

Biofuels

-- Policy Perspectives

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Development Alternatives

5th International Biofuels Conference

New Delhi

7 February 2008



Development Alternatives

Primary Concern Implicit in Current Debates

**Liquid substitutes for fluid fossil
fuels – petroleum and gas –
for transportation**





Cities



... Runaway Consumption ...

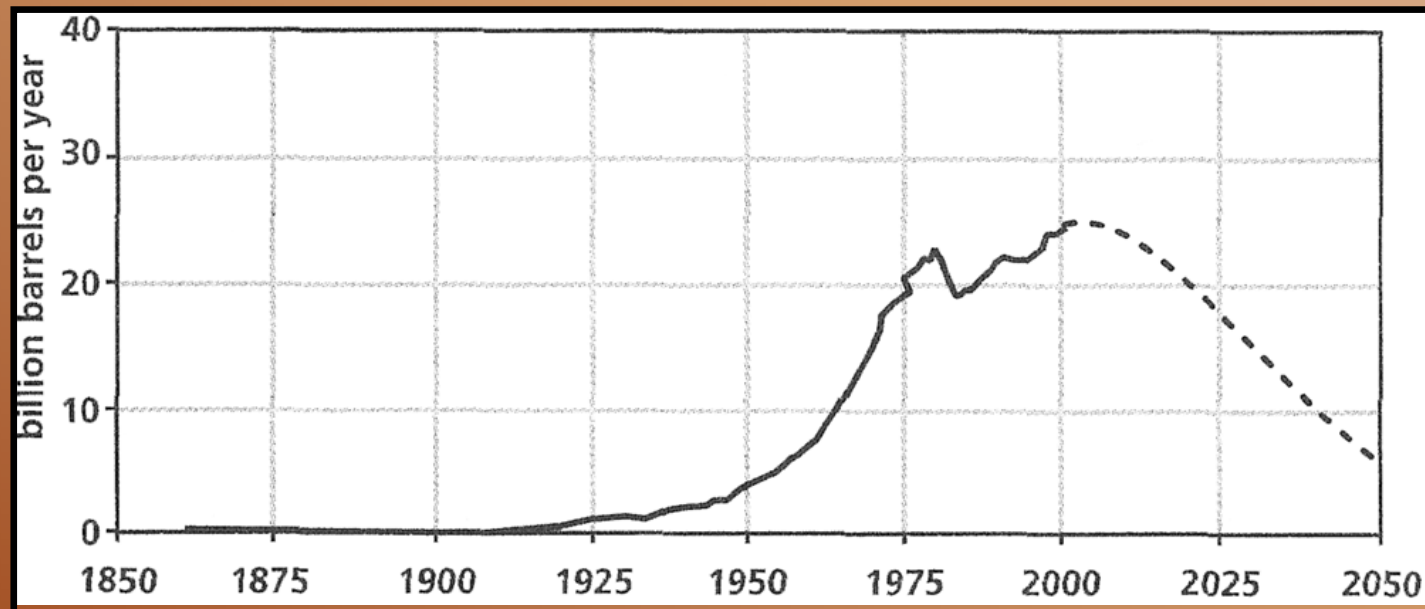


...Roads ...



Oil and gas peaks

Oil production peaks before 2020



Source: Defeyes, 2001: Hubbert's Peak

Gas

Econ. growth (%)	0	2,8	5
Year of depletion	2260	2075	2055

Source: Meadows *et al.* 2004: Limits to Growth - The 30-Year Update

Policies

- **Augmenting Supply**
- **Expansion of Production**
- **Technology Choice**
- **Innovation**
- **Sustainability**



Optimizing Societal Outcomes



Competing Resources

- **Fuel vs Food**
- **Fuel for the Rich vs Food for the Poor**
 - **Fuel for Rich vs Fuel for the Poor**
 - **Fuel for Now vs Fuel in the Future**

