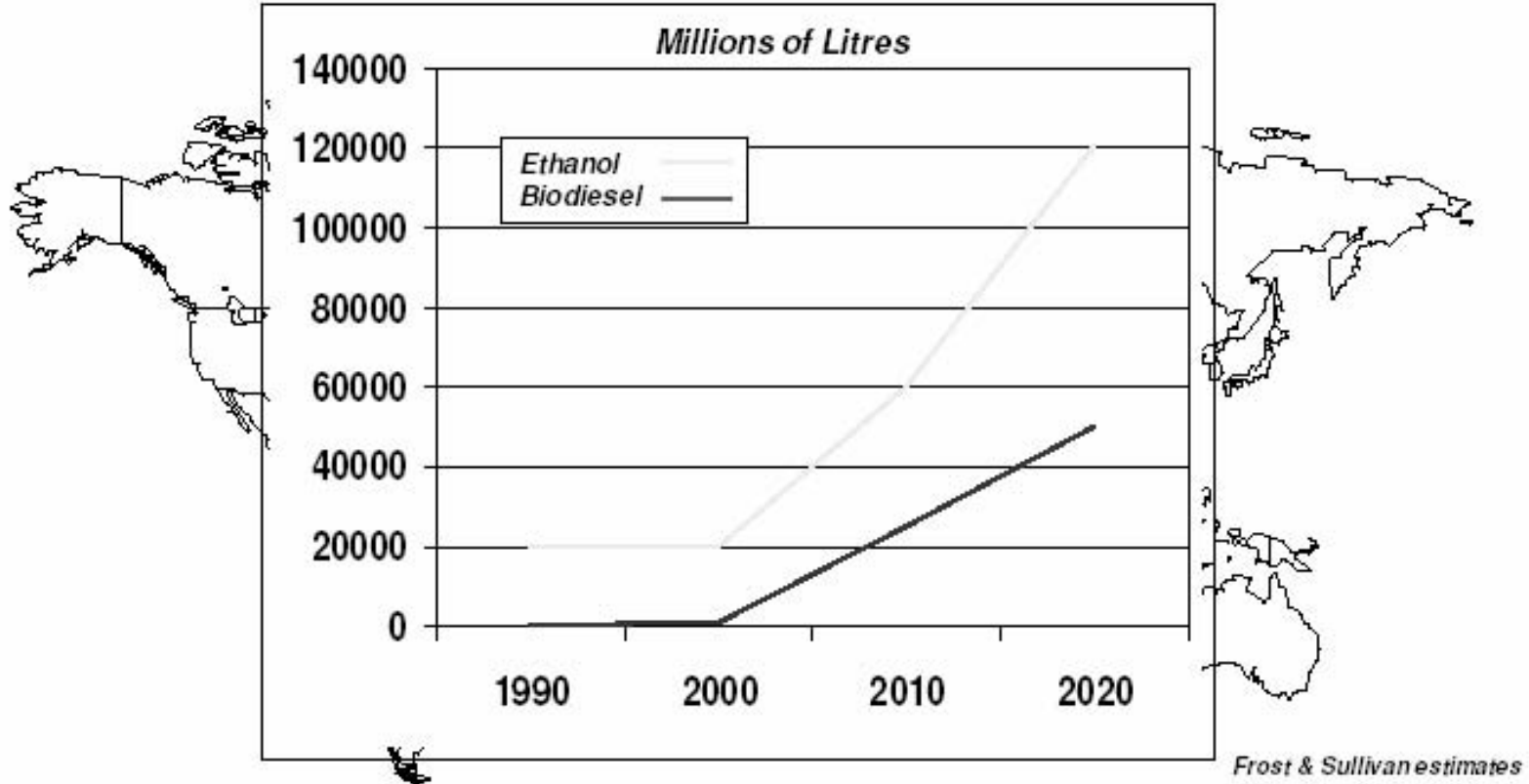
* Provisional accreditation

** Under evaluation

Global Demand

Current Market Size and Forecast for *Biofuels* through to 2020

- *Biodiesel and Bioethanol will continue to grow at fast rates to 2020.....*
- *India especially and China could push biodiesel usage higher*

