

THE ROLE OF APPROPRIATE TECHNOLOGY TRAINING PROGRAMS AND RESEARCH IN GREEN ENERGY WEALTH CREATION

by

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POPULATION 40 MILLION

80% live in rural areas

68% Biomass Energy

9% Electricity;

22% Petroleum Liquid fuels,

1% (solar PV, wind, biogas, biofuels)

ELECTRICITY ACCESS

4% Rural

49% Urban

15% National

Dominant players: KENGEN, KPLC & IPP

Kenya's Energy Future: Faces bleak future unless we appropriate intervention measures

Research shows:

- a) Predicts serious energy deficits by 2015 considering raising population ;
- b) Serious deforestation, environmental degradation and loss of biodiversity !;
- Deforestation effects: Resulting climate change hence effecting food production leading to perennial hunger problem

Kenya operating scenario

- Energy players work independently poor network among researchers, academia, TVET, industries, NGOs, Ministry of Energy and other stakeholders;
- There is no energy master plan for rural energy development (Adhoc propagation of rural energy types and involvement of players);
- General lack of proper framework for sustainable biomass energy production and use;
- Lack of biomass energy solid fuel manufacturing standards;
- Shortage of manpower in terms of skills and coordination to support energy service delivery (technical, entrepreneur and community)



Wealth creation in Energy

- Conventional fossil fuels (petroleum & coal, natural gas (LPG) (multinational companies)
- Sustainable energy (hydro, solar, wind, biomass, geothermal)
- Manufacturing energy equipment & accessories rechargeable batteries, torches, PV powered products, LED lights, electric cables, magnets, generators, motors and many others
- Carbon-emission trading programs (energy Vs environment-via Kyoto protocol-].

KENYATTA UNIVERSITY APPROPRIATE TECHNOLOGY AND ENERGY PROGRAMS APPROACH TO GREEN ENERGY WEALTH CREATION

History:

APPROPRIATE TECHNOLOGY CENTRE (ATC) ;

- Established in 1980's to address rural/urban development problems through education and research.

Focus Areas:

- a) Sustainable energy technologies;
- b) Water supply and sanitation technologies,
- c) Food processing technologies;
- d) Low cost building technologies;
- e) Other appropriate technologies in various sector

ATC role & successes in 1980's

- Served as regional biomass stove testing centre;
- Served as biomass training centre for stove artisans hence JUA kali stove making sector took off;
- Provided training on other alternative devices solar cookers, biomass briquette technologies and fireless cooking baskets;
- Training on solar drying technologies and other appropriate technologies.

Successes of ATC (KU) in collaboration with KENGO, CARE, UNICEF, USAID & BELLERIVE FOUNDATION AND GTZ

- Thai bucket stove was modified to develop Kenya Ceramic Jiko (KCJ)
- Kuni Mbili wood stove
- Other stoves and energy saving equipment;

Thai Bucket Ceramic stove



Evolution of the KCJ over the years



Kuni mbili wood stove



Other new stove designs in promoted in Jua Kali sector, Kenya



Success of KU BSc (AT) programs

- **About 300 graduates since 1997-2004**
- **Most are working in Renewable Energy Companies/NGO**
- **Government, colleges, universities, research institutions;**
- **Entrepreneurs as Biogas contractors, Solar water heating; solar PV; wind power generation (CAT skills); solar companies; biomass stoves**
- **Alternative energy sector: refugee camps & other sectors**

Transformation of ATC to School of Engineering and Technology

- Department of Energy Engineering
- Department of Manufacturing Engineering
- Department of water Engineering
- Department of Information, Communication Technology
- Department of Electrical and Electronics Engineering
- Anticipate: to grow other department depending on local and export graduate market need

New School of Engineering and Technology



KU programs on Sustainable Energy

From 2004-present

- a) BSc (Energy Engineering) modeled from MIT, University of Ottawa & UK, Asian Universities;
- b) BSc (Appropriate Technology for community Development);
- c) MSc & PhD (Renewable Energy Technology);
- d) MSc & PhD (Sustainable Energy Engineering)

New sustainable Energy programs

- Bachelor of Energy Technology (4 yr)
- Bachelor of Appropriate Technology for Community Development (4 yr):concentration: water, energy, agricultural processing, transportation; SME manufacturing

Postgraduate programs:

- MSc/PhD(Energy Management)
- MSc/PhD (Sustainable Energy)
- MSc/PhD (Renewable Energy)