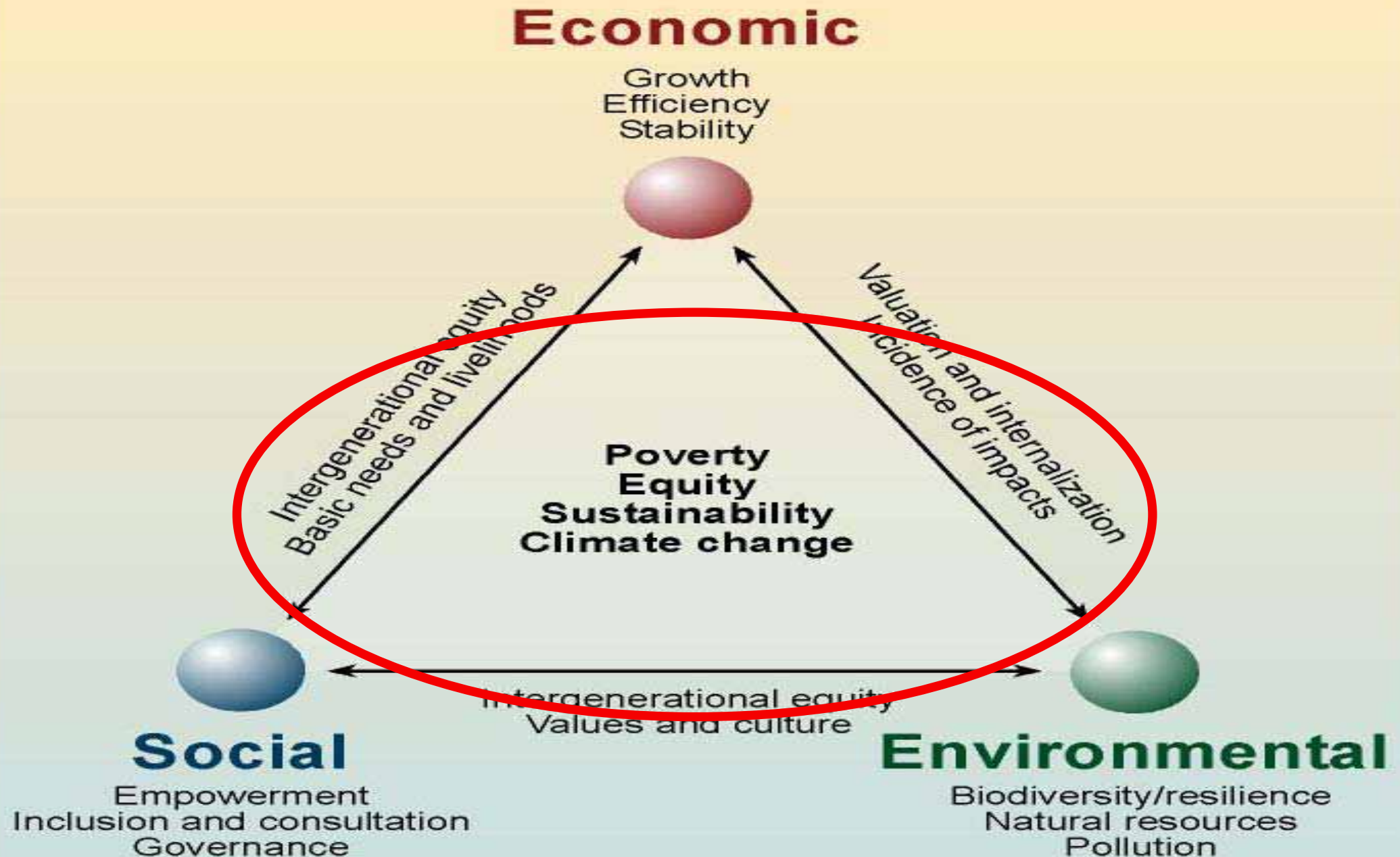


Sustainability = Equitable Access

- **Now and Tomorrow**
- **Here and There**



Key elements of sustainable development and interconnections



Calories Required to Produce 100 Calories of Biofuel

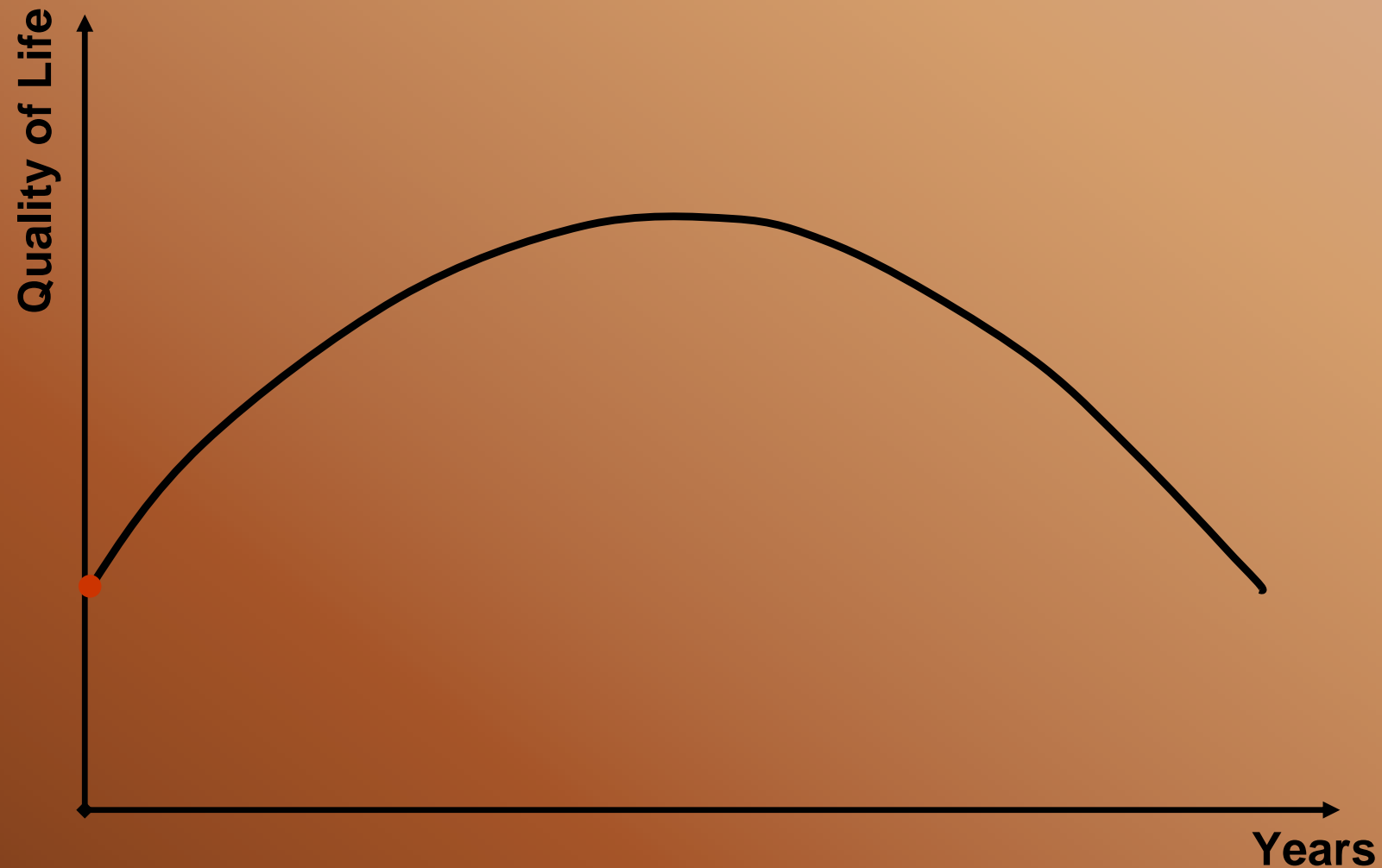
➤ Ethanol

- Corn 129
- Switchgrass 145
- Wood biomass 157

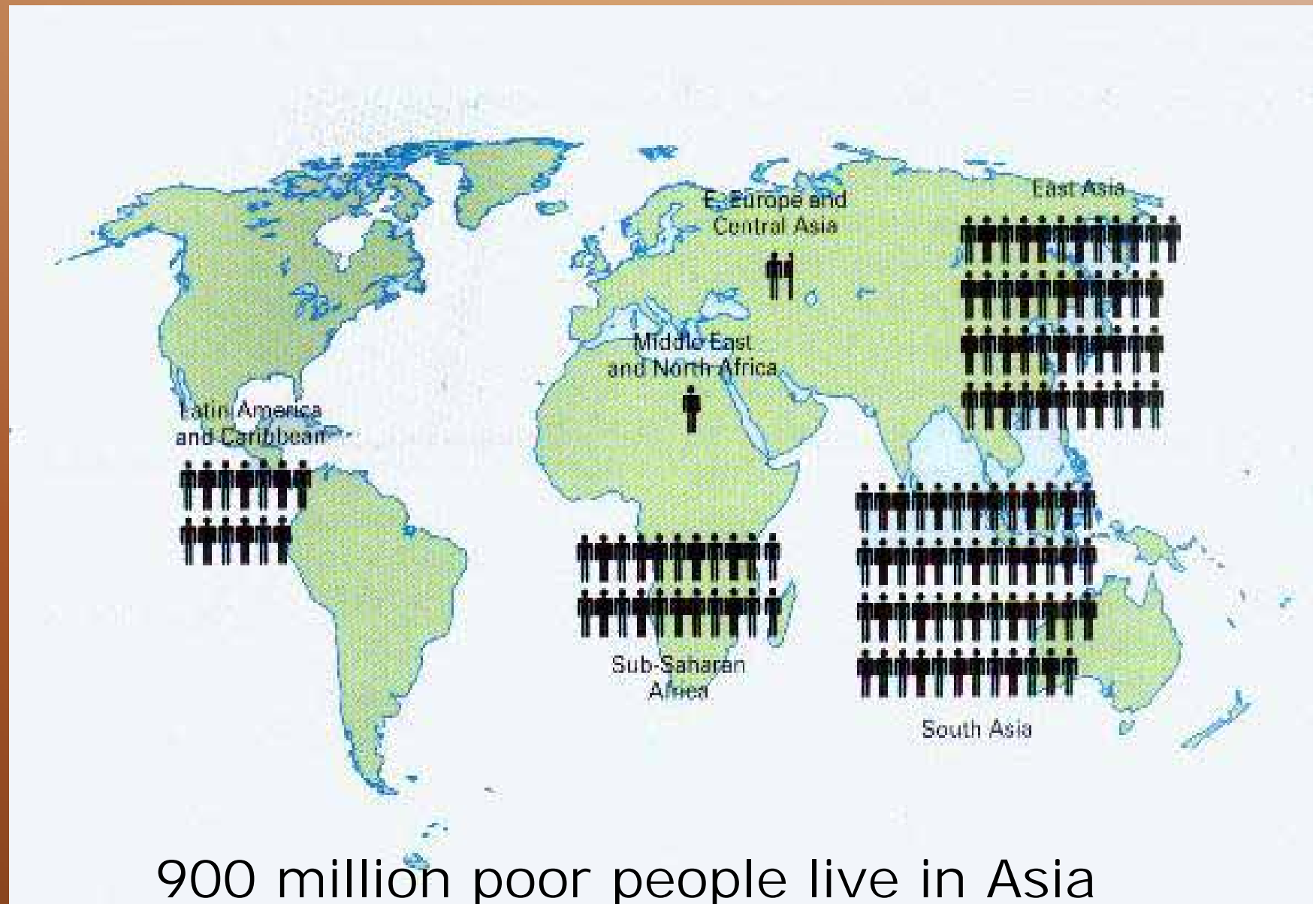
➤ Biodiesel

- Soybean 127
- Sunflower 218

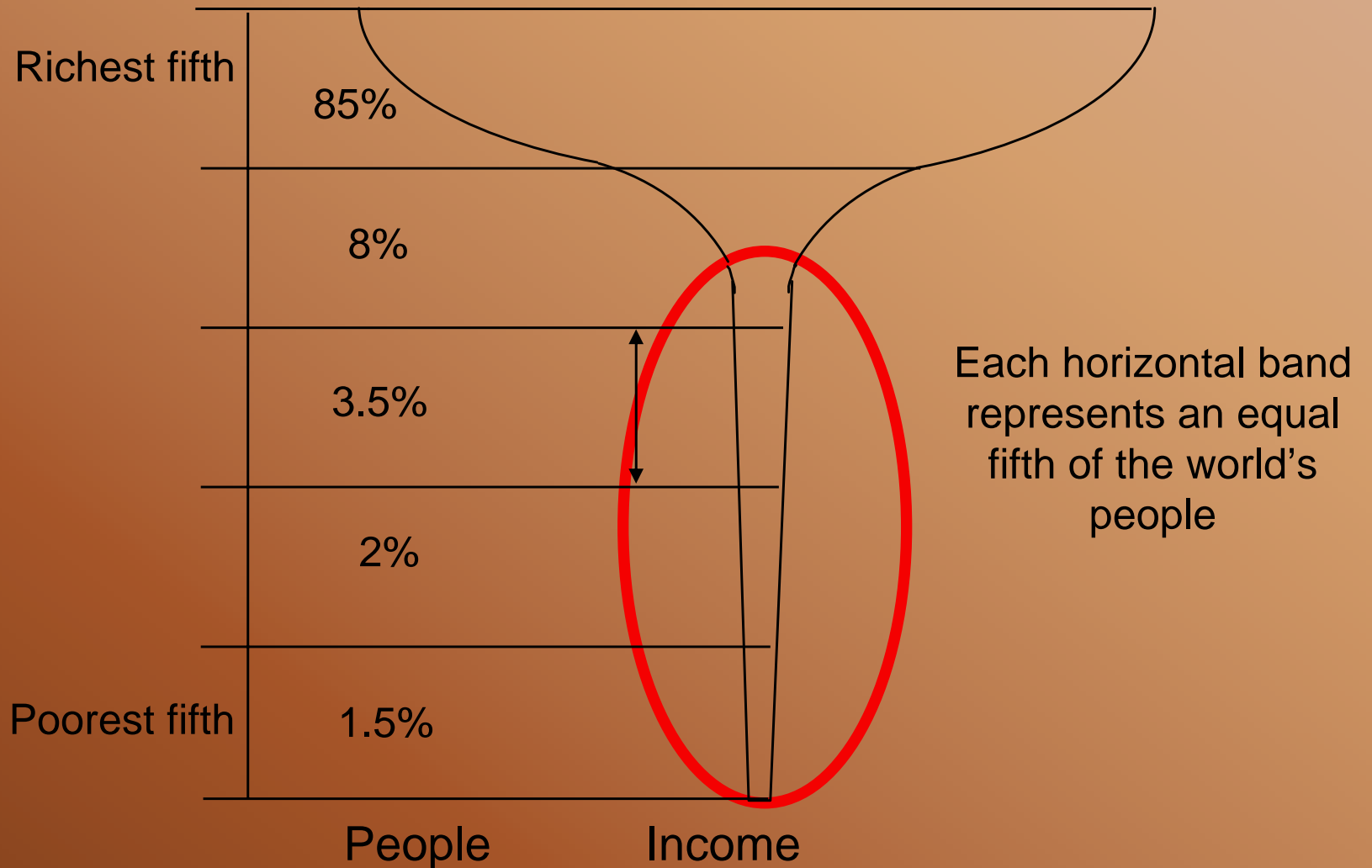
The Likely Results of a Copy-Cat Approach



Poverty



Global income distribution



Erosion



Deserts growing by
50 thousand square km per year

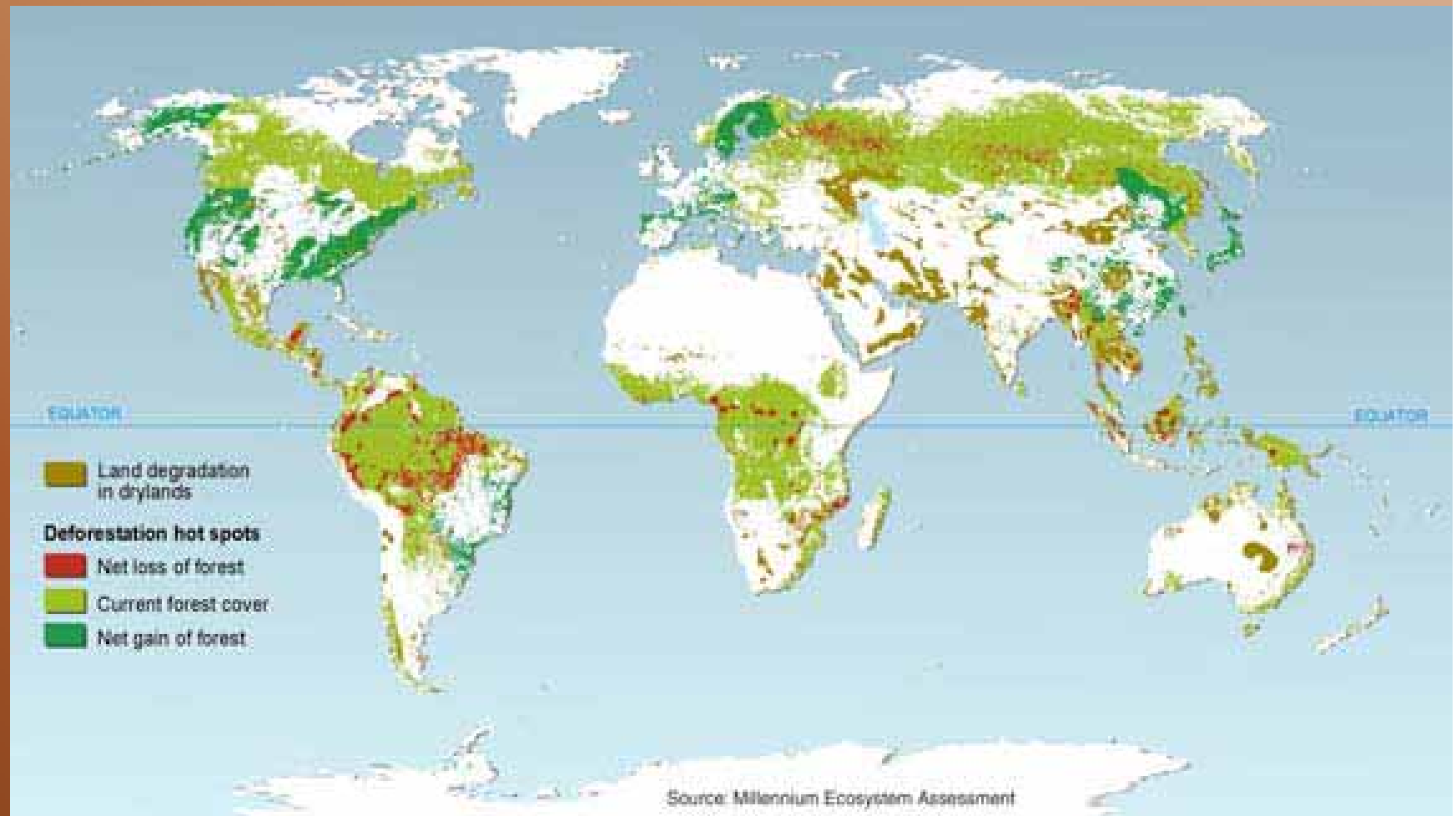


Primate Habitat

Remaining 60,000 Orang Utans will disappear within 15 years at current rates of forest clearing for Oil Palm and Other Monocultures