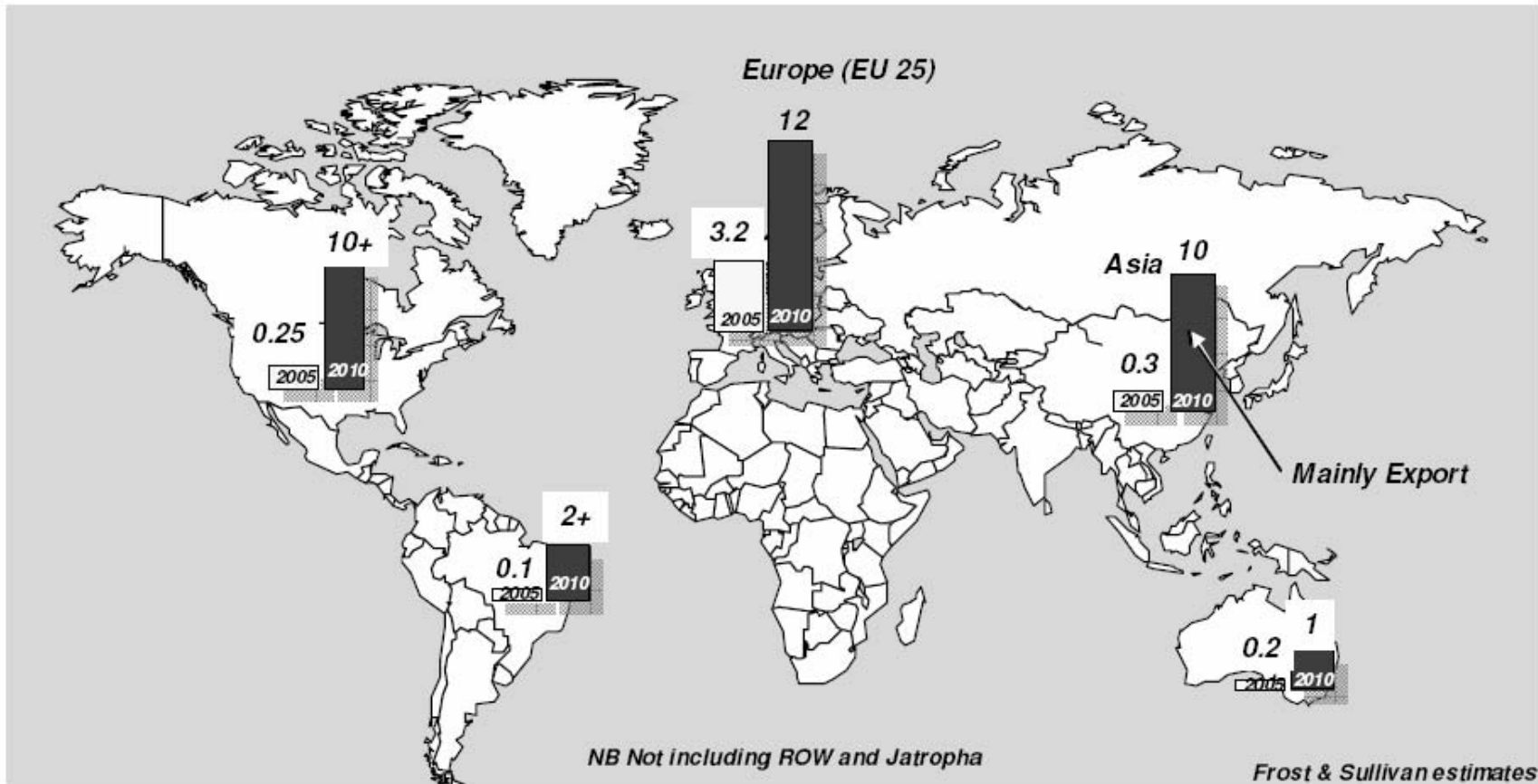


Global Demand

CAPACITIES: NOW AND NEXT

Current Market Size and Forecast for *Biodiesel* through to 2010

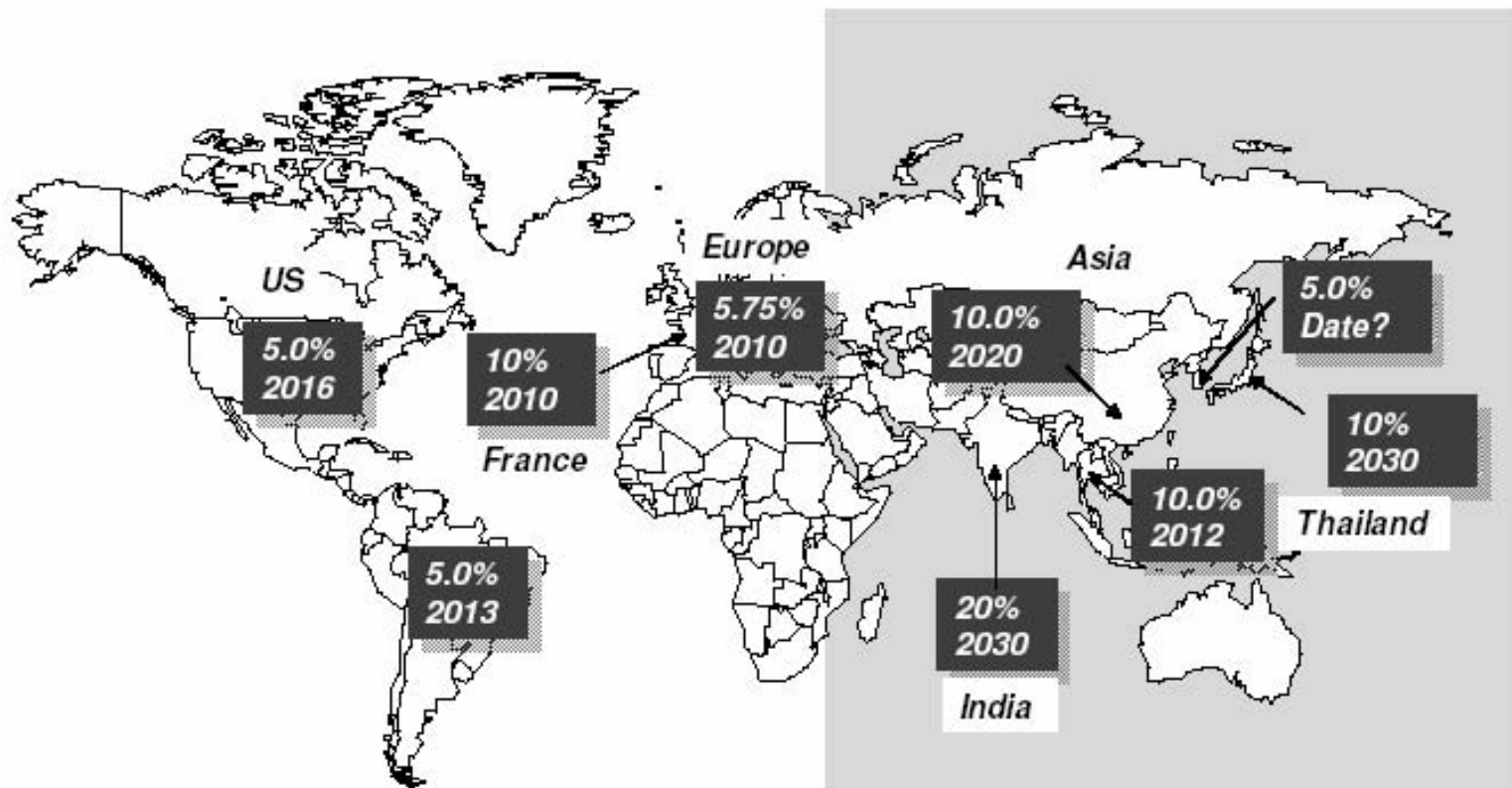
- *Europe initiated the market, other countries catching up fast such as the US*
- *Asia has been slow to mandate, some companies lobbying against it*



