

Innovative Nano-Scale Bio-Fuels for Effective Rural Development

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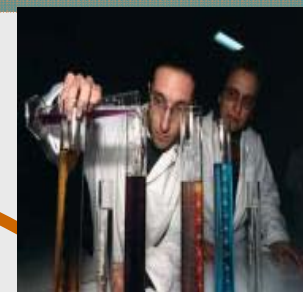
**The Regional Conference on:
“Renewable Energy and Sustainable Development in Rural Areas
of the ESCWA Region”**

27th November 2013,
Rabat Hotel, Rabat city, Morocco



Overview

- ❑ Effective Rural Development in Developing Economies
- ❑ Prioritization of RETs
- ❑ Nanotechnology – A Brief Account of an Effective Enabling Tool
- ❑ Bio-fuel Technologies: The Nano-Scale Solutions
- ❑ The Novel Technologies-Equal Partnership-Ensured Equity Nexus
- ❑ A Success Story and the Way Forward



DEVELOPING ECONOMIES could be:

1. Driven by **Foreign Borrowings** not sustainable;
2. Resulting from **Commodity Booms** boom and bust cycles
3. Led by **Economic Restructuring and Diversification into New Products and Services.** (incorporated in NIS design)
most sustainable track and based on **quality production of manufactured goods and modern services.**



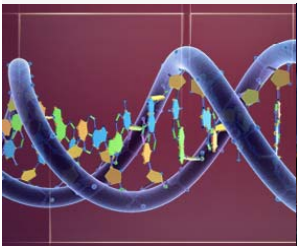
ESSENCE OF INNOVATION ECONOMY

The **quality production of manufactured goods and modern services** is the **essence** of the **Knowledge-driven** or the **Innovation Economy** and is dependent on **Total National Capacity (TNC) in Science, Technology and Innovation (STI)**, which can only be achieved through a strong **National Innovation System (NIS)**;



IMPLICATION OF TOTAL NATIONAL CAPACITY (TNC) in STI

- Requires a rigorous STI Policy encompassing
 - ✓ Capacity to develop (**R&D**) in selected priority areas, and to acquire high-impact technologies (**technology transfer**);
 - ✓ Capacity to **apply and utilize selected technologies** and promote innovation in their field;
 - ✓ Management of the interface between the two (in both Government and Industry): **a working NIS that ensures knowledge is converted into wealth and once identified, any technology is successfully adopted as a high-impact tool for development (innovation ecosystem)**



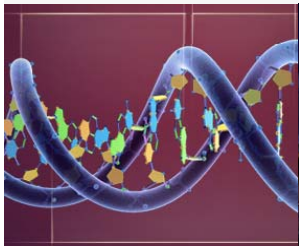
In the context of **RURAL DEVELOPMENT**

- ✓ Majority of population (about 80%) lives in rural areas and are **poor farmers** with **no support system for long-term investments**;
- ✓ **Poor access to basic services** (drinking water, waste water treatment, healthcare, quality energy, etc.)
- ✓ No proper **infrastructure to support development** (in some way it is a +)
- ✓ Migration to urban centers causing **wider gaps in food production and overloaded city slumps**



PRIORITIZATION OF RETs

- **RET systems are practical vehicles to address many global mandates:**
 - ✓ Poverty Eradication (**jobs creation & improved livelihoods**);
 - ✓ **Food Security** (reversing migration and overcoming agric. Issues);
 - ✓ Improved **access to basic services** particularly clean water & energy;
 - ✓ Improved **finance opportunities** for sustainable development;
 - ✓ Development based on **environmentally-sound systems**;
 - ✓ Rigorously address **Climate Change** and **Global Warming** through both **Mitigation & Adaptation** (**new Innovative techniques & technologies**)



PRIORITIZATION OF RETs

- ✓ **Mitigation:** Innovative actions taken to lower the concentration of GHGs in the atmosphere and thereby reduce the extent to which the global climate system changes relative to how we have known it to be in the recent past;
- ✓ **Adaptation:** Innovative actions taken to reduce the negative consequences of changes in the climate e.g. switching to drought resistant crops, and it usually depends on the **scale considered**, the **locations affected**, the **income-generating or livelihood activities people are involved in**, the level of **access people have to services** (both public and private), etc.