Forest depletion



Increasing water stress

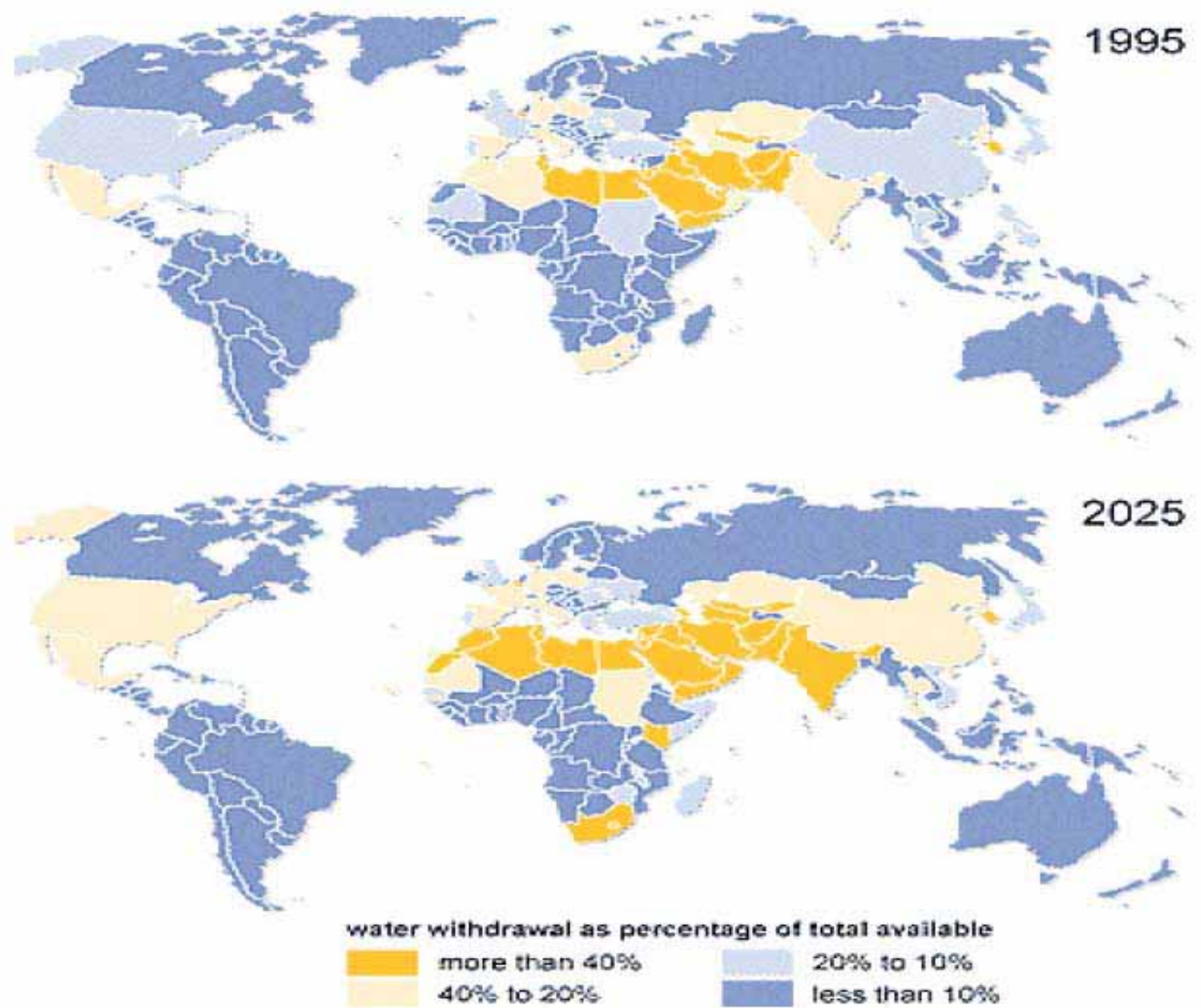
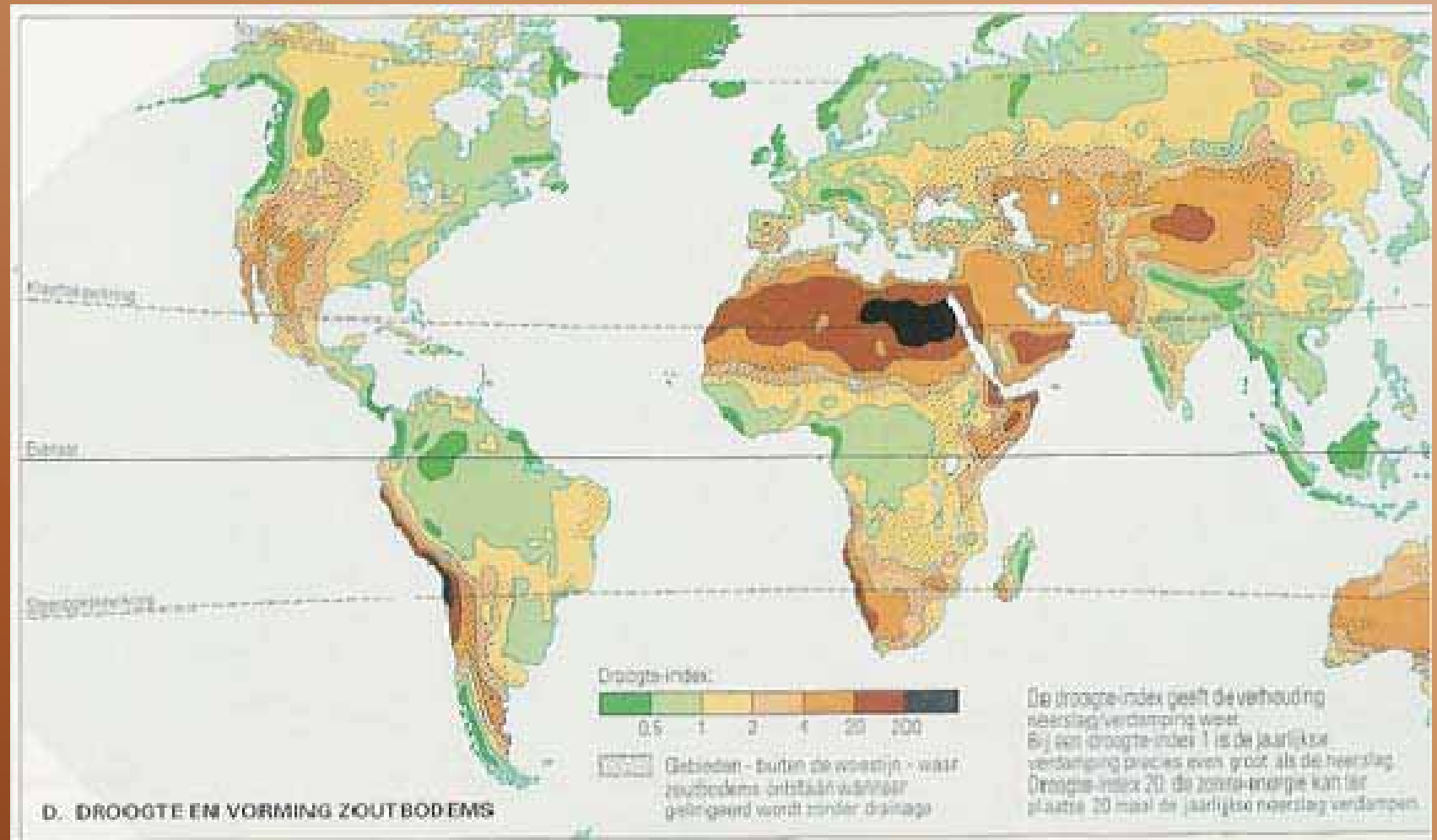


Figure 1: Water stress 1995-2025 (source: GEO-2000 The State of the Environment (UNEP))



Global dry areas and salinisation



Aridity index: precipitation/evaporation

40% of the earth surface is arid: inclined to salinization

Biofuels Policy Making -- Context

- **In Isolation of Other Issues**
 - **Population Growth**
 - **Urbanisation**
 - **Consumption Patterns**
 - **Technology**
- **Linear Thinking**
 - **Incremental Change**
 - **Current Constraints, Solutions**

Commercial Energy Use in India

➤ Electricity	23%
➤ Construction	21%
➤ Transport	18%
➤ Industry	17%
➤ Domestic	15%
➤ Other	6%