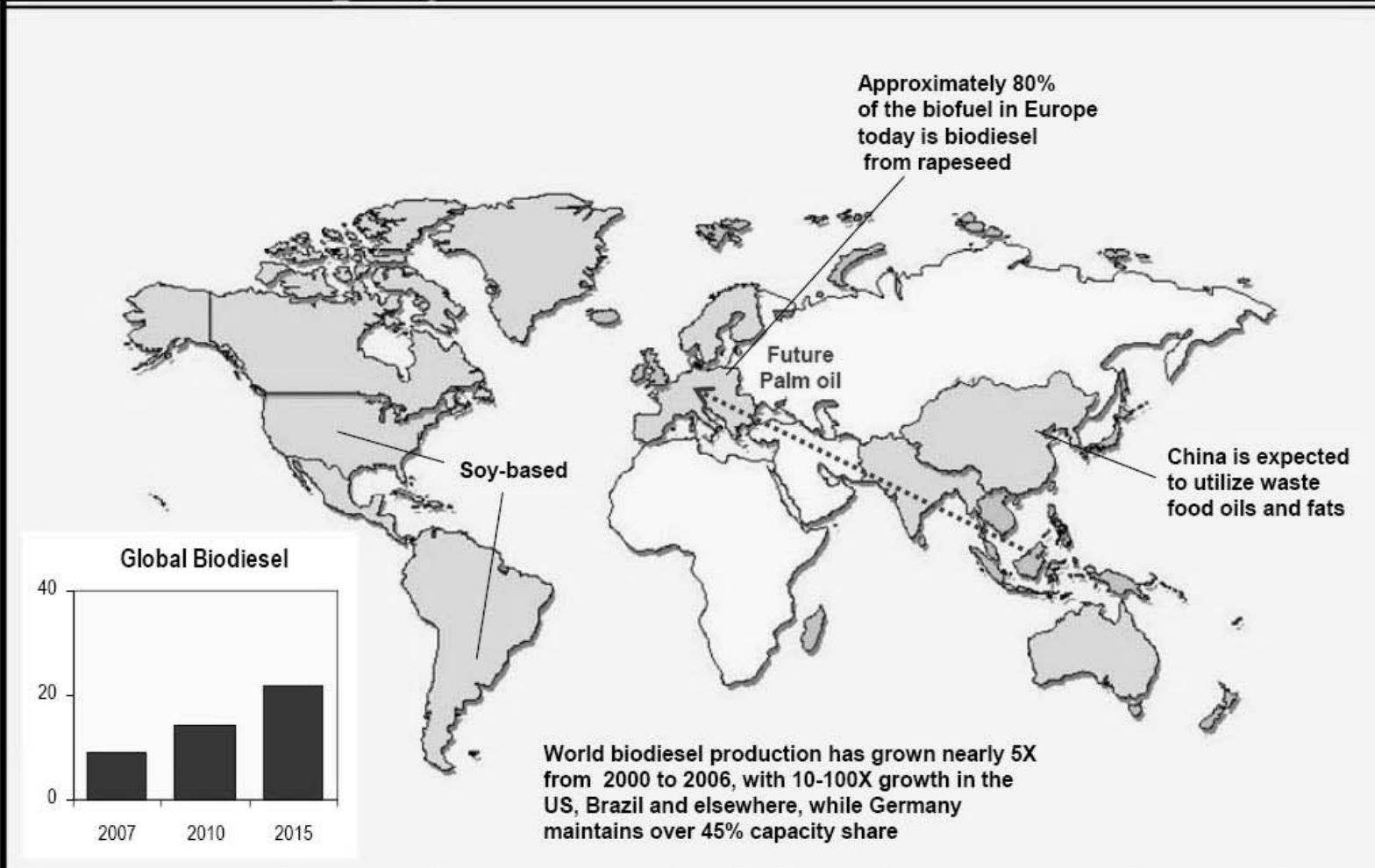
Global Demand

Market will mainly continue to be export led in SE Asia

- *Koreans are closest to a mandate but Oil companies are lobbying against it..*



Global Supply





*National Economic Development
Authority (NEDA)/National Anti-Poverty
Commission (NAPC) Cabinet Meeting,
Malacañang Palace, 8 August 2006*

*“The PNOC Alternative Fuels
Corporation shall have the primary
responsibility over the Biofuels
Project and shall be the one to
coordinate with the concerned
agencies.”*

President Gloria Macapagal-Arroyo

Biofuels Act of 2006

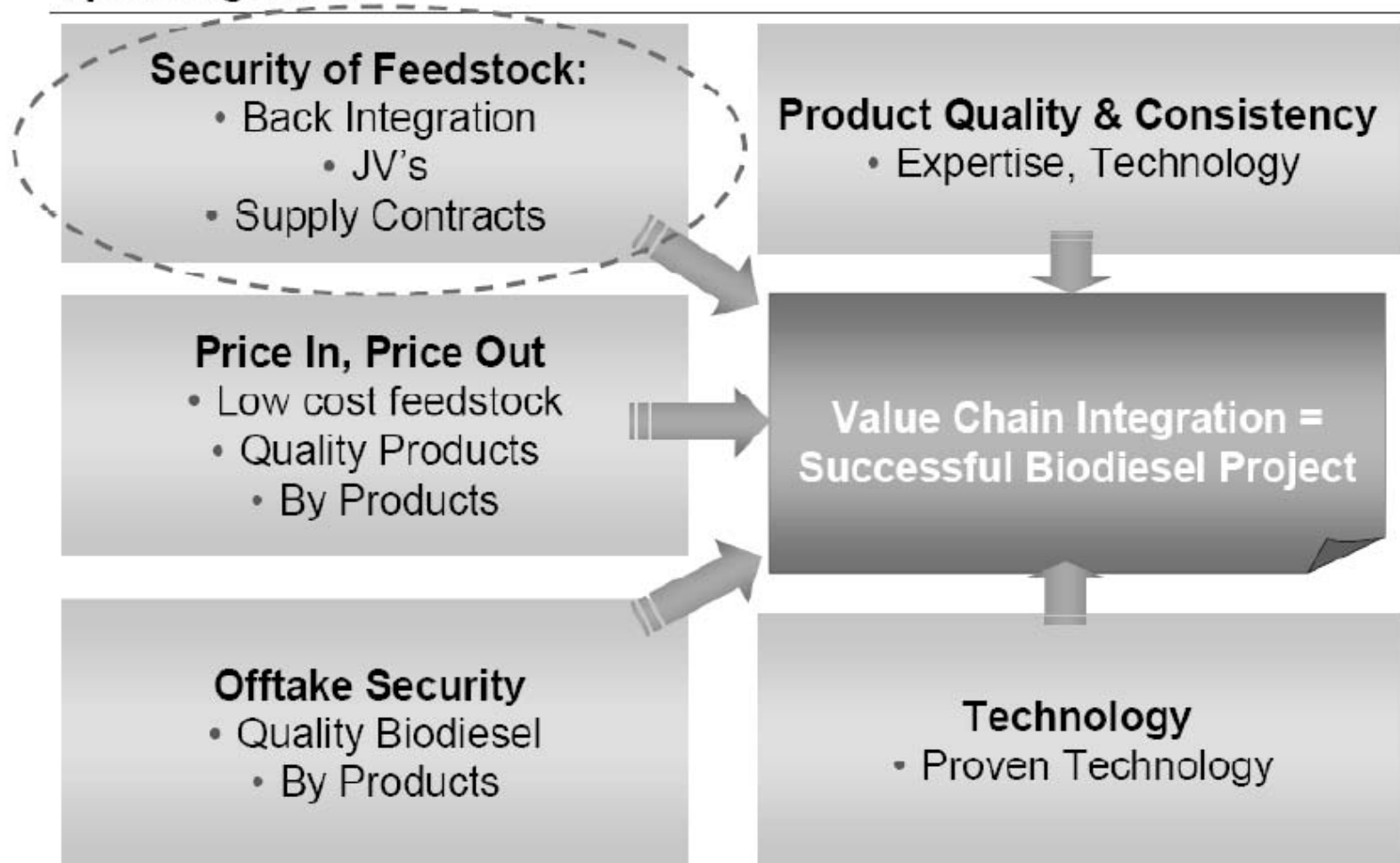


□ Mandatory Use of Biofuels

- **Within 3 months ..., a minimum 1% biodiesel by volume shall be blended into all diesel engine fuels sold in the country ... within 2 years, ... a minimum of 2% blend of biodiesel by volume ...**
- **Within 2 years ..., at least 5% bioethanol shall comprise the annual total volume of gasoline fuel actually sold and distributed..., ... within 4 years from the effectivity of this act ... a minimum of 10 percent ...**

Value Chain Integration

Key Success Factors/ Risk Minimization : Feedstock is 80% of operating costs



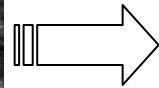
Jatropha Biodiesel Project



MEGA NURSERY



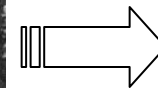
1,500 hectares
(PNOC-AFC)