KU Energy programs gives emphasis on:

- Voluntary industrial attachment
- Mandatory Industrial attachment
- Hands on practicals, labs & field visits
- Use of CAD/CAM techniques in product development
- Final year project in wealth creation in sustainable energy
- Energy wealth creation collaborative projects with Jua Kali informal sector, farmers; Industries & other stakeholders;
- Transformation of Final year projects into KU business incubation centre (up coming)

Successes of Energy training programs

Produced about 300 graduate Energy Engineers:

- a) KENGEN, IPP and tea factories
- b) Solar energy companies (solar thermal & solar PV)
- c) Energy managers (Energy efficiency/ Auditing)
- d) Wind energy companies
- e) Postgraduates (local & overseas)

Energy Wealth Creation Challenges

- Accreditation of Energy programs and other new and emerging challenging;
- Appropriate Technology programs in TIVET;
- Increased population combined with unplanned settlements limits energy self sufficiency;
- Lack of energy master plan at county level;
- Lack of stakeholders joint consultation [energy-water-agriculture-environment]
- Lack of incentives and rebate program to promote renewable energy supply;
- High costs of cooking and heating energy
- Too many fake energy products in Kenya market

We must act now thro:

- a) Develop road energy wealth creation roadmap (strategic plan)
- b) Make Strategic Investment in Education & research training programs in energy, water, agriculture and environment (thro: international accreditation and creating centers of excellence)
- c) Create Science and technology incubation centers (for enterprise development)
- d) Create conducive policies and regulation that encourages energy investments & collaboration with companies and organizations;

Chandaria Business Incubation Centre (in KU)



Kenyatta University ISO 9001:2008 Certified

Strategic ventures for Energy wealth creation

- a) Power generation technologies
{Co-operative society managed micro-hydro generation (for cheaper power)} for industries
- b) Invest in semi-arid/arid lands through dry land crops to produce raw materials for ethanol/liquid biomass fuel production;
- c) Transformation of biomass waste in biofuels (biomass briquettes & gasification technology power generation)
- d) Solar thermal (solar heaters & solar concentrator
- e) PV manufacturing (local & export market);
- f) Energy gadgets electrical/electronic manufacturing , magnets, generators/alternator

Strategic ventures

- Invest in carbon emission trading training programs [viz. funding & provision of subsidies in promoting renewable energy geographically disadvantaged regions];
- Invest in efficient dry land plantation for supply of solid biomass fuels (wood-fuel & charcoal)

Strategic ventures for energy wealth creation

- g) Electric transportation (bicycles, motorcycles, three wheelers, cars, trams and trains)
- h) Kenya coal resource: MUST be transformed into solid, gas & liquid fuels
- i) Wind resources to be transformed into electric power