**Poor Farmers; Finance; Adept Technologies; Manufacturing Abilities;
Social Justice; Sustainable Development => Bio-fuels Production**



Bio-fuels Production – Global Challenges

- ✓ **Conflict** with Food Chain products;
- ✓ **Labour Intensive** – Harvesting is done on a daily basis. Only **Jatropha** fruits which are yellow and black can be collected.
- ✓ **Low Yield/Production** – Low average buy back price of Jatropha seeds worldwide is at USD100–USD150 per ton.
- ✓ Bio-diesel production via “**Transesterification**” is a **total failure**. Turning **Jatropha bio-diesel** to meet EN14214 with minus 21C pour point requires the said methyl ester be fractionated twice and this process is **very energy intensive and very costly**.



Nanotechnology : A Brief Account of an Effective Enabling Tool



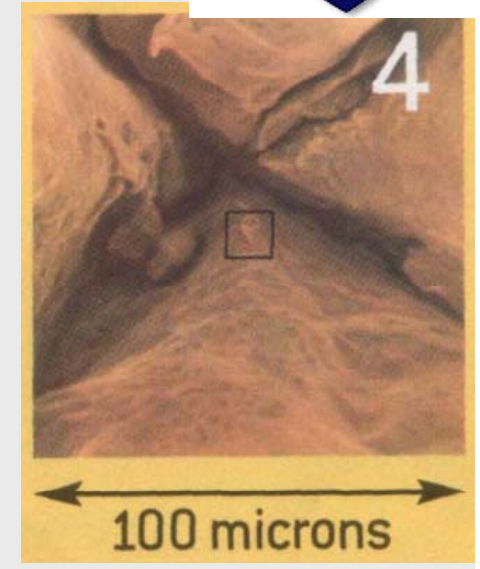
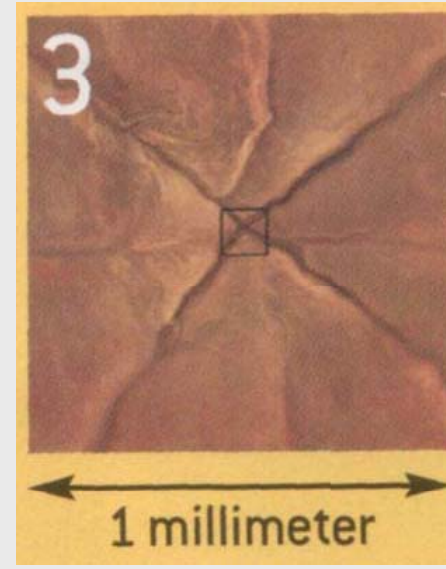
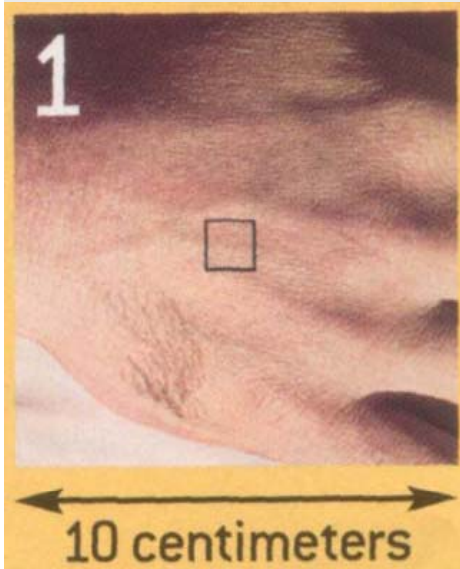
There's Plenty of Room at the Bottom : An invitation to Enter a New Field of Physics



Richard Feynman,
Caltech 1959

“People tell me about miniaturization, and how far it has progressed today. They tell me about electric motors that are the size of the nail on your small finger. And there is a device on the market, they tell me, by which you can write the Lord’s Prayer on the head of a pin. But that is nothing; that’s the most primitive, halting step in the direction I intend to discuss. It is a staggeringly small world that is below. In the year 2000, when they look back at this age, they will wonder why it was not until the year 1960 that anybody began seriously to move in this direction. Why cannot we write the entire 24 volumes of the Encyclopedia Brittanica on the head of a pin ?”