PLANTATION



700,000 hectares
(Partners)

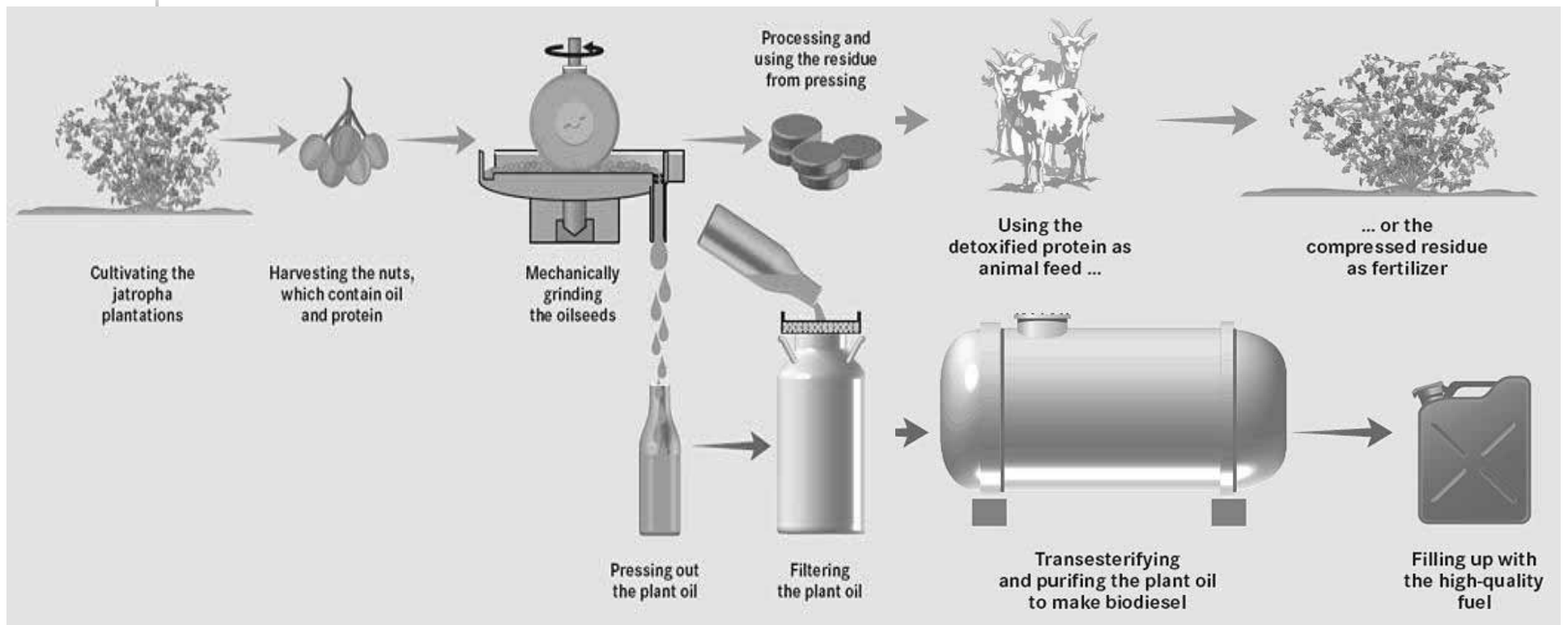


BIODIESEL PRODUCTION



1,000,000 MT/year
(Partners)

From Soil to Oil



Jatropha Biodiesel Roadmap



Assessment and site selection for nursery and plantation sites (2006)

Sourcing/inventory of planting materials (2006)

Assessment of technology and market (2006-2007)

Agreements with joint venture partners (2006-2007)

Research and Development (2007-onwards)

MEGA-NURSERY



1,500 hectares (provenance testing, seed production, model farm, tissue culture, varietal improvement, seed technology, R&D)

Seeds/Seedlings

PLANTATION



140,000 has

250,000 has

310,000 has

700,000 hectares (2008-2010)

Seeds

100,000 MT

400,000 MT

500,000 MT

1 million metric tons (2009-2011)

Biodiesel

Market: Domestic and Export

BIODIESEL PROCESSING



Crucial Considerations



- ❑ **Scarcity of seeds and seedlings**

- ❑ **Performance specifications of varieties** (*oil content, seed yield, adaptability to various climatic/soil conditions, etc.*)
- ❑ **Varietal improvement**
- ❑ **Propagation capacity of seeds and seedlings**
- ❑ **Land availability**
- ❑ **Uninterrupted long term use of land** (*social, political, ownership/claim issues*)
- ❑ **Labor availability and trainability**
- ❑ **Long term labor arrangements**
- ❑ **Extracted crude oil** (*quality and price*)

Jatropha in the Philippines

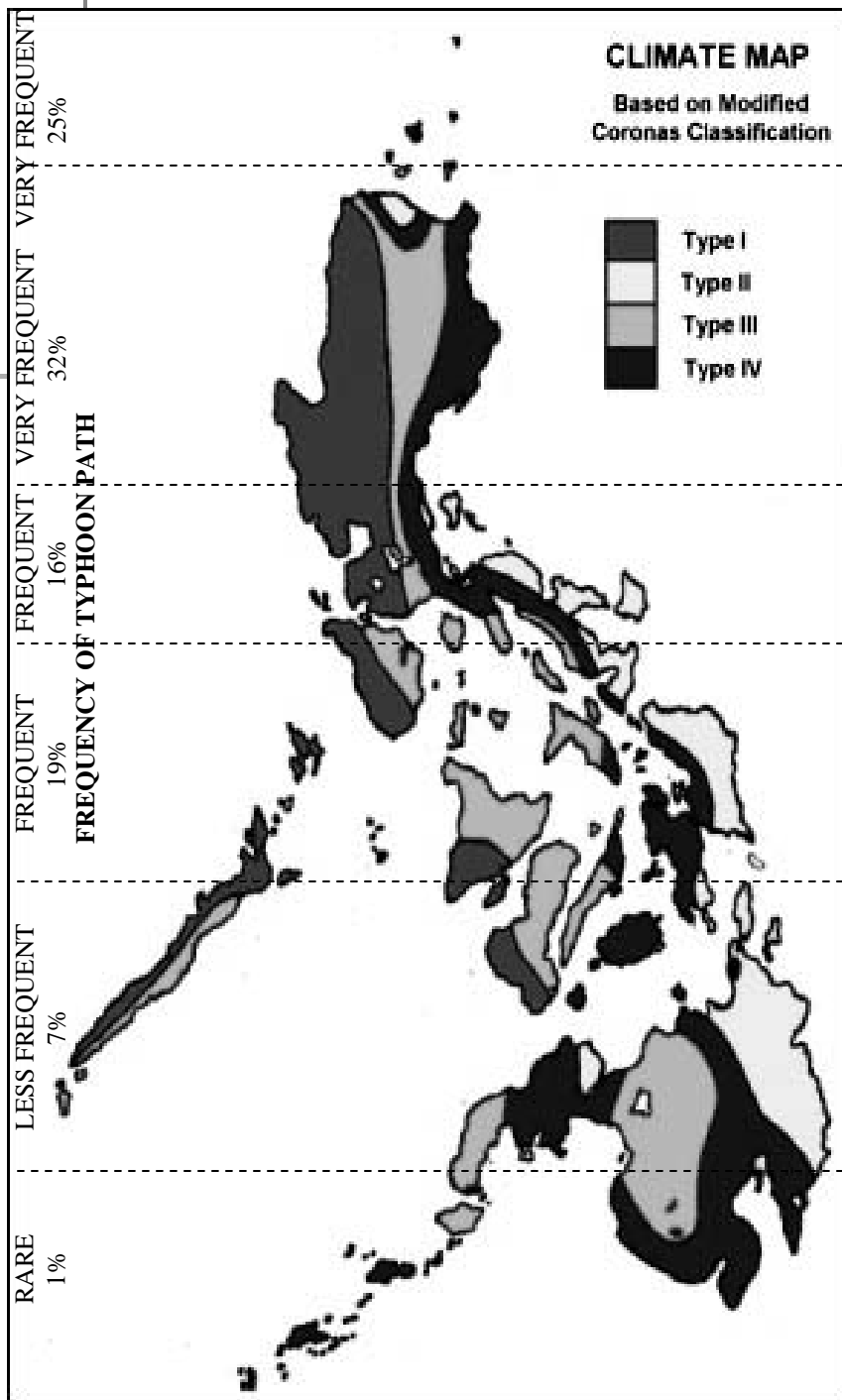
- **The Philippines has sufficient arable lands and favorable climatic conditions for growing Jatropha**
 - **Potential area for plantation**
 - *4 million hectares (captive plantation)*
 - *1 million hectares (hedge plantation)*
 - **15 million hectares of forest areas**
(> 5 million denuded or logged out)
 - **evenly distributed rainfall throughout the year (particularly in Southern Philippines)**