Biofuels

- **Solid**
- **Liquid**
- **Gaseous**





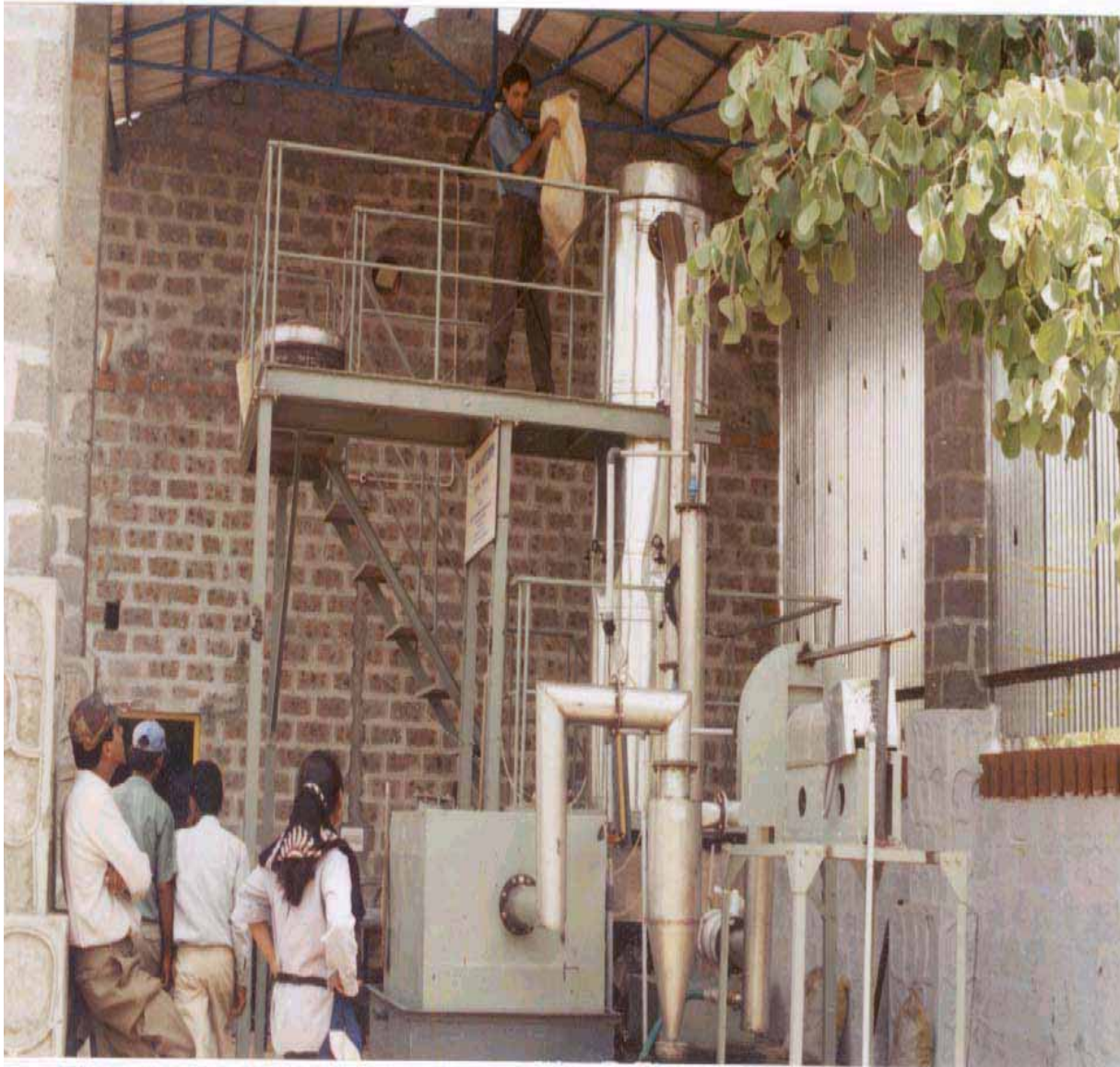
Liquid Fuels for Urban Systems and Transport



Energy in Agriculture



Development Alternatives



**> 2.5 billion
people
do not have
commercial
energy
let alone
liquid fuels
or electricity**



Development Alternatives





**The
50%**

**Bottom
of the
Pyramid**



Ipomea

**The
Shame-
less
One**

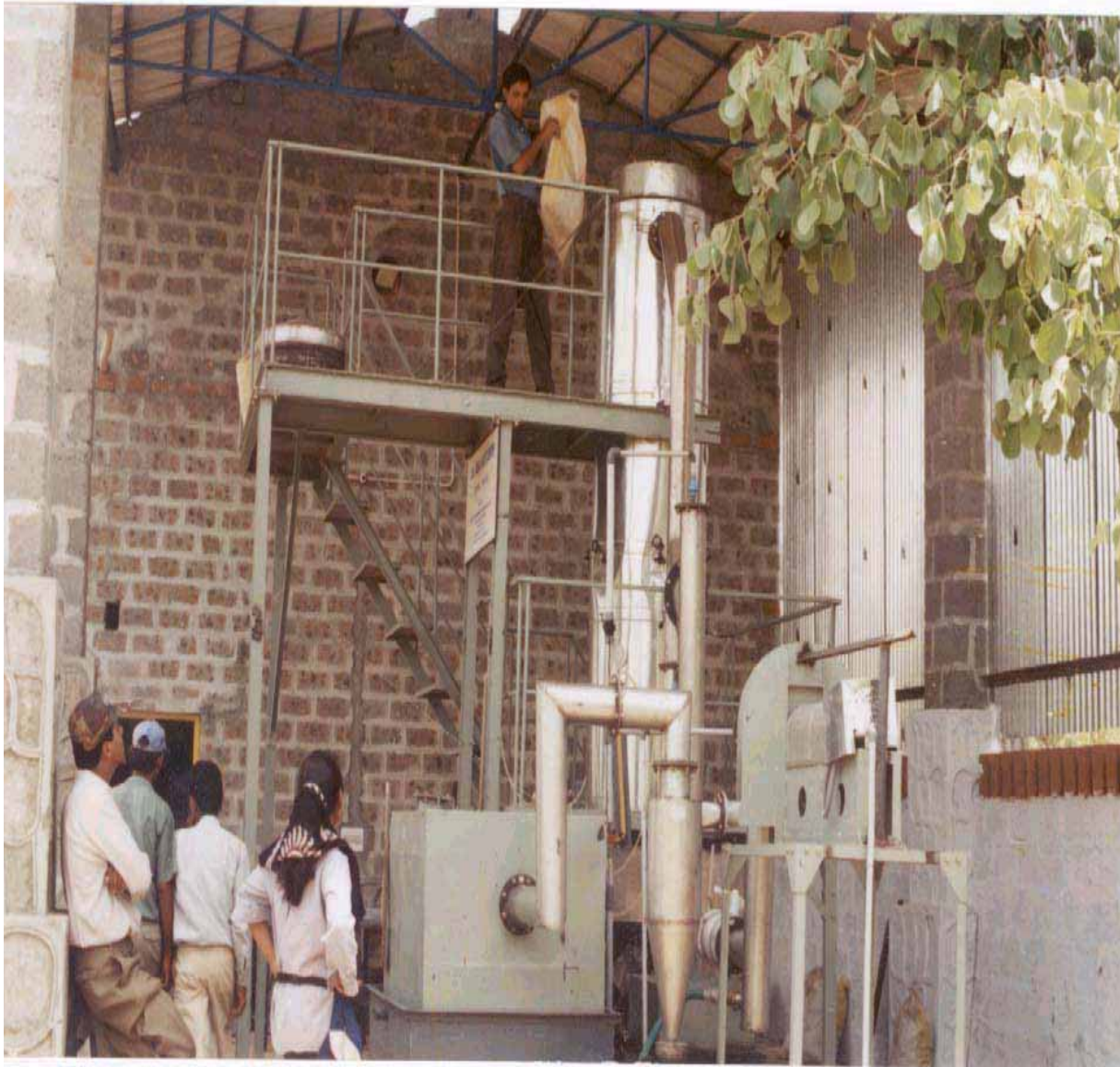


Development Alternatives





Development Alternatives



Energy Efficiency Issues

- **First Law**
- **Second Law**
- **Third Law**



Energy – Which?

- **S u b s y s t e m – O p t i m i z e !**
- **Whole System – Sub-Optimize?**

Remember! Biofuels

Are Only One of Several Options

Also: Conservation, Other Fuels,

New Conversion Technologies



Policies based on Reality

➤ Experiences

- Development Alternatives
- DESI Power
- ZERI
- OASE



Feasible and Implementable



Experiences

– Development Alternatives

➤ Solid Biofuels

- Cooking, Charcoal**
- Electricity Generation**
- Forest Regeneration**

➤ Conservation = Energy Saving

- Construction**





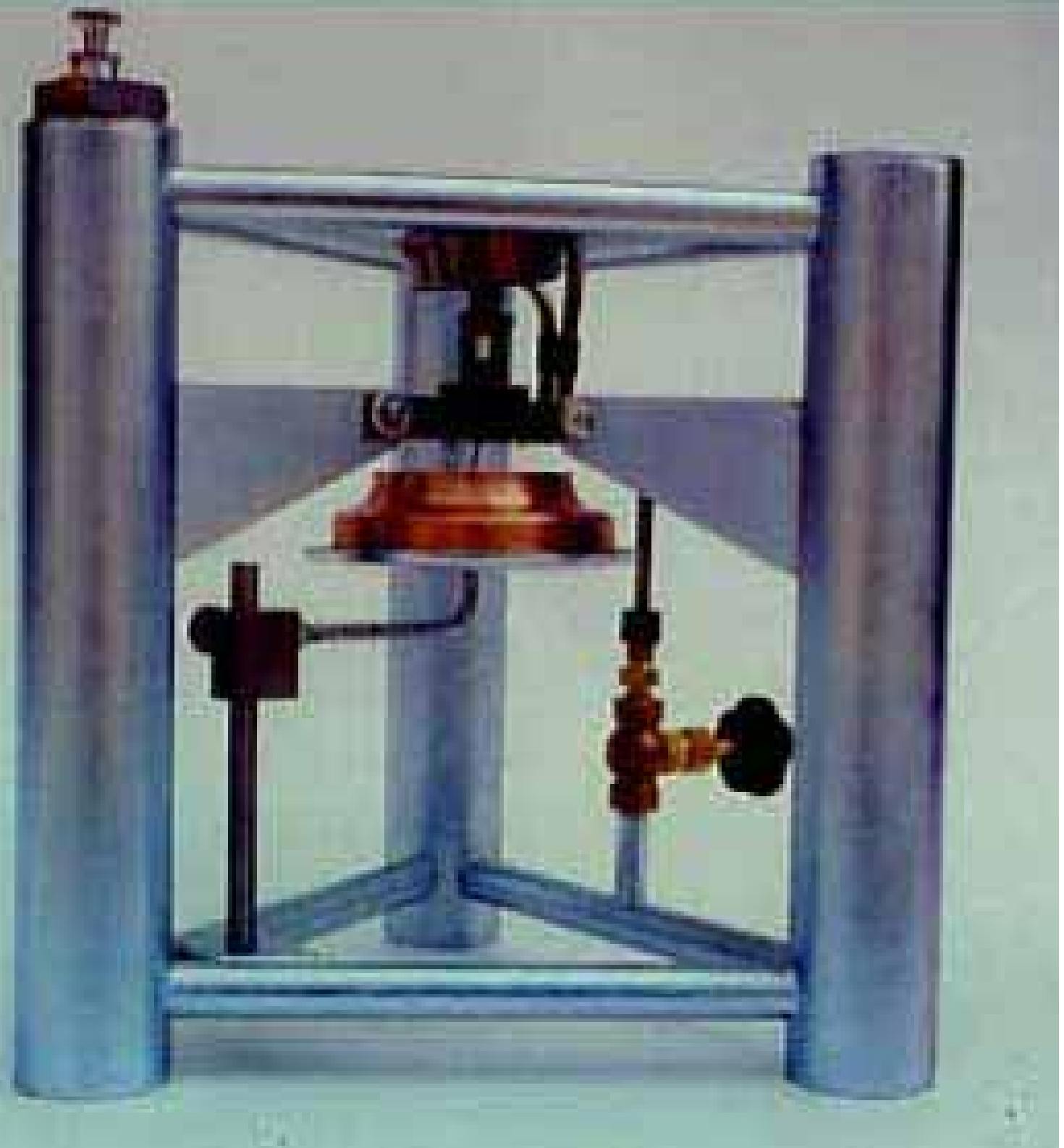
TARA WOODSTOVES



Plant Oil Stove

Fuel:

- Non-Edible Oils
- Kerosene





Plant Oils as Bio-fuels in India

- Jatropha
- Castor seed
- Rapeseed
- Karanj
- Taramira
- Palm acid



Experiences – ZERI

(Zero Emission Research & Initiatives)

➤ Biofuels

- **Wood**
- **Biodiesel**
 - **from Oil Palm**
 - **from Jatropha**
- **Forest Regeneration**



**SAVANNAH TO FOREST
GENERATES CARBON SINK
FACTOR 16 IN 5 YEARS**

FOREST CREATED WITH FUNGUS

INCREASES PRECIPITATION

GENERATES DRINKING WATER

FOREST AND WATER GENERATE

JOB AND SUSTAINABLE

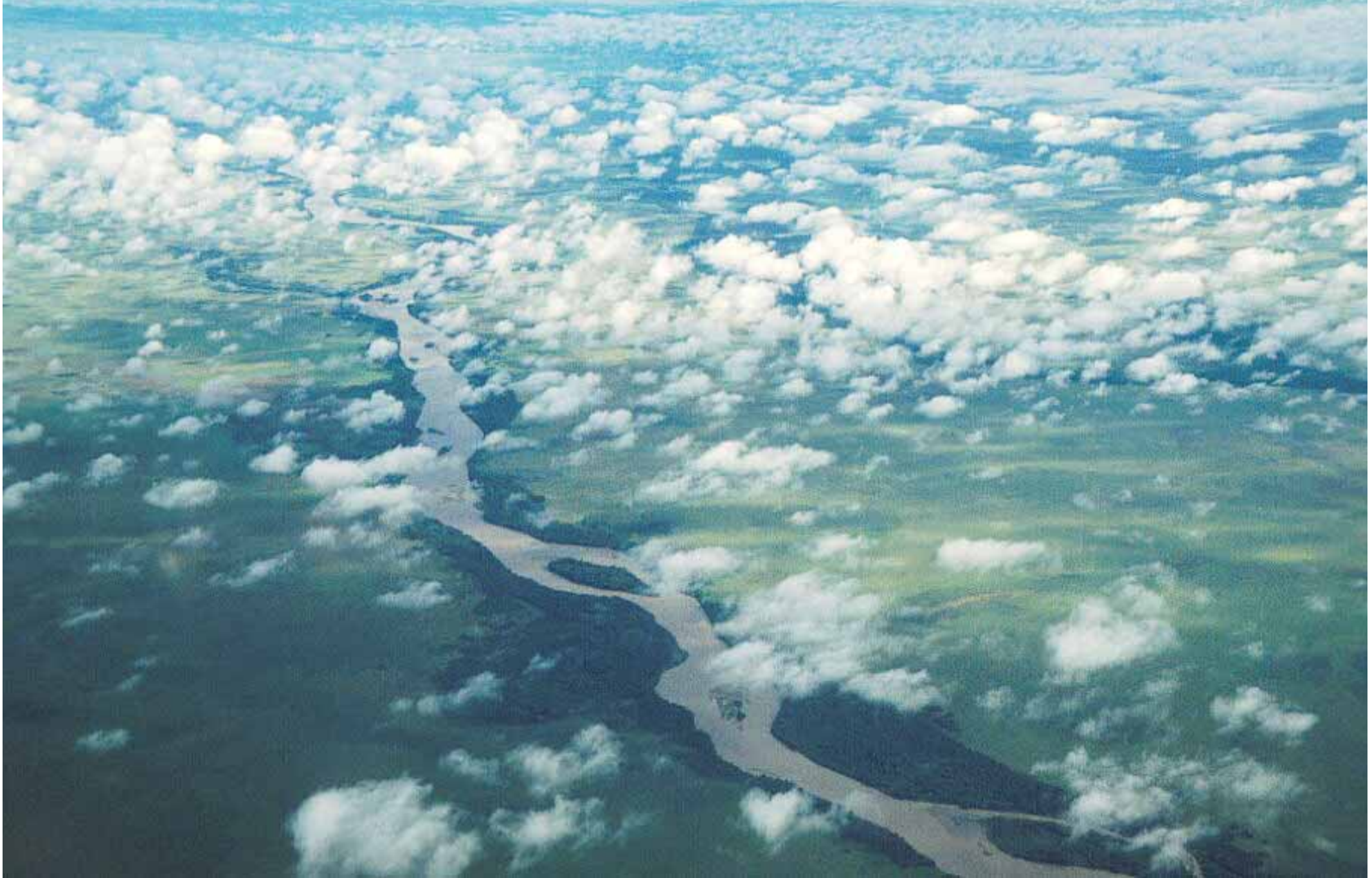
COMMUNITIES, AND MORE





★ THE SAVANNAH IN VICHADA

Development Alternatives



WATER IS ABUNDANT BUT PH LOW

Development Alternatives



DRINKING WATER

CARBON SINK

BIODIVERSITY

BIOFUELS

**SUSTAINABLE
COMMUNITIES**

SAVANNAH



Table 3: Vegetable Oil and Biodiesel Properties

Type Oil/Fat	Melting Range, °C			Iodine Value	Cetane Number
	Oil/Fat	Methyl Ester	Ethyl Ester		
Coconut oil	20-24	-9	-6	8-10	70
Palm kernel oil	20-26	-8	-8	12-18	70
Palm stearine	35-40	21	18	20-45	85
Palm oil	30-38	14	10	44-58	65
Tallow	35-40	16	12	50-60	75
Lard	32-36	14	10	60-70	65
Olive Oil	-12	-6	-8	77-94	60
Palm oleine	20-25	5	3	85-95	65
Rapeseed oil, h. cruc	5	0	-2	97-105	55
Cotton seed oil	0	-5	-8	100-115	55
Rapeseed oil, l. cruc	-5	-10	-12	110-115	58
Corn oil	-5	-10	-12	115-124	53
Sunflower oil	-18	-12	-14	125-135	52
Soybean Oil	-12	-10	-12	125-140	53

Gaviotas Transesterification Plant





Experiences – ODE

(Ocean Desert Enterprises Ltd)

➤ Biosaline biomass

(charcoal, energy, timber, paper, CO₂ seq., food)

- Experiments and R&D in Netherlands, Germany, Spain, Mexico, Dubai, India, Bangla Desh, Pakistan, Australia



Greening the desert



Biosaline agriculture:

Turning wastelands into productive lands



Scaling Up

Needs

- Product standardisation and technology certification
- Active engagement of industry;
boiler and engine manufacturers
- Financial incentives linked to service delivery and performance
- Innovative financing for ESCOs
- Feed-in Tariffs



Research Agenda

- **Inventories of Oil Bearing Species**
 - **Trees**
- **Energy Use Technologies**
- **External Combustion**
 - **Steam Cycle**
 - **Sterling Cycle**
- **Downscaling Existing Technologies**



Action Agenda

- **Develop Multiple “Crop” Methods**
- **Create Biomass Energy Banks**
- **Remove Complexities for Approval of Small CDM Projects**
- **Develop Creative CDMs:**
 - **Sequestration**
 - **Carbon Neutral Fuels**
 - **Clustering and Community Development**



Biomass Energy Banks

a new initiative for

- Effective aggregation of biomass resources
- Processing of primary materials
- Transaction of energy products and services
- Ensuring energy security



Policy Agenda

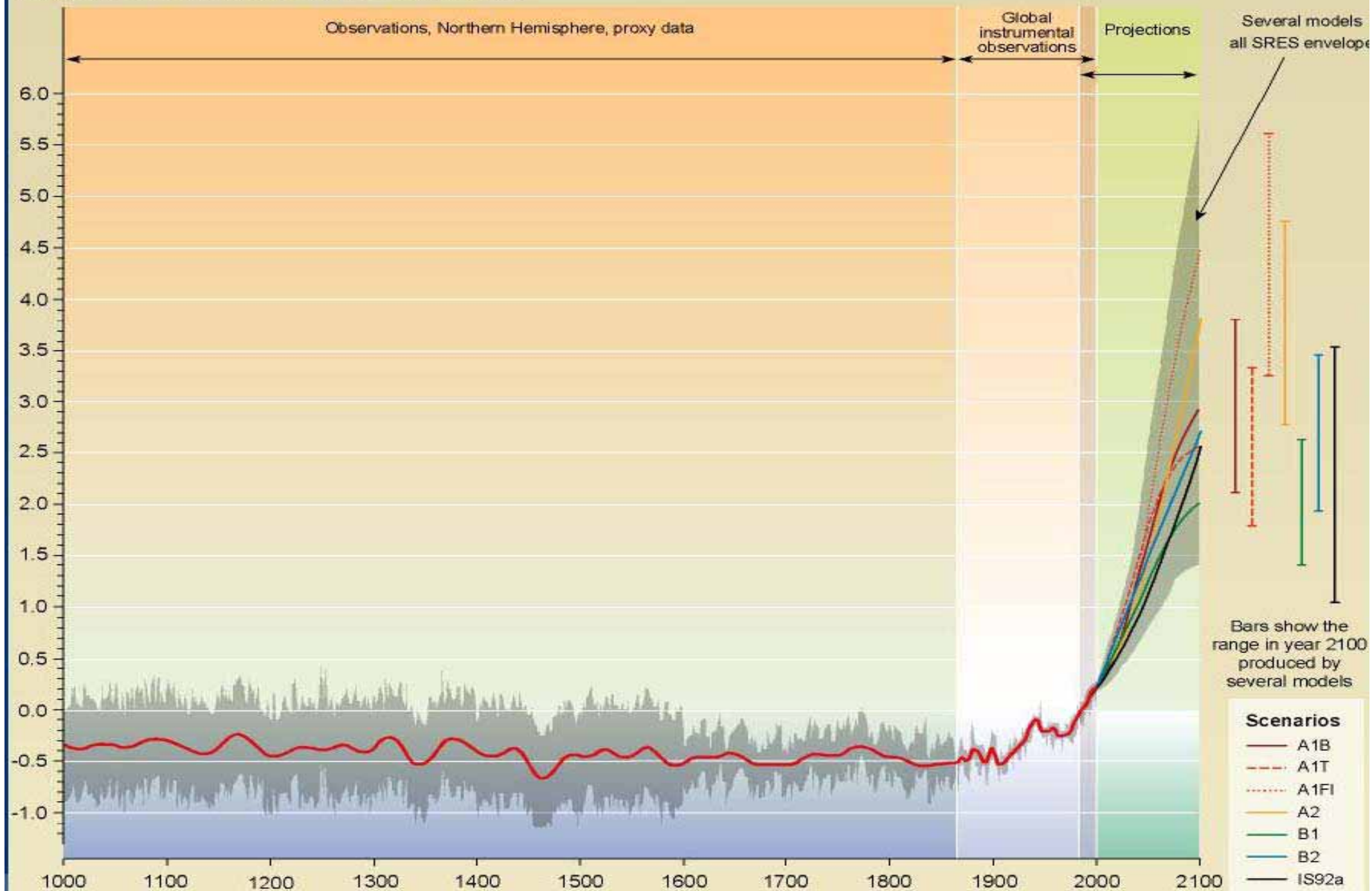
- **Remove Subsidies that Promote Fossil Fuel Use**
- **Introduce Taxes to Encourage Full Cost Pricing**
- **Support Research**
- **Establish Technical Support Systems**
- **Regional Planning to Reduce Need for Transportation**