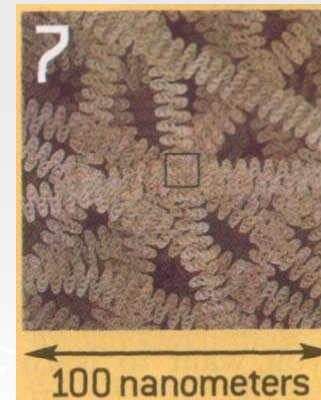
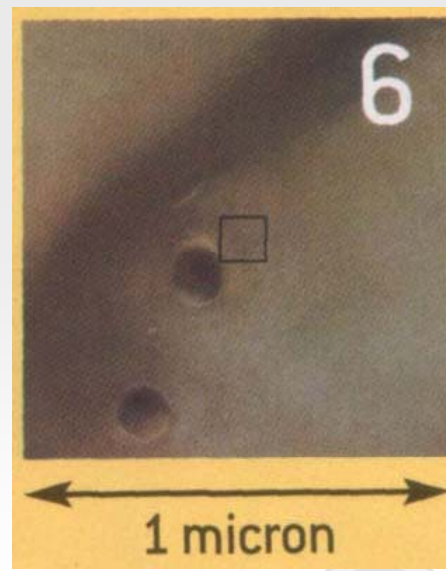
This goal requires patterning at the 10 nanometer scale and, hence, nanotechnology (NT)



Skin



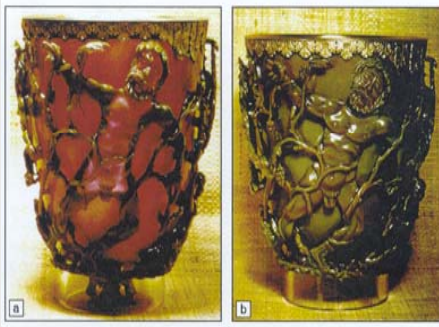
White Blood Cell



DNA

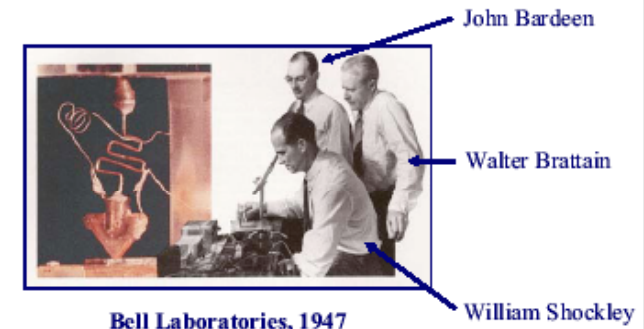
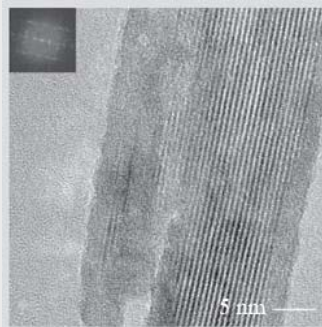
- $1 \text{ nm} = 10^{-9} \text{ m}$.
- *Nanotechnology (NT) is the understanding and control of matter at dimensions of roughly 1 to 100 nm.*
NT is not an industry; it is an enabling technology.

NT : Historical

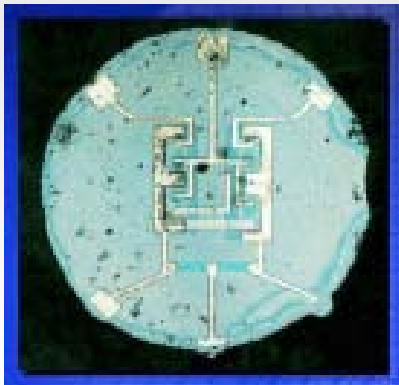
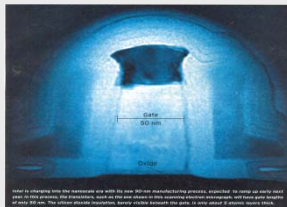


2000 years ago : the cup is seen in (a) transmitted light, and (b) reflected light.

1000 years ago : carbon nanotubes and nanowires in Damascus steel sword.