Expeditions

- ❑ ***Seeds/Seedlings Expeditions:*** Northern Luzon (Ilocos Region, CAR, Cagayan, Isabela), Central Luzon (Nueva Ecija, Tarlac), Southern Luzon (Batangas, Laguna, Cavite, Quezon), MIMAROPA (Mindoro, Palawan), Bicol Region (Camarines, Albay, Sorsogon, Masbate), Western Visayas (Panay, Negros), Central Visayas (Cebu), Eastern Visayas (Samar, Leyte), Zamboanga, Northern Mindanao (Bukidnon, Cagayan de Oro, Lanao, Misamis Oriental/Occidental), Davao, North/South Cotabato, Caraga (Agusan del Norte, Surigao).
- ❑ ***Land Expeditions:*** Bukidnon, Misamis Oriental/Occidental, Agusan del Norte/Sur, North/South Cotabato, Sarangani, General Santos, Lanao del Norte/Sur, Davao, Bataan, Palawan, Nueva Ecija, Tarlac, Mindoro





- ☐ **Type I – Two pronounced seasons. Dry from November to April, wet during the rest of the year.**
- ☐ **Type II – No dry season with a very pronounced maximum rainfall from November to January**
- ☐ **Type III – Seasons not very pronounced. Relatively dry from November to April, wet during the rest of the year.**
- ☐ **Type IV – Rainfall more or less evenly distributed throughout the year.**

INTEGRATED BIODIESEL PROJECT

Mega Nurseries/Model Plantations:

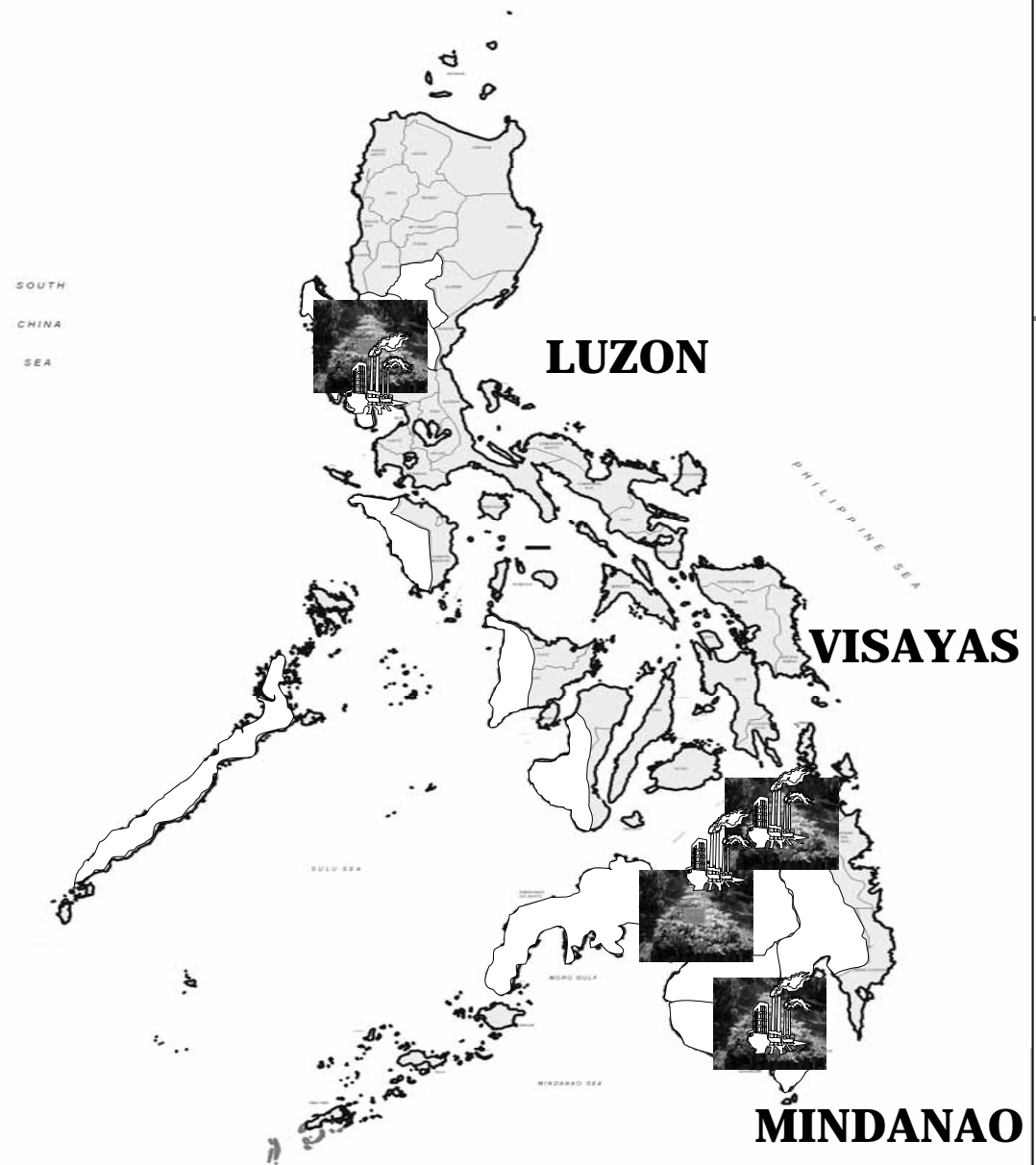
- Fort Magsaysay (500 has)
- Cagayan de Oro (500 has)
- Agusan del Sur (300 has)
- Gen. Santos/Sarangani (200 has)