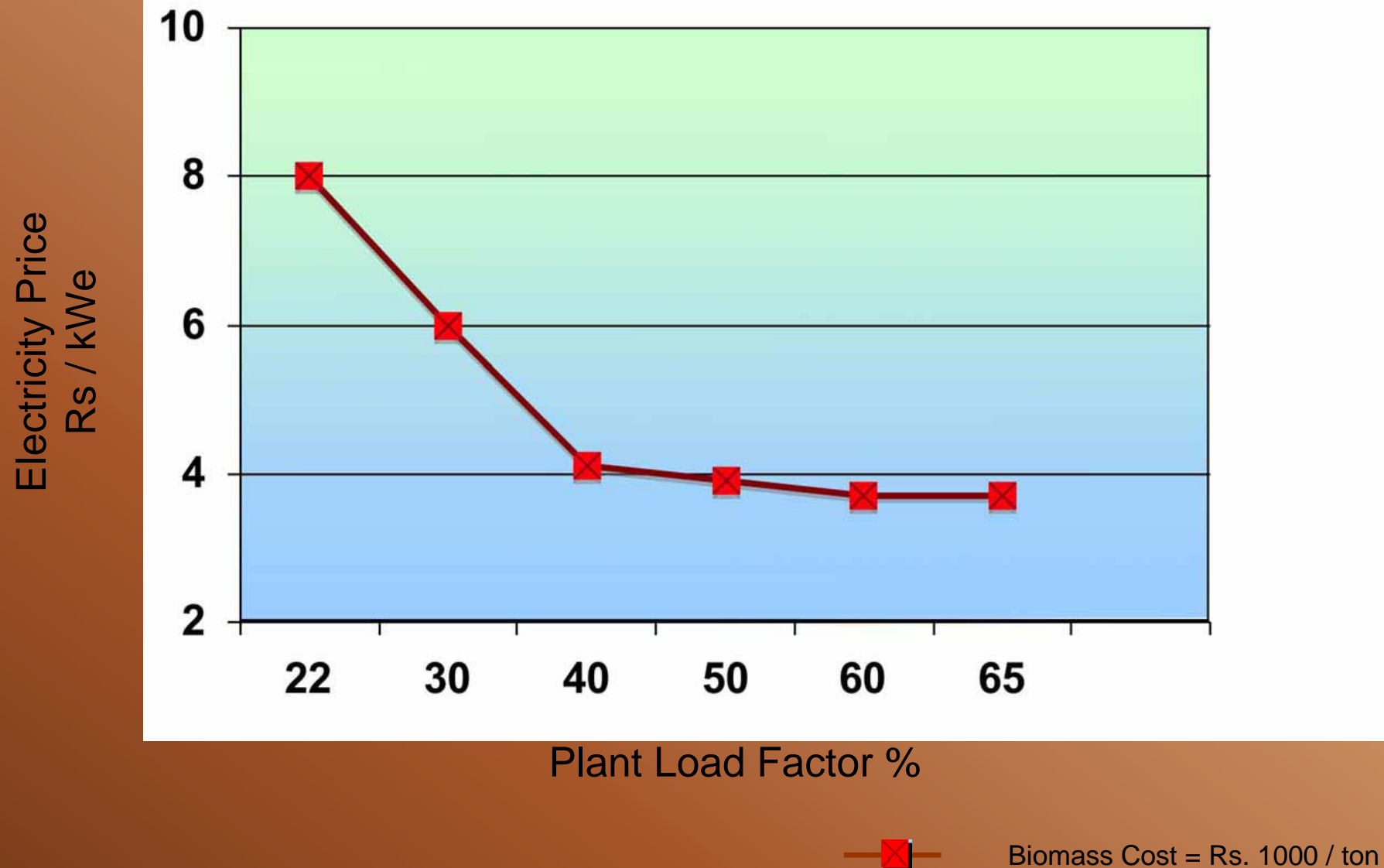


Variations of the Earth's surface temperature: year 1000 to year 2100

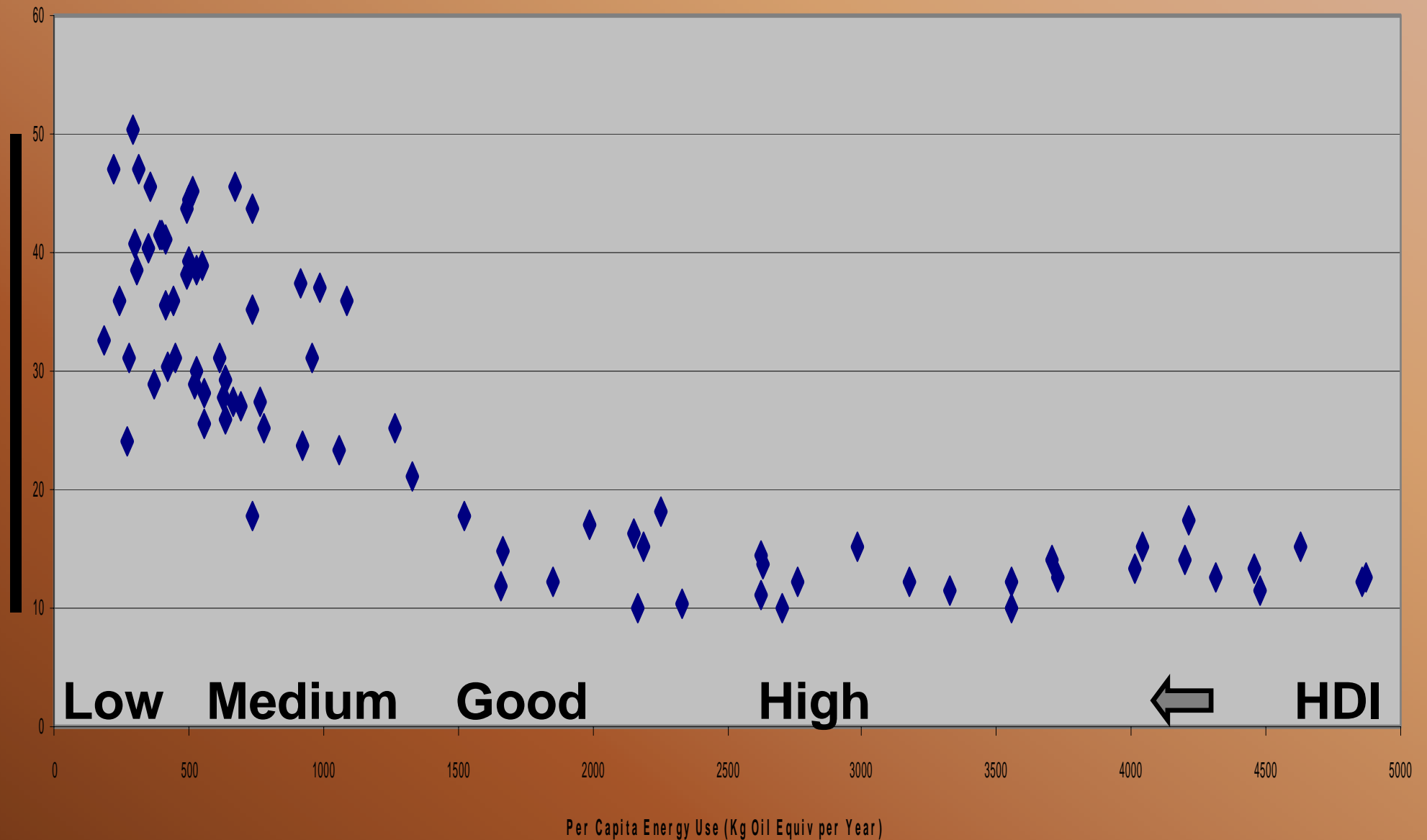
Departures in temperature in °C (from the 1990 value)



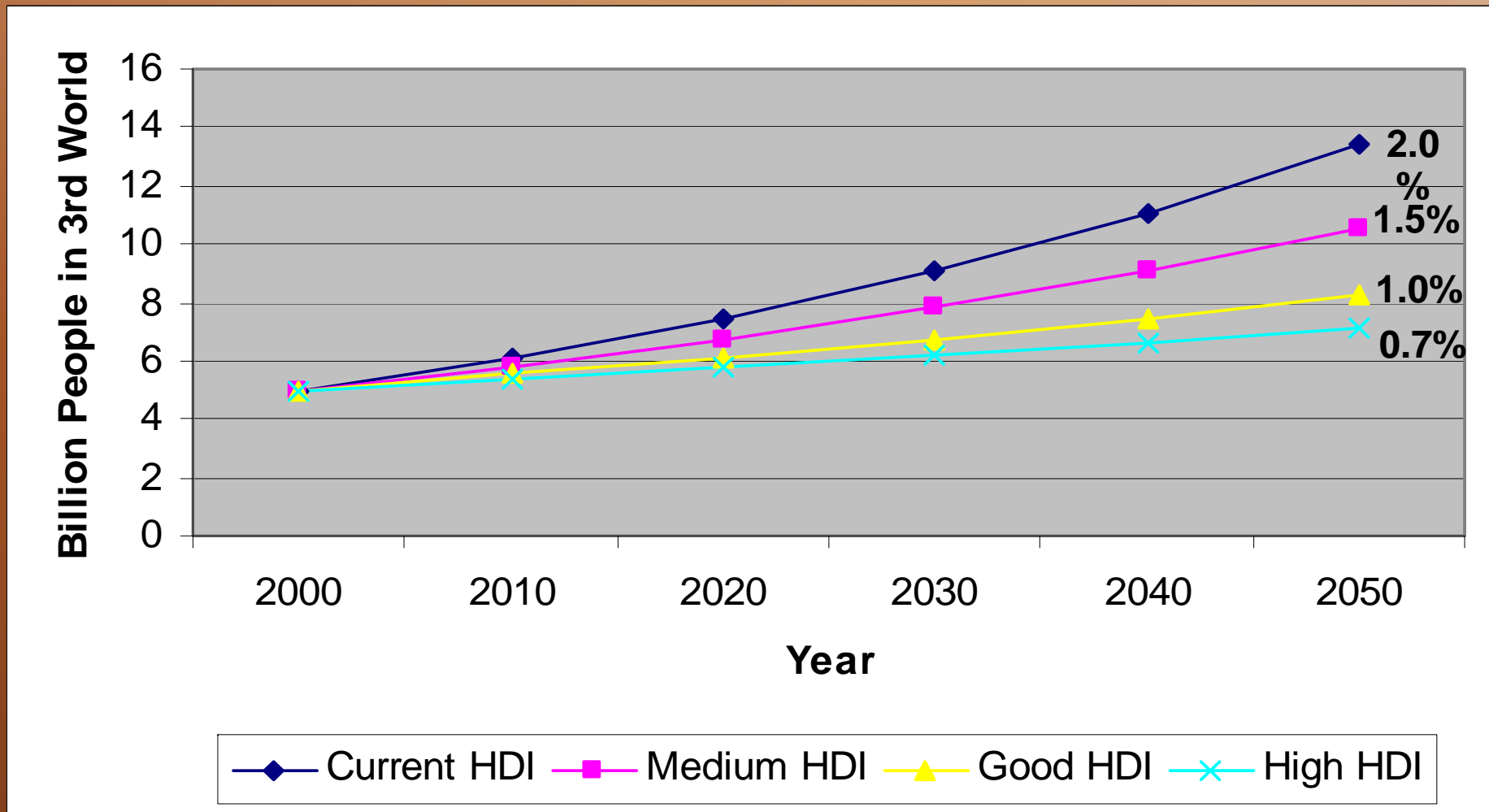
DESI Power_EmPower partnership Programme
Electricity Price with a Pure Gas Engine
(2 units / 33 kWe each)