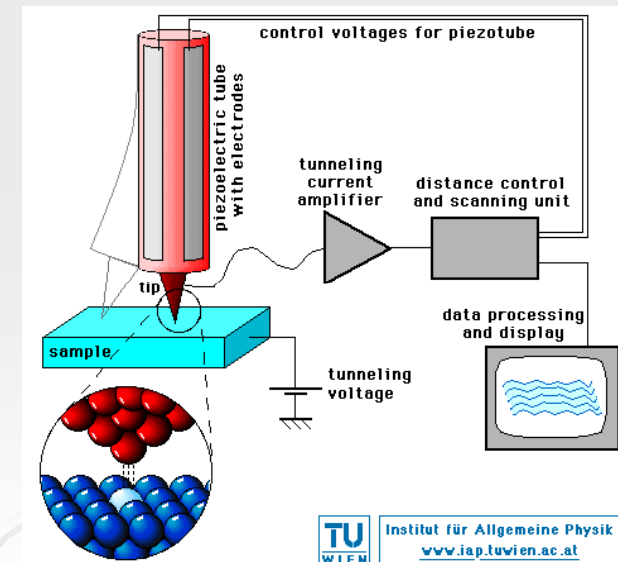
1947 Invention of the transistor at Bell Labs.



1961 : the first planar IC



1965 "Cramming more components onto ICs"



1981 : Binnig and Rohrer invented the scanning tunneling microscope

*If NT has been around for almost
2000 years why is it taking off now?
Why is it so “big” now?*

*Because we have learned what is
going on:*

- *We can now controllably and repeatedly make things in the nano-size range.*
- *And we can now see what we have made.*
- *A whole new technology came to being-
Nanotechnology.*

Application Areas for NT

Medicine
and
Health

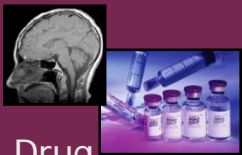
Information
Technology

Energy
Production
/ Storage

Materials
Science

Food, Water
and the
Environment

Instruments



Drug
delivery



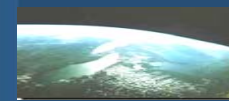
GMR Hard
Disk



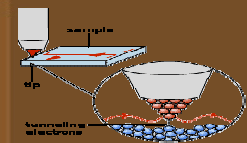
Hydrogen
Fuel Cells



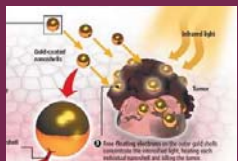
Lightweight &
strong mats.



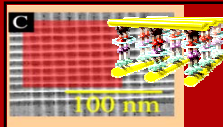
Remediation
methods



Tunneling
microscopy



Treatments
for Cancer



Molecular
Switches



Solar Cells



City-Sized
Skyscrapers



"Smart"
Membranes



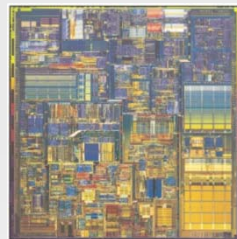
Nano
Manipulators

Expected to impact virtually all technological sectors as an "enabling" or "key" technology

Impact of Nanotechnology on Consumer Products



Electronic products



Consumer products



UNESCO NECTAR

❑ Regional Virtual Network that links academia, R&D centers, and industry in pre-defined modalities for enhanced support of education, R&D, and Innovation (ERDI) and fostering technology transfer (TT) through N-S and S-S cooperation.

❑ The Network will strengthen the institutional capacity of the current National Innovation System (NIS) in each member state, and build the required capacities of all STI stakeholders in the region (Educators, Scientists, Researchers, and Students);

❑ Use UNESCO UNISPAR and UNITWIN to optimally use the current network for N-S cooperation, establish UNESCO Chair in Advancement of Converging Technologies;

❑ Ensure the strong involvement of the Private Sector and civil society at large in these member states.



**Establish Knowledge to
Economy Process**

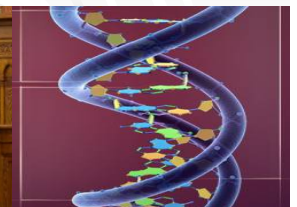
Absence of or
Gaps in the
National Policy

Lack of R&D Funds

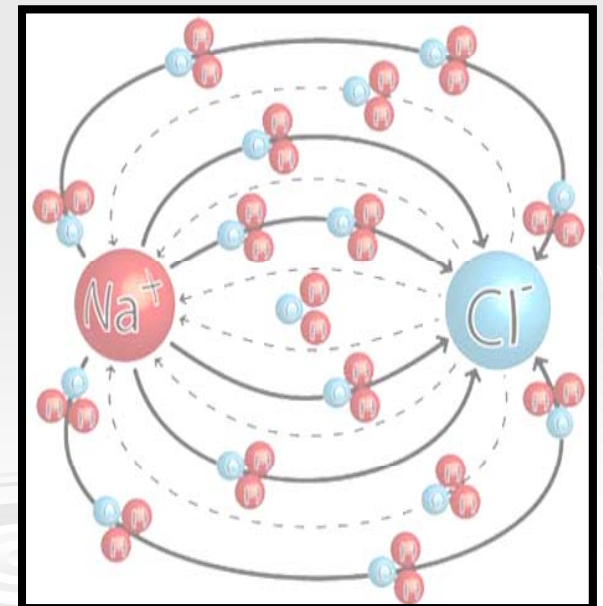
**Low Collaborative
Interests amongst
Quality Researchers**