Plantations (700,000 has):

- Military Reservations (137,537 has)
- Penal colonies (18,000 has)
- Private/ancestral lands (>1.5M has)
- Government lands (>300,000 has)

Biodiesel Plants (1 million MT/yr):

- PNOC-AFC Industrial Park
- Phividec Industrial Estate
- Nasipit EcoZone
- Gen. Santos



Military Reservations

- ❑ Establishment and development of jatropha mega-nursery / model plantations in Fort Magsaysay, Nueva Ecija (500 has.) and other military reservations



Ancestral Lands

- ❑ Establishment and development of jatropha mega-nursery and model plantation in a 500-hectare ancestral land in Cagayan de Oro



Private Lands

Palawan



Sarangani



Private Lands





Speech of President Gloria Macapagal Arroyo as delivered by DA Undersecretary Jesus Emmanuel M. Paras during the First Mindanao Jatropha Forum, Cagayan de Oro City, 28 August 2007:

- **“To accelerate the allocation for Jatropha plantations for PNOC-AFC and its partners, I am instructing DENR Secretary Lito Atienza and DAR Secretary Nasser Pangandaman to prepare an inventory of idle and uncultivated government lands.”**

PGMA statement during the Pulong Bayan, Talakag, Bukidnon, 28 August 2007:

- **“... There is a budget for DOE and its corporations for jatropha and energy independence.”**
- **Memo from PGMA to the PNOC-AFC Chairman dated 28 August 2007: “OK for P1 Billion”**
(referring to the additional budget request of PNOC-AFC for 2008)

Research & Development



Integrated R&D Program on *Jatropha Curcas* for Biodiesel

- ❑ PNOC-AFC; Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), and; University of the Philippines-Los Baños (UPLB)

- ❑ Project Components
 - Germplasm management, varietal improvement and seed technology R&D
 - Cost-effective propagation techniques for rapid multiplication
 - Soil fertility management technologies
 - Flowering and fruiting physiology
 - Pest and disease management
 - Enzyme biotechnology for oil extraction
 - Wastes and by-products de-toxification



Research & Development



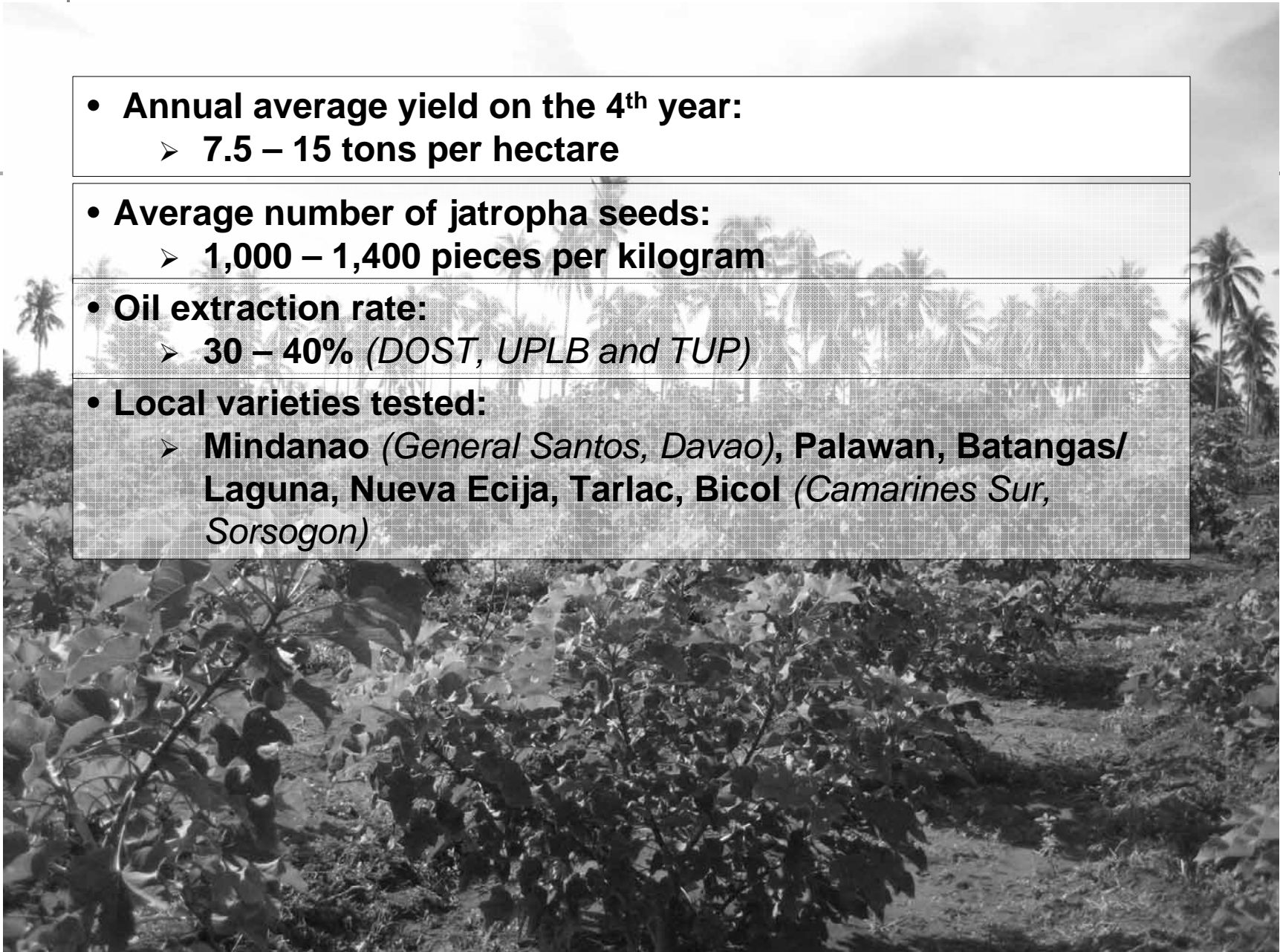
Pilot Production and Testing of Biodiesel from Jatropha Curcas

- ❑ PNOC-AFC and DOST (Philippine Council for Industry and Energy Research & Development, Industrial Technology Development Institute and Metals Industry Research & Development)
- ❑ Project Components
 - Jatropha oil and methyl ester production and characterization
 - Development of high-value by-products
 - Performance testing of Jatropha Methyl Ester



Research & Development

- Annual average yield on the 4th year:
 - 7.5 – 15 tons per hectare
- Average number of jatropha seeds:
 - 1,000 – 1,400 pieces per kilogram
- Oil extraction rate:
 - 30 – 40% (*DOST, UPLB and TUP*)
- Local varieties tested:
 - Mindanao (*General Santos, Davao*), Palawan, Batangas/
Laguna, Nueva Ecija, Tarlac, Bicol (*Camarines Sur,
Sorsogon*)