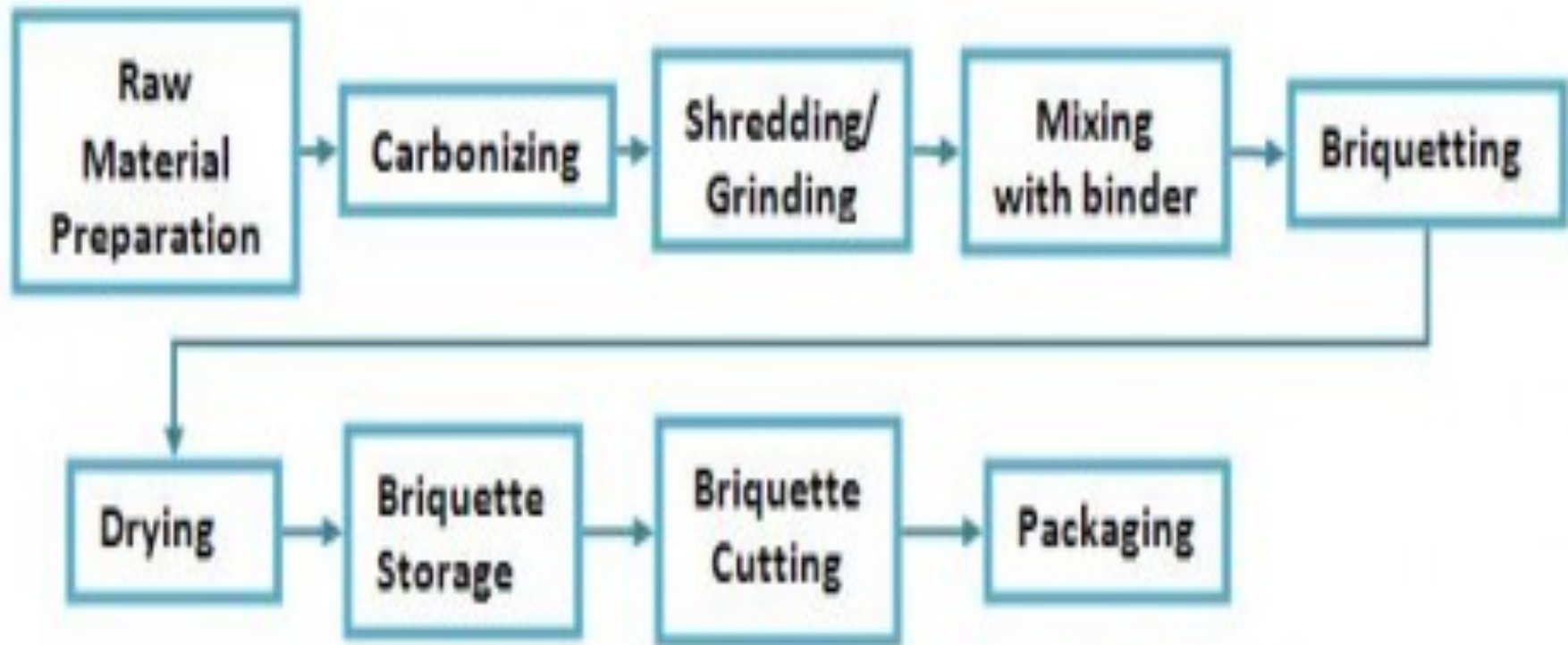
Transform biomass waste into fuel



Transform municipal waste into fuel



Biomass wastes to bio-fuels



Processes involved in making briquettes from forest wastes

Green Energy Business Opportunities and Value Chain

- Briquette production stages:
- creates value chain
- Provides business opportunities for entrepreneurs, whole sellers, retailers,
- equipment and machineries manufacturers
- Briquette machinery service industry

Green energy wealth creation projects





Sample briquettes from motorized screw press Rod-shaped. Components: charcoal dust with 3% of clay added as a binder



Manual piston press machine produces the cylindrical briquettes, hollow in the middle

Manual biomass briquetting press





Samples of piston pressed briquettes: cylindrical shaped, hollow in the middle. Mixing ratios: charcoal dust: paper 2:1

Wooden briquette press



Manual briquette press



Biomass waste briquettes



Biomass briquettes from waste materials (Dondora waste dump site)





Prototype Kenya Konsava wood fuel stove
(carbon-emission trading program)



Biogas from human waste (Kibera)



Photovoltaic Technology

- PV is now a \$8 million p.a. business
- About 200,000 solar PV systems installed - most of them installed in rural households
- About 15,000 solar systems installed in Kenya p.a.

Other energy technologies with huge wealth creation potential

- Micro-hydropower
- Solar water heating industry (fabrication & installation)
- Wind power generation systems (fabrication and installation)
- Rechargeable battery manufacturing
- Food processing for local and export market

Roof top solar commercial dryer for fruits and vegetables



An integrated greenhouse-solar drying system under construction



Food for Thought:

- To get a glimpse of the future, look at rising energy; water, food consumption, climate change-environment effects, dependency on imports; interest rates, inflation, and employment stats?
- What will happen to us if we continue to work, think, and act as we always have? and
- We need a Revolution in science technology curricula to help us solve our socio-economic problems using AT
- Revolutionize our education system viz attitude & value [DIY? & embrace good cultural & work ethic values]
- Develop strategic AT training programs on the basis of available resources targeting local and export market at village and county level.....
- Develop incentives to promote sustainable energy thro' appropriate policies

Lessons from other countries

- Chinese Officials knew that to accomplish in decades what took others centuries, they needed to focus on “deep” fundamentals:
 - They aggressively pursued a twin-track strategy to compress time.
 - They extended their global reach through expanded trade and relations
 - With 500,000 new engineers and scientists a year, China has routinely studied, imitated, improved, and redesigned products all through the 1990s to improve their ability to innovate and grow their own economy.
- We must understand what’s happening in China!! and radically change our training strategies and prepare our graduates for global competition
- Learn from Other Asian Tigers (Japan, South Korea, India, Malaysia and other developing countries).