No R&D/University
and industry Link

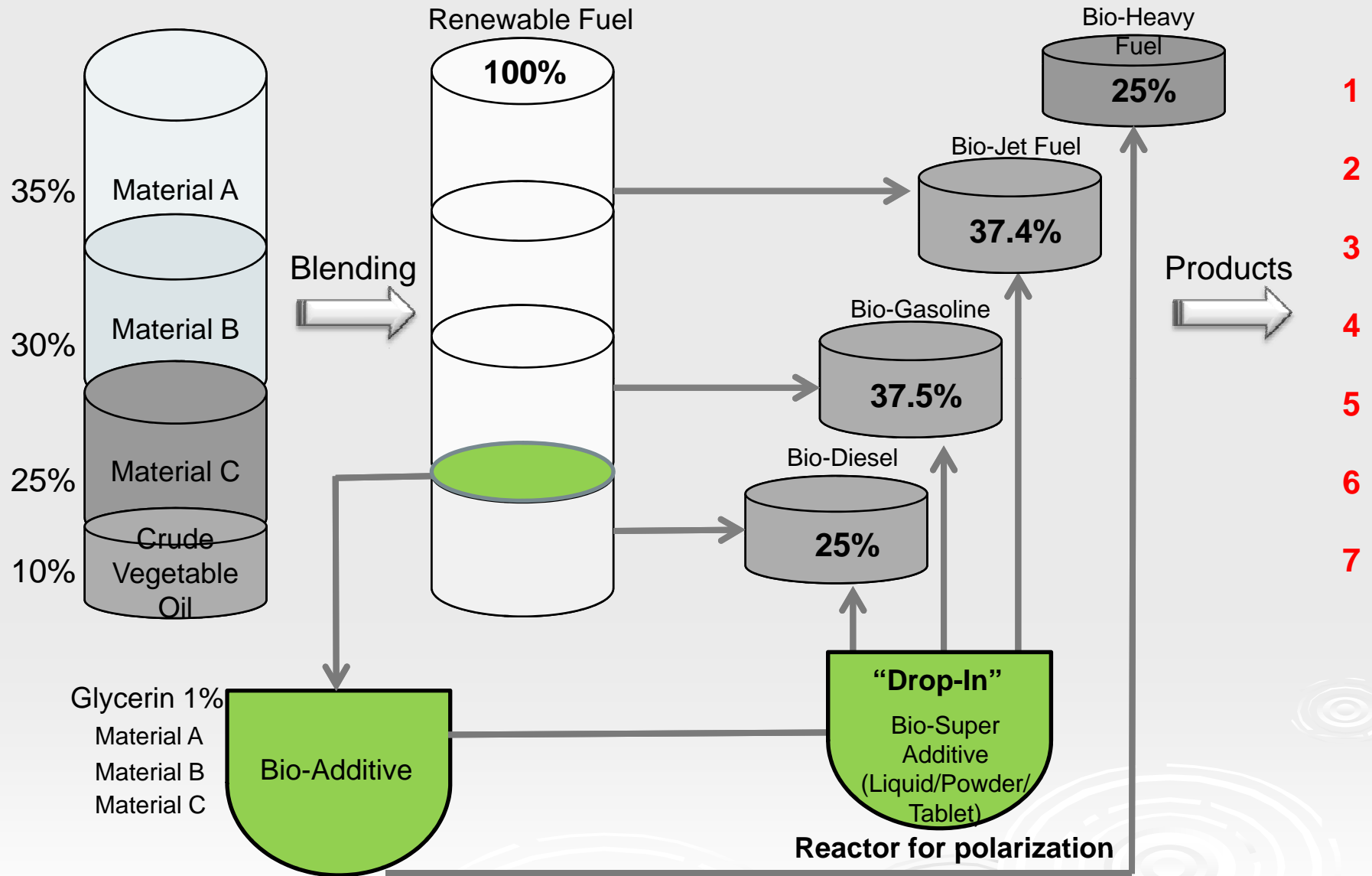
Wrong Incubation
for Tech Bus.