Research & Development

- ❑ multiple branching



Research & Development

- stages of flowering and maturity of fruits

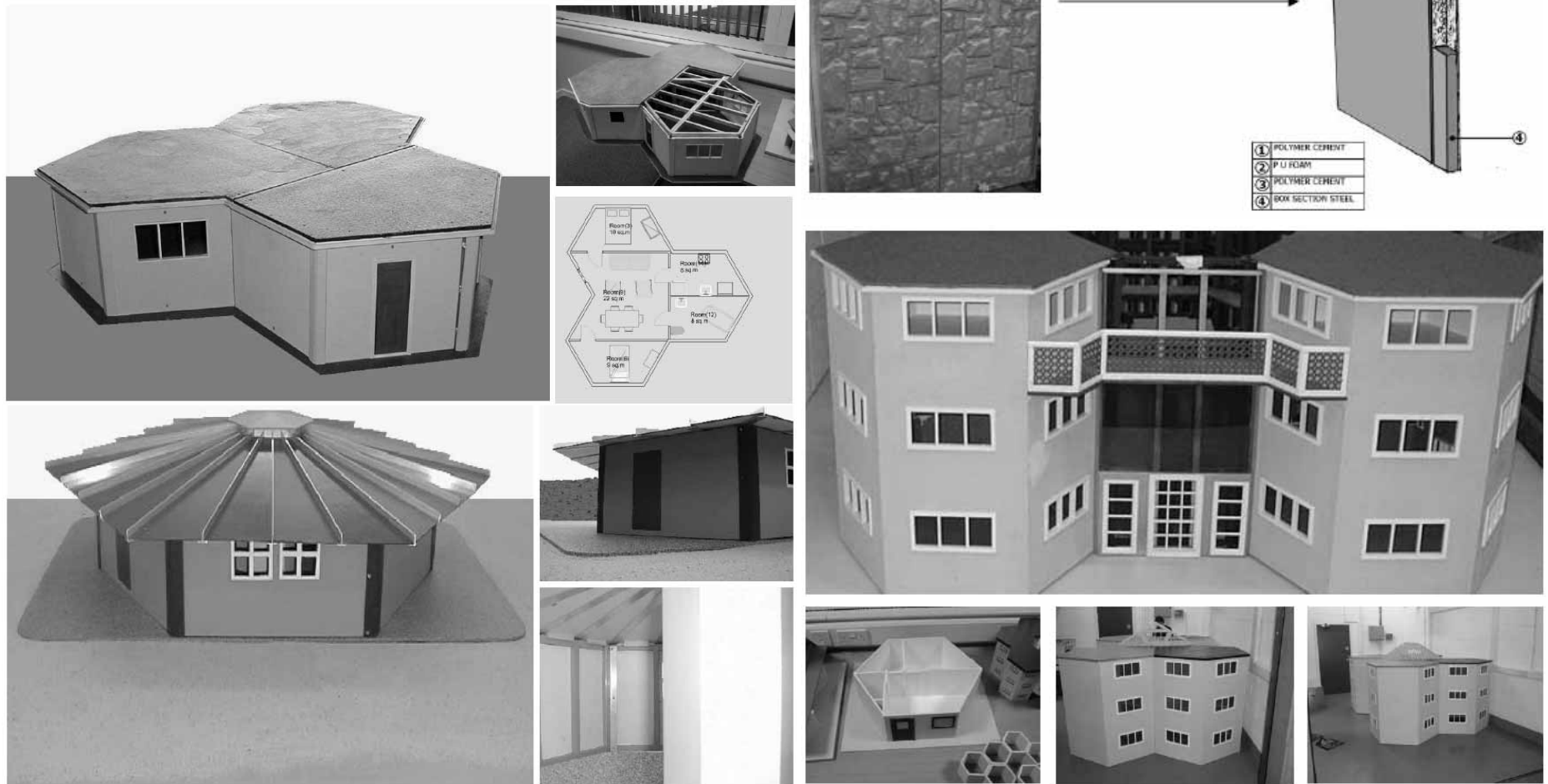


By-Products

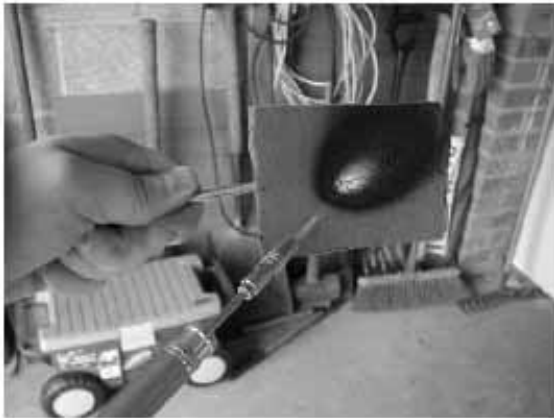


Bio-Plastics

- ❑ Polyurethane products for low-cost housing, school buildings, etc.



Bio-Plastics



Research & Development

NON-EDIBLE OIL CROPS

❑ **Aleurites trisperma, A. mollucana, A. triloba (*Lumbang*)**

- 200-300 trees/ha; 5-20 tons of nuts/ha/yr; 30 to 80 kg of oil/tree; 6 to 20 tons oil/ha.



❑ **Ricinus communis or castor plant (*Tangan-Tangan*)**

- Seeds contain 45 to 50% oil; oil yield is about 1,200 to 2000 liters/ha.



❑ **Pongamia pinnata (*Bani*)**

- 27-36% oil; 9-90kg seed/tree; 900-9,000 kg seed/ha



(Source: James Duke, Handbook of Energy Crops, 1983)

Q4 2007 Targets



- Determination of top varieties and planting protocols**
- GIS mapping, survey and database establishment of plantation areas**
- Establishment of another 500 hectares nursery/model plantation**
- MOU/MOA with plantation partners**
- Off-take agreement with Petron**
- Partnership on plantation technology**
- Evaluation and acquisition of oil extraction equipment**
- Establishment of pricing mechanism for seeds and oil**
- IEC, capacity building, investment roadshows, stakeholders' fora, conferences, networking**

2008 Targets and Milestones



1st Qtr 2008



- Off-take agreements with Land Bank loan beneficiaries
- Determination of viability in establishing seed-buying centers (*logistics*)
- Procurement of seeds from existing plantations for pre-commercial biodiesel production
- Development, testing and demonstration of small-scale biodiesel plant
- Start pre-commercial production and testing of jatropha biodiesel
- Availment of BOI and PEZA incentives (biorefinery and jatropha plantation)

2nd Qtr 2008



- Start establishment of PNOC-owned 20,000 hectares plantation
- Lease land for biorefinery
- Start construction of PNOC-NRG 500,000 MTY biorefinery
- Continue tests of higher blends of jatropha biodiesel (2%-20%)
- Start pre-commercial production of polyols
- Off-take agreement for polyols

