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COUNCIL**

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Expert Group Meeting on “Adopting the Sustainable Livelihoods Approach
for Promoting Rural Development in the ESCWA Region”
Beirut, 21-22 December 2009

**BIOFUELS: CHALLENGES AND OPPORTUNITIES
FOR PROMOTING SUSTAINABLE LIVELIHOODS
IN THE ARAB REGION**

By

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Biofuels: Challenges and opportunities for promoting sustainable livelihoods in the Arab region



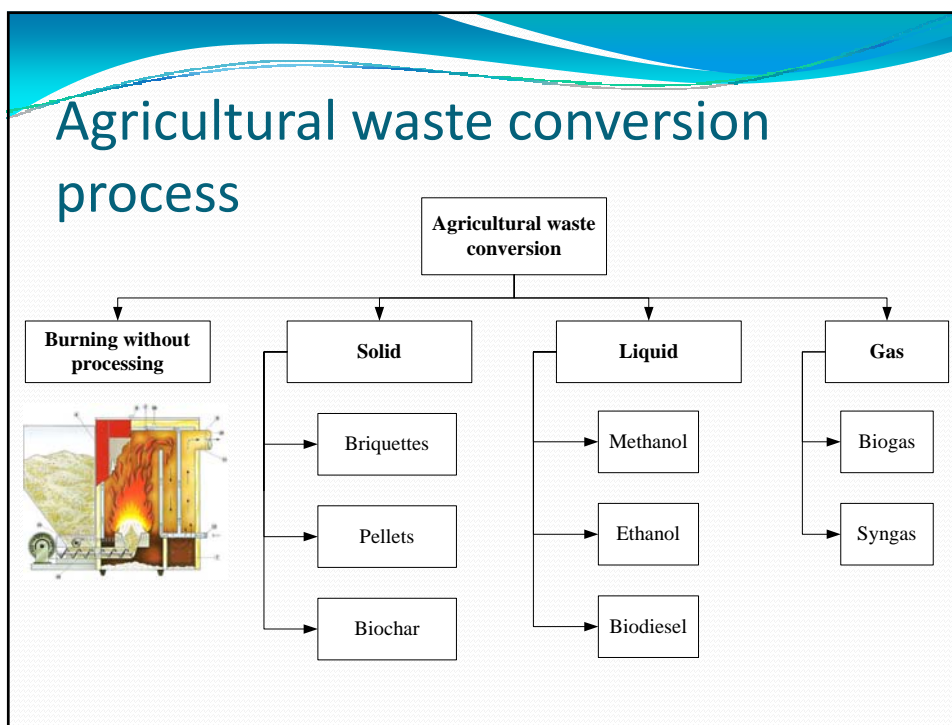
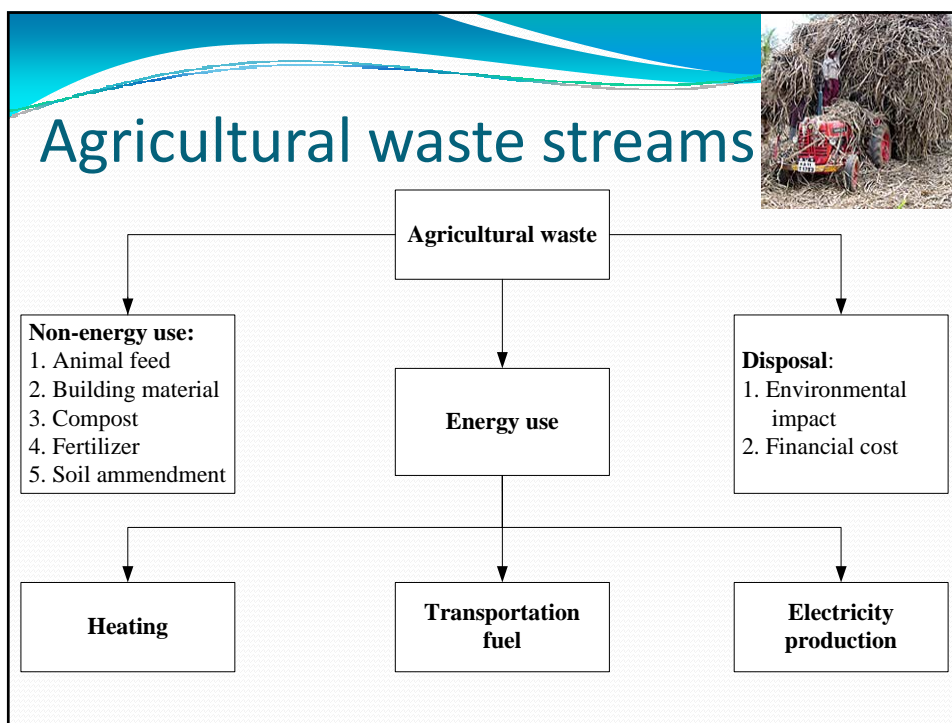
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Introduction