Human Fertility and Energy Use



HDI and Population Growth



Global Population in the Year 2050

HDI in the 3rd World:

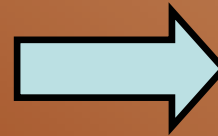
If Low HDI (2.0%) Continues: **13.5 Billion**

With rise to Medium HDI (1.5%) **10.5 Billion**

With rise to Good HDI (1.0%) **8.2 Billion**

With transition to High HDI (0.7%) **7.0 Billion**

BAU



***Several Billion
Extra People***



Emerging Issues Needing Action

- Effective Incubation
 - Plant oil energy solutions
- Scaling Up of Services
 - Briquetting
 - Biomass gasifier power systems



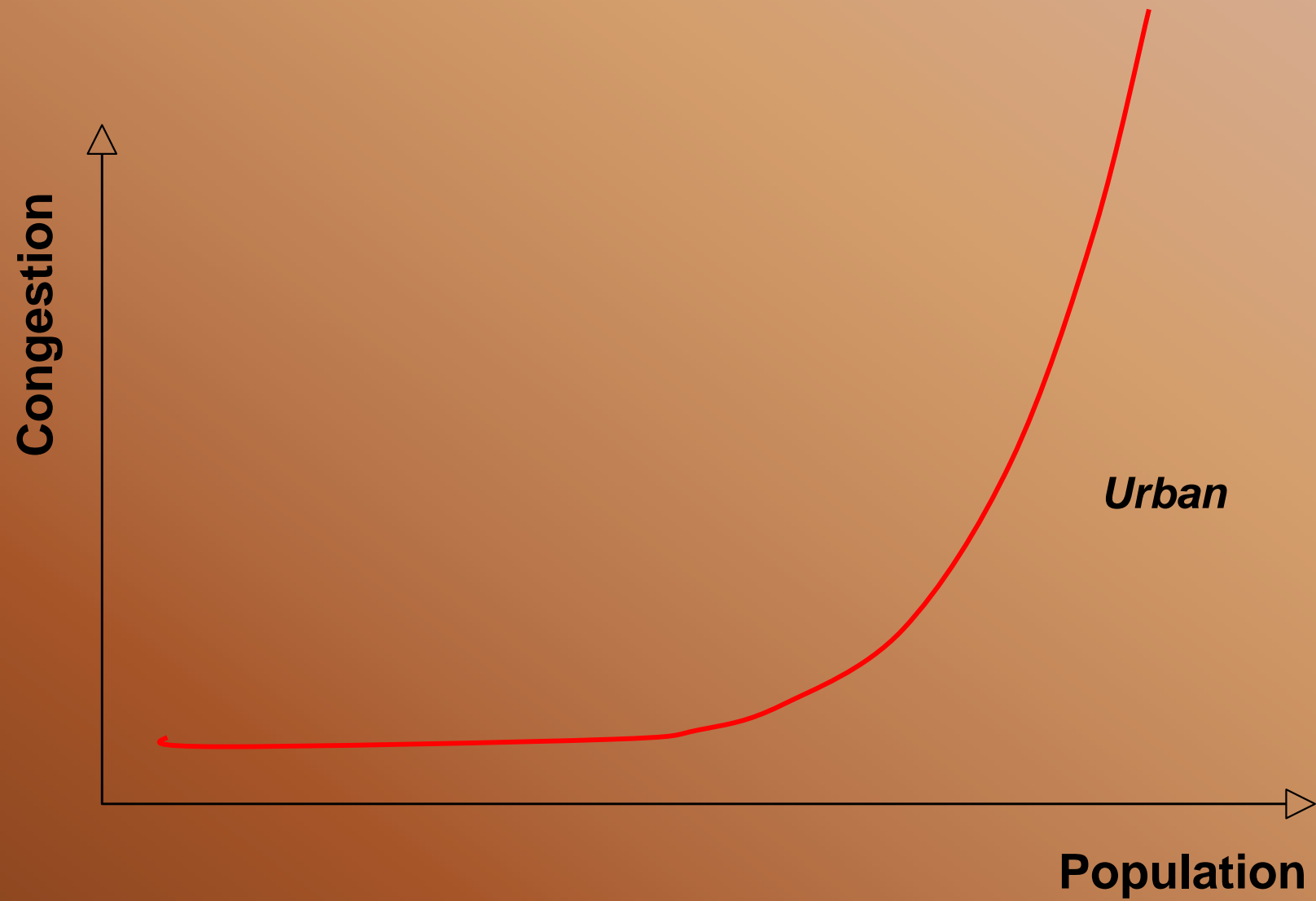
Effective Incubation

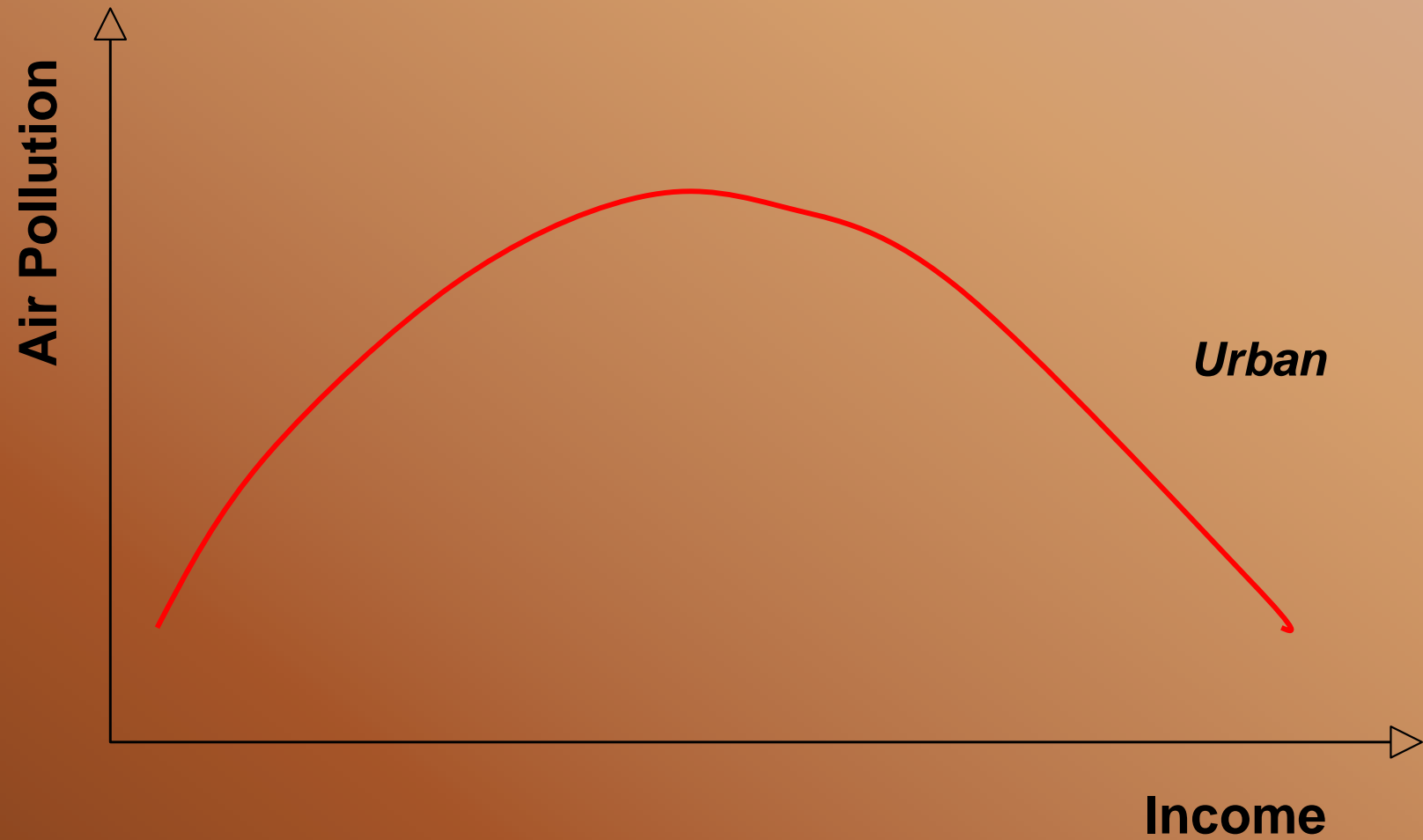
Demands

- Systems Approach
 - eco-system management
 - technology, production, marketing
- Service delivery at all levels
 - oil production, devices
 - service solutions
- Investments
 - microfinance for farmers
 - enterprise finance
 - energy services incubator