- **At the nano-scale**, surface and interface forces become dominant.
 - Adhesion forces
 - Capillary forces
 - Strain forces
- These forces can exceed forces that are often dominant in macroscopic structures, e. g. gravity.
- **Polarization Technology** allows for alignment of positive and negative ions of different elements. This process is achieved under high pressure and highly magnetic environment.
- **Rare earth** is one part of the main ingredients in order to produce Bio-fuel additives via Polarization Technology.



NANO-EMULSION & POLARIZATION TECHNOLOGY – PROCESS FLOW DIAGRAM



Offerings Towards New Economic Development

THE PROPOSED CLEAN ENERGY ECONOMY DEVELOPMENT PROGRAM FOR EGYPT							
BIONAS' OFFERING	BIONAS' BIOFUEL PRODUCTS	COMPOSITION				SAVINGS ON OIL CONSUMPTION (%)	REDUCE EMISSION (%)
		H2O (%)	METHANOL (%)	ADDITIVES (%)	FOSSIL FUELS (%)		
1. Application of new technology.	B20 Bio-Petrol	10	-	10	80 (Gasoline)	20	70 – 80
2. No further investment on facilities and infrastructures.	M30 Petrol	-	30	3	67 (Gasoline)	33	70 – 80
3. Consumers save 5 – 10% on daily fuel consumption.	B10-B30 Bio-Diesel	-	5 - 15	5 – 15	90 – 70 (Diesel)	10 – 30	60 – 78
4. Reduce emission with minimum 60%.	B10-B25 Bio-Jet Fuel	-	5 – 12.5	5 – 12.5	90 - 75 (Jet Fuel)	10 – 25	70 – 80
5. Establish new economy complement to existing policy towards fuel subsidy	B25 Bio-Heavy Fuel	25	-	1	74 (Heavy Fuel)	26	70 – 80
6. Create new export market	Bio Booster Tablet	-	-	5	95	5	60 – 70

YETKİLİ ÖLÇÜM İSTASYONU

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ARAÇ BİLGİLERİ

PLAKA NO 01bus34 TİP ONAYI Yok
ADI SOYADI
MARKA CITROEN
YAKIT TÜRÜ BENZİN MODEL 2011
ARAÇ CİNSİ Otomobil KATAL. KONV. YOK

RESMİ ÖLÇÜM DEĞERLERİ

	RÖLANTİ			YÜKSEK RÖLANTİ		
	Benzin	LPG	Min-Max	Benzin	LPG	Min-Max
CO	0.82	0	{ 0 3.5 }	0	0	{ }
CO2	13.75	0	{ 0 20 }	0	0	{ }
HC	224	0	{ 0 120 }	0	0	{ }
O2	0.49	0	{ 0 5 }	0	0	{ }
Lamb	0.991	0	{ .97 1.03 }	0	0	{ }

SONUÇLAR

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PERSONEL
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YETKİLİ ÖLÇÜM İSTASYONU

DOĞAN OTO LASTİK JANT RÜZGARLIBAHÇE MAH.
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ARAÇ BİLGİLERİ

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ADI SOYADI
MARKA CITROEN
YAKIT TÜRÜ BENZİN MODEL 2011
ARAÇ CİNSİ Otomobil KATAL. KONV. YOK

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CO2	13.75	0	{ 0 20 }	0	0	{ }
HC	224	0	{ 0 120 }	0	0	{ }
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	RÖLANTİ			YÜKSEK RÖLANTİ		
	Benzin	LPG	Min-Max	Benzin	LPG	Min-Max
CO	0.13	0	{ 0 3.5 }	0	0	{ }
CO2	14.75	0	{ 0 20 }	0	0	{ }
HC	7	0	{ 0 120 }	0	0	{ }
O2	0.02	0	{ 0 5 }	0	0	{ }
Lamb	0.999	0	{ .97 1.03 }	0	0	{ }

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	RÖLANTİ			YÜKSEK RÖLANTİ		
	Benzin	LPG	Min-Max	Benzin	LPG	Min-Max
CO	0.13	0	{ 0 3.5 }	0	0	{ }
CO2	14.75	0	{ 0 20 }	0	0	{ }
HC	7	0	{ 0 120 }	0	0	{ }
O2	0.02	0	{ 0 5 }	0	0	{ }
Lamb	0.999	0	{ .97 1.03 }	0	0	{ }