3rd Qtr 2008



- Development of downstream by-products (polyurethane)
- Revenue generation from seedling sale to farmer groups/JV partners
- Start 200,000 hectares plantation development with the entry of first 2 JV partners

4th Qtr 2008



- Continue pre-commercial production of biodiesel and polyols
- Continue development of 200,000 hectares plantation
- Continue construction of 500,000 MT biorefinery

- R&D on other feedstocks (non-edible oil crops, algae) and by-products (fertilizer, animal feeds)

2008 Targets and Milestones



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Investment/JV Partners



INTEGRATED PLANTATION-REFINERY AND OFF-TAKES

- **Natural Resource Group (Singapore)**
- **Biogreen Energy Sdn Bhd (Malaysia)**
- **Norfuels (Norway)**
- **EcoSolutions (Korea)**
- **Brunei National Petroleum Co. (Brunei)**
- **Korea Technology Industry Co., Ltd. (Korea)**
- **Bionor Transformacion, S.A. (Spain)**
- **Colony Holdings (China)**
- **Green Oil Company Ltd. (Netherlands)**
- **Green Fuels (Spain)**
- **ZeroPoint Clean Tech., Inc. (USA)**
- **Israel-based group**
- **Philippine companies (vegetable oil and oleochemical manufacturing companies, oil companies)**

Integrated Biodiesel Project



BUSINESS MODEL



Mega-Nursery

- ❑ 1,500 has.
- ❑ Seed Production
- ❑ R & D (*tissue culture, provenance testing, oil extraction, intercropping, etc.*)

Seedlings



Plantation

- ❑ 700,000 has.
 - Y1 (2008): 140,000 has.
 - Y2 (2009): 250,000 has.
 - Y3 (2010): 310,000 has.

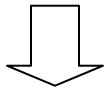
Seeds



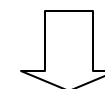
Refinery

- ❑ 1 Million MT
 - Y1 (2009): 100,000 MT
 - Y2 (2010): 400,000 MT
 - Y3 (2011): 500,000 MT

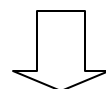
Excess
Seeds



Jatropha Oil



Biodiesel



Jatropha Oil

In Closing ...



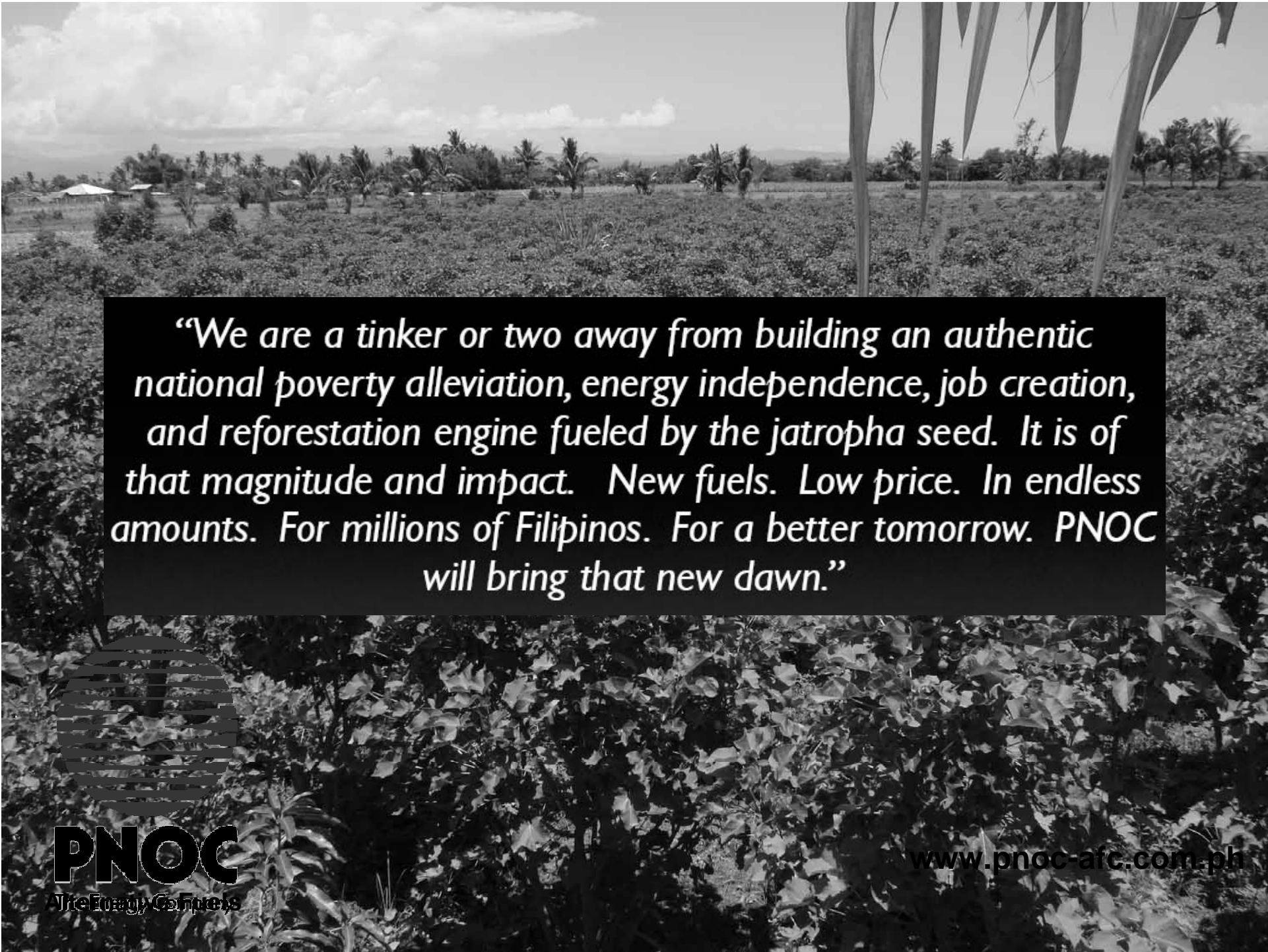
- ❑ **Competitive Potential:** labor, vast lands, climate, fertile soil (*Mindanao*), **PNOC-AFC Industrial Park**
- ❑ **Goal:** pursue (*along with partners*) **1 Million MT biofuel refining capacity and 700,000 hectares of plantation** (*expandable to 2 million hectares*)
- ❑ **Benefits:** energy security and fuel diversification, reduction in air pollution, climate change mitigation, strengthen agriculture economy
- ❑ **Social Impact:** bring job opportunities to poverty-afflicted regions of the country
- ❑ **Vision:** lead the Philippines to the forefront of the **Global Biofuels Industry**

Nursery ...



Plantation ...





“We are a tinker or two away from building an authentic national poverty alleviation, energy independence, job creation, and reforestation engine fueled by the jatropha seed. It is of that magnitude and impact. New fuels. Low price. In endless amounts. For millions of Filipinos. For a better tomorrow. PNOC will bring that new dawn.”



PNOC
Alternative Energy & Fuels

www.pnoc-afc.com.ph