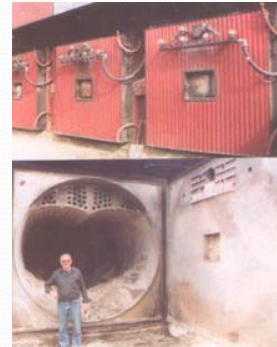
- The use of second generation biofuels from agricultural waste
- Various sources of biological waste products
- Conversion technologies
- Applications
- Three case studies
 - Olive press waste
 - Sugar industry byproducts
 - Dairy industry byproducts





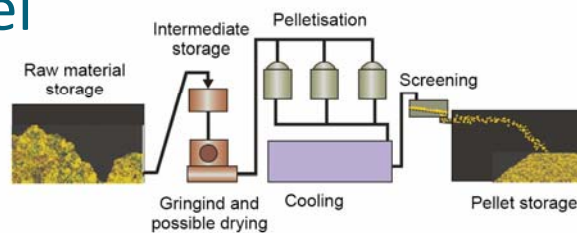
Direct Burning

- Small scale
- Large scale
- Co-firing
- Applications: Heat and/or electricity
- Mature, economic and established

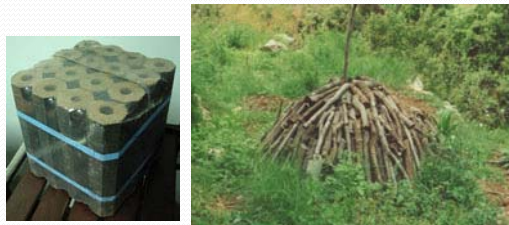


Solid Biofuel

- Briquettes
- Pellets
- Charcoal/biochar



- Applications: Heat and/or electricity
- Mature, economical and established



Liquid Biofuel

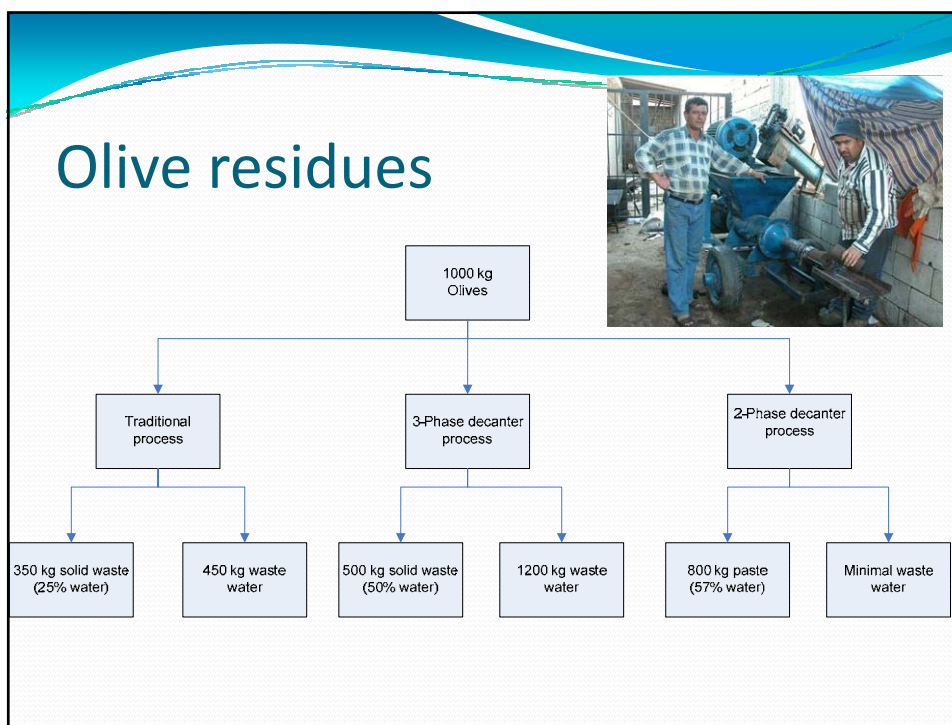
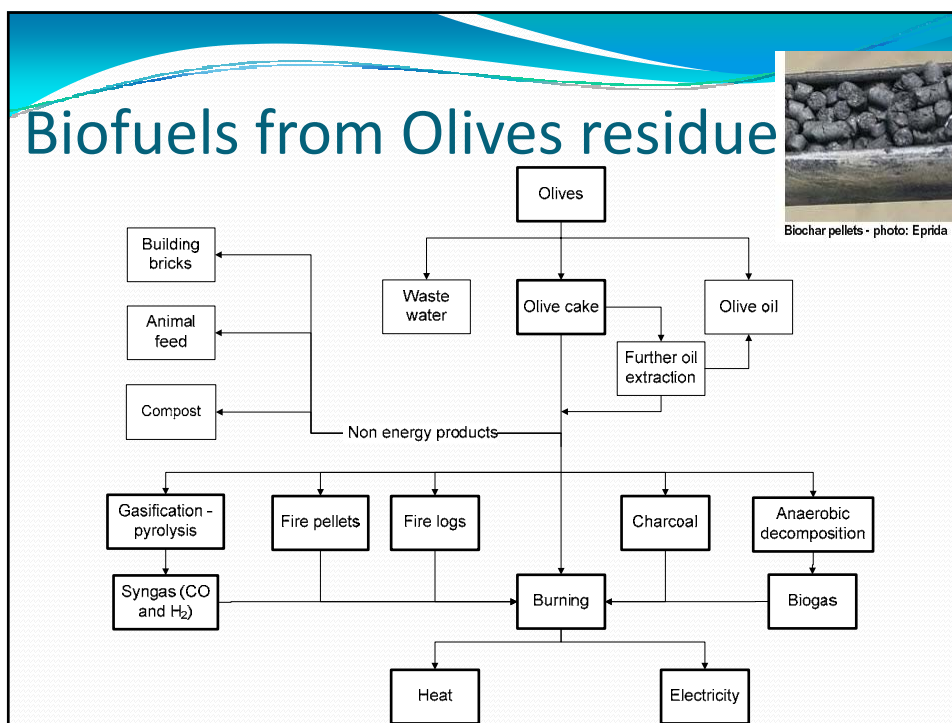
- Methanol
- Ethanol
- Biodiesel
- Applications: Transport fuel
- Mature for first generation, established