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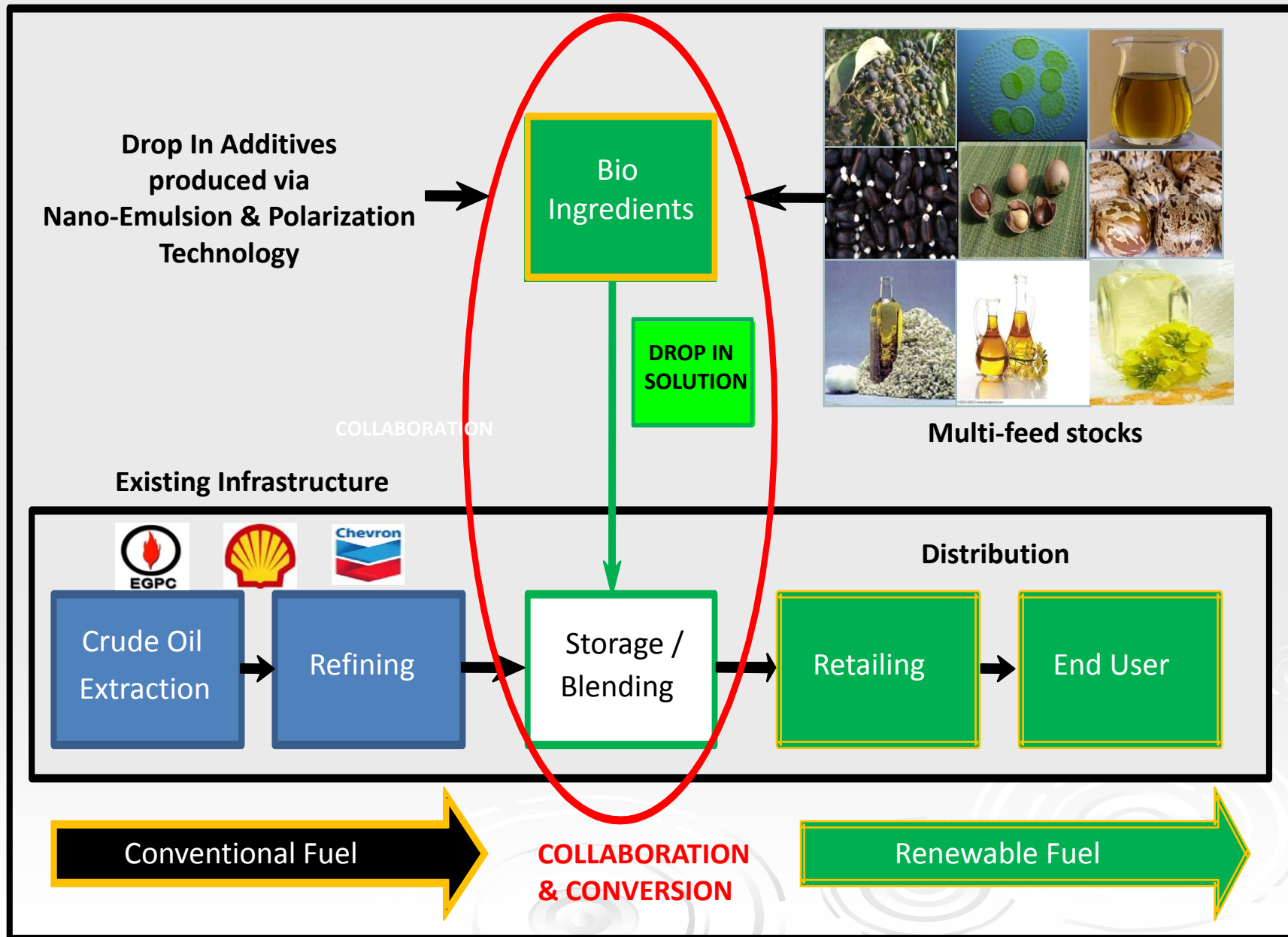
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Logistic and Commercial Flow Process

Collaboration and Conversion Process



Existing Supply Chain of Biofuel Production



Innovative Supply Chain of Biofuel Production



Setting the Right Course

The Integrated Whole System Design (WSD) Approach is to be utilized when implementing any roadmap and/or developmental plan for Effective Rural Development