Sustainable Energy Services Needed in Rural India

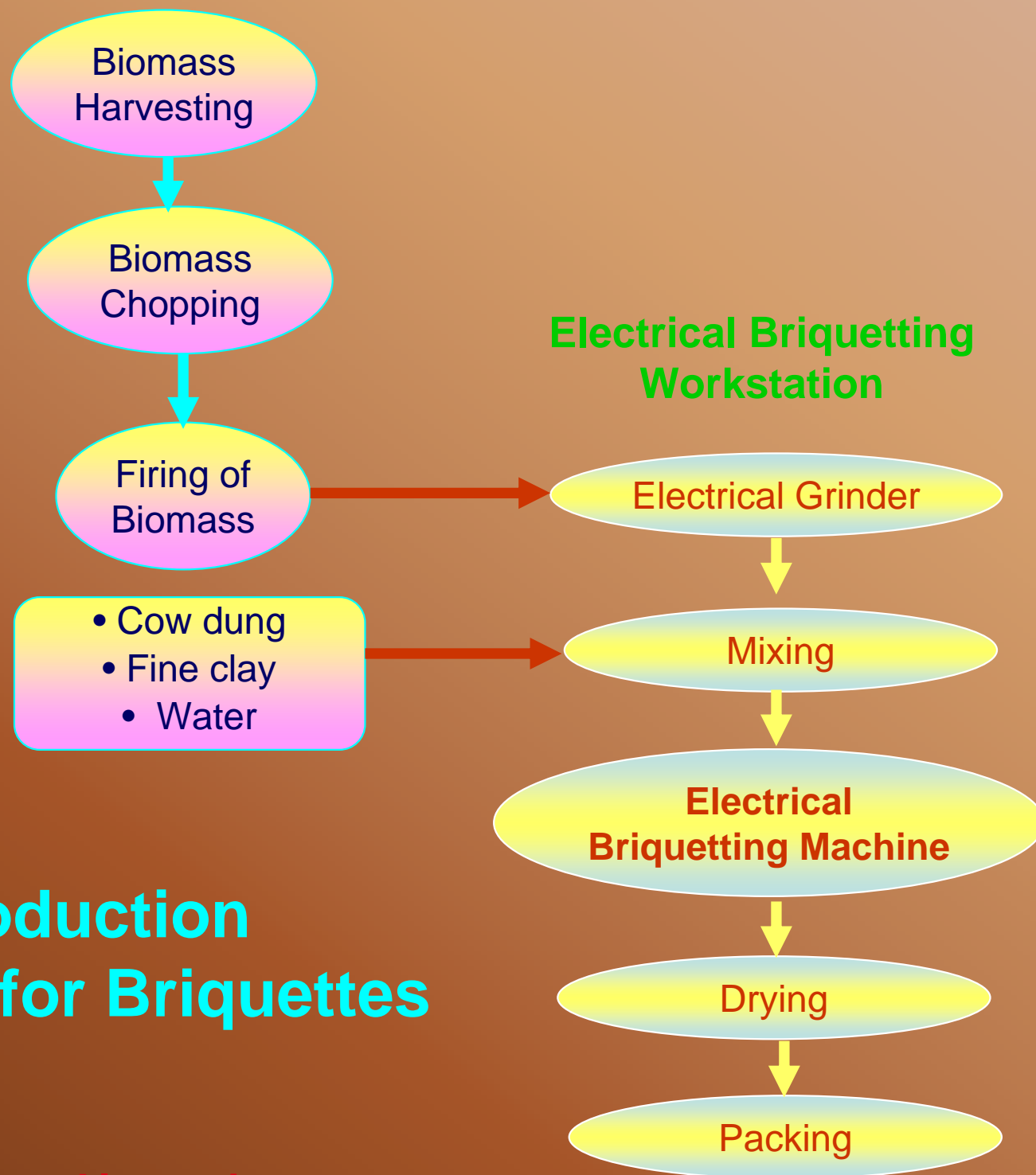
- Renewable Resources
- Local Access
- Efficient, Reliable Systems
- Minimum Pollution
- Affordable Prices



Energy Services vs Fuel Type

	Cooking	Space Heating	Energy Liveli-hoods	Convenience Cooking	Water Pumping	Lighting	Automotive Power ICT
		Biomass	✓	✓	✓		
Solid Fuels		✓	✓ (processed)	✓			
Liquid Fuels					✓	✓	
Gasification						✓	✓
			based Electricity				

Production Process for Briquettes



TARA Briquetting Extruder





Development Alternatives

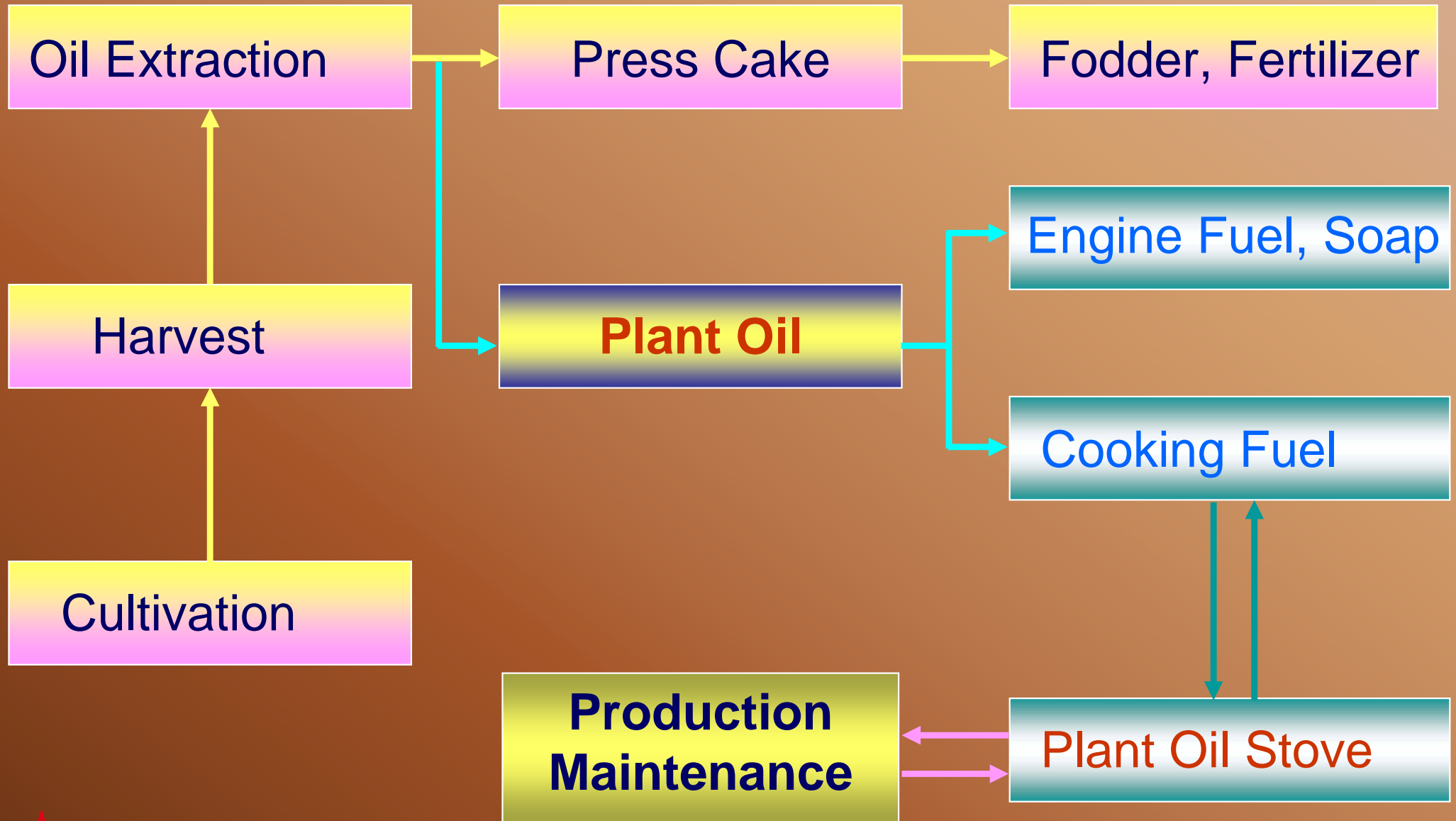
Briquetted Fuel
is positioned as a
Clean, Convenient Solution
for Space Heating and Cooking

Users : households, commercial establishments

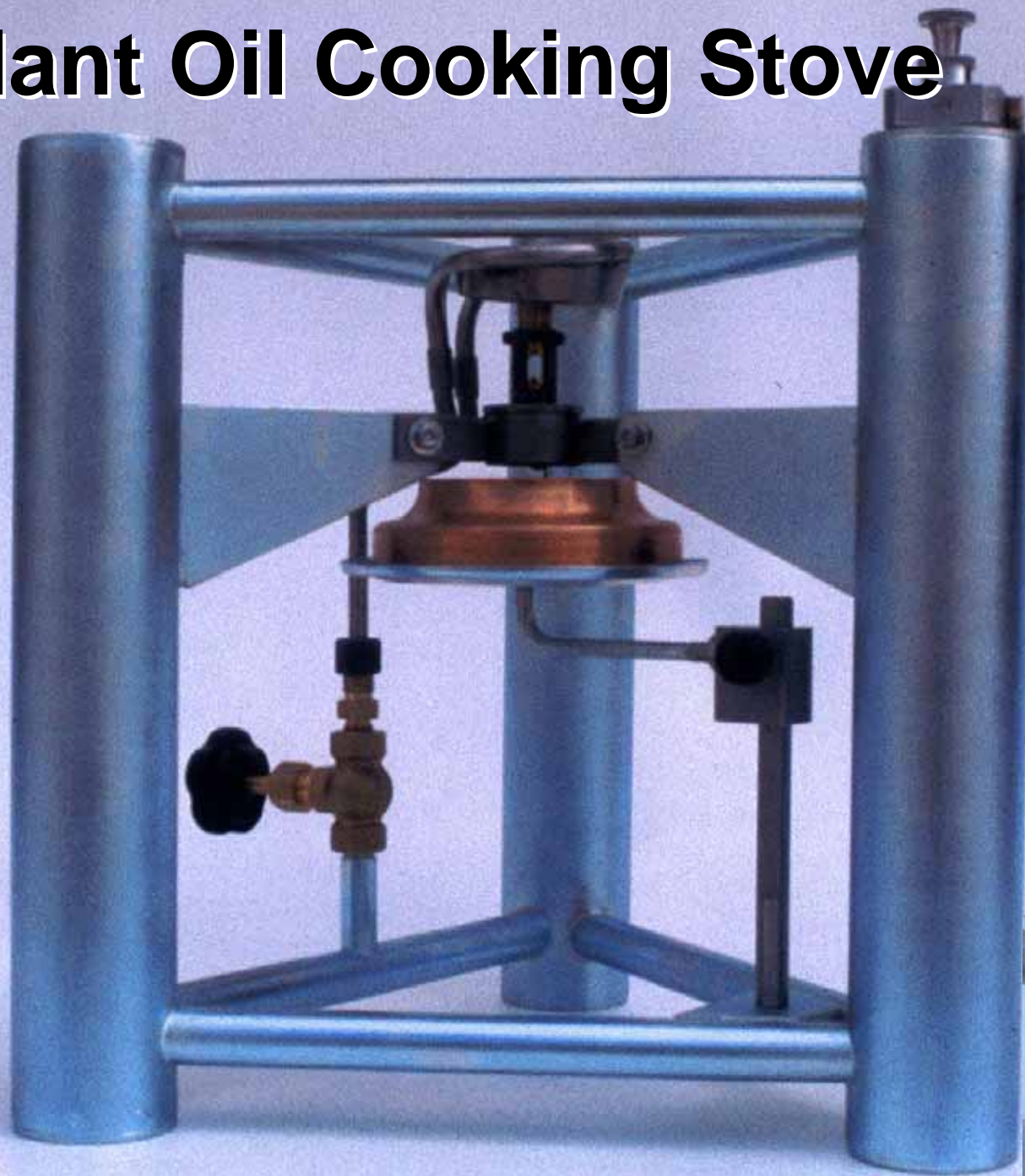


Plant Oil System

– a rural enterprise



Plant Oil Cooking Stove



Burner of the Plant
Oil Cooking Stove