Gaseous Biofuel

- Biogas
- Syngas
- Applications: Heat and electricity. Potential future use of hydrogen derived from syngas in fuel cells
- Biogas production is mature, Syngas production is technologically advance





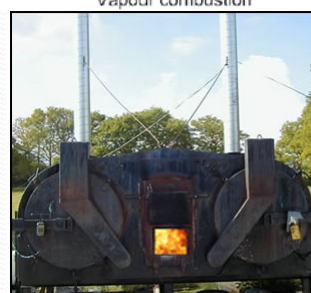
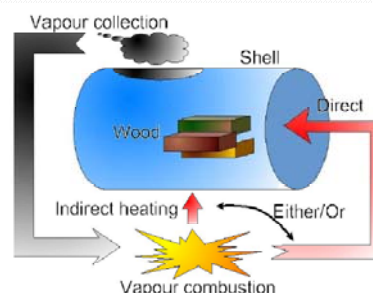
MARKET VOLUME ESTIMATION FOR POMACE



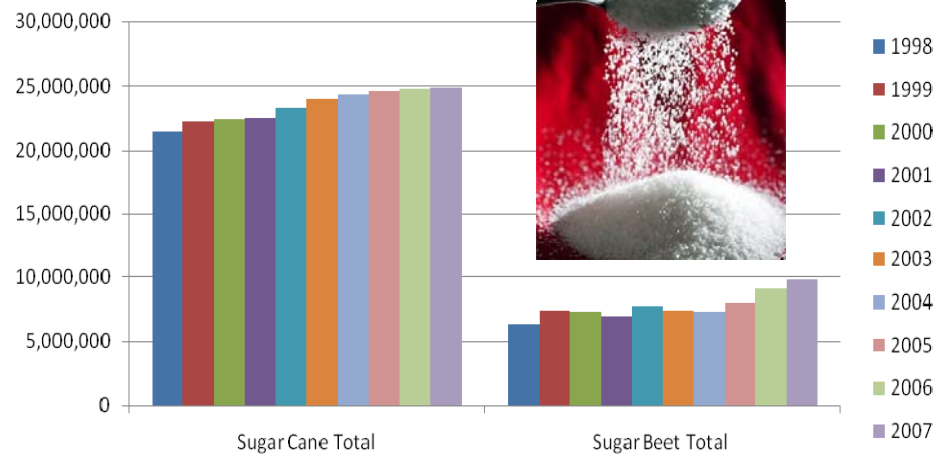
Country	Olives produced (tons)	Olives pressed (tons)	Pomace produced (tons)	Pomace selling Market volume (\$)	Yearly country energy cost saving (\$/year)	Total SMEs market volume (\$/year)
Lebanon	110,000	88,000	35,200	\$3,520,000	\$8,184,000	\$11,704,000
Jordan	120,000	96,000	38,400	\$3,840,000	\$8,928,000	\$12,768,000
Syria	785,000	628,000	251,200	\$25,120,000	\$58,404,000	\$83,524,000
Palestine	120,000	96,000	38,400	\$3,840,000	\$8,928,000	\$12,768,000
Region	1,135,000	908,000	363,200	\$36,320,000	\$84,444,000	\$120,764,000

Recommendation for Olive waste Market

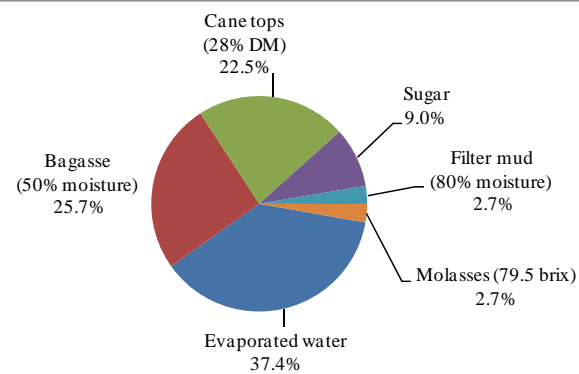
- Electricity generation: Not economical
- Heating applications: Bulk, Pellets, briquettes and biochar
- Opportunities exist on the consumption side
- Small scale feasible for considered countries
- Large scale feasible for Syria
- A market already exists and olive waste is not “waste”



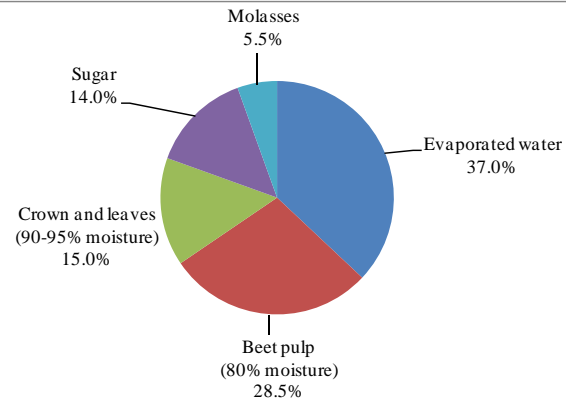
Sugar Cane and Sugar Beet



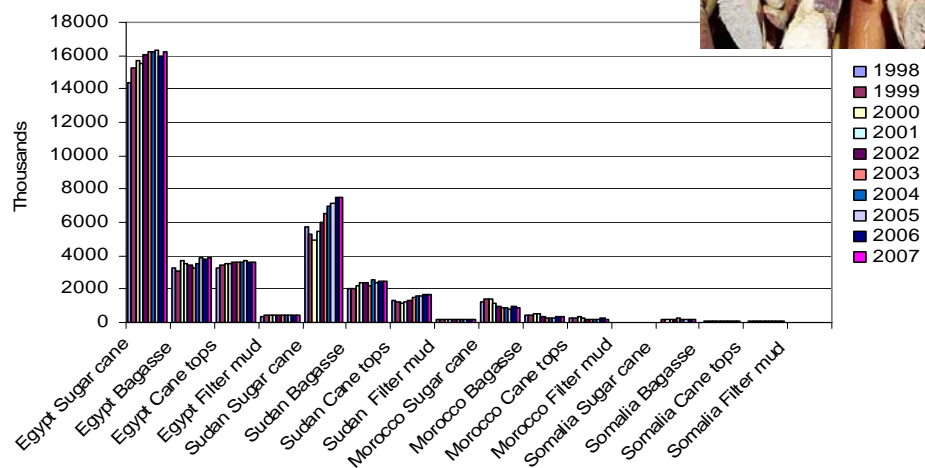
Sugar Cane



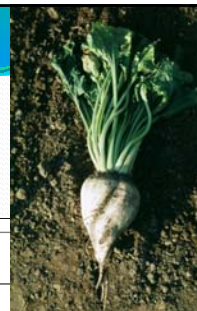