- ☐ Optimizing whole systems for all possible benefits often boosts end-use overall system efficiency as compared to the approach that investigates individual components for single benefits;
- ☐ Utilize the enabling tools (Nanotechnology, nano-biotechnology, etc.) to develop and use the appropriate technologies that take into consideration availability of natural resources in any given region;
- ☐ Build the **Total National Capacities** in those technological areas, on which Sustainable Rural Development becomes achievable
- ☐ Equity through Innovative Practical Financial Models



Setting the Right Course

Incorporate the five ideals of the UN High-level Panel on the Post-2015 Development Agenda (HLP) in a new innovative working model to achieve sustainable development:

- ☐ Put sustainable development at the core (WSD Approach);
- ☐ **leave no one behind** (social justice leading to ensured Equity)
- ☐ forge a new global partnership that focuses on Eradication of poverty and transforming economies through sustainable development;
- ☐ **transform economies for jobs and inclusive growth**;
- ☐ build peace and effective, open and accountable public institutions.

Sustainable development requires **changes in human values, attitudes, and actions**, as sustainability science is in itself rooted in values and hence many proposed sustainable development solutions depend on **the values and the attitudes of potential stakeholders**.



Setting the Right Course

The Novel Technologies-Equal Opportunities-Ensured Equity Nexus

❑ The example illustrates the easiness with which sustainable development goals could be achieved when science and the proper set of values and are utilized;

❑ The scenario proposal aims at **increasing renewable energy utilization** in the national energy mix of Developing Countries, while **combating climate change through innovative biofuel technologies** that reduce GHG emissions of fossil fuels by 60-70% (approved by the Environmental Protection Agency (EPA), United States).

❑ The used modality will ensure jobs and wealth creation within that State's Economy. This program model has been working successfully for over 5 years now in Malaysia, Philippines, and Indonesia and has already enhanced the livelihoods of about two million poor farmers in 600,000 villages in these countries.



Setting the Right Course

Through an affordable and innovative development programme that uses the latest cost-effective polarization technology in biofuel production, the project guarantees through individually signed contracts (newly formed SMEs) with the involved farmers the following benefits:

1. Free Jatropha seeds and fertilizers for the contracted land size as a start-up package;
2. GOOD guarantee buy back of harvest at a gratifying price compared with the international prices (\$150USD versus \$300USD);
3. The financial return of the project is split into two portions, where the price of the harvest (Jatropha seeds) is paid to the farmers, while the investing private company is satisfied with the financial return of selling the Jatropha oil to produce bio-fuels;



Setting the Right Course

Through an affordable and innovative development programme that uses the latest cost-effective polarization technology in biofuel production, the project guarantees through individually signed contracts (newly formed SMEs) with the involved farmers the following benefits:

4. Farmers will receive the **crucial know-how and best practices** that has acquired in the field, and which is a must-have factor for the success of this project;
5. Signing contracts with the impoverished farmers will bring the **sense of partnership and ownership** into these farmers and hence ensuring high success rate for the project;



100% financing of Jatropha Seeds to plant 10 acres/farmer





19 10 2008









18 10 2008

1 Planter : 1 Nursery





20 7 2008









Multiple Branches



Planting in swampy areas



Pruning



700kgs/hectare/month



Buy Back Guarantee





Latest R&D, harvest on the 2nd month with high yield

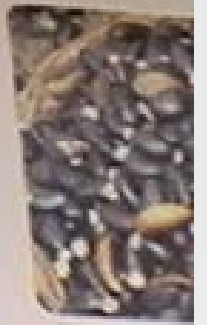


Bionas Press Mill in remote areas





PUSAT JUAL BELI HASIL BUAH JARAK (JATROPHA)
PUSAT PEMROSESAN MINYAK JARAK
PUSAT LATIHAN INDUSTRI BIO-FUEL JATROPHA CURCAS
www.bionas.com.my / www.pers.com.my















Machines to produce Jatropha seedcake pallet and briquette (Biomass)



Jatropha Biomass – Pallet & Briquette



Recommendations

Raising awareness and offering technical assistance to DCs (MCs) regarding: (in several countries now)

- ☐ Use the Dynamic Strategic Fit (DSF) in designing developmental programs;
- ☐ Availability of new and innovative technologies for production of cost-effective bio-fuels;
- ☐ Setting up of the required capacity building programs for TT;
- ☐ Promoting the NT-EO-EE Nexus approach to ensure successful implementation of program on MEGA Scale



☺THANK YOU☺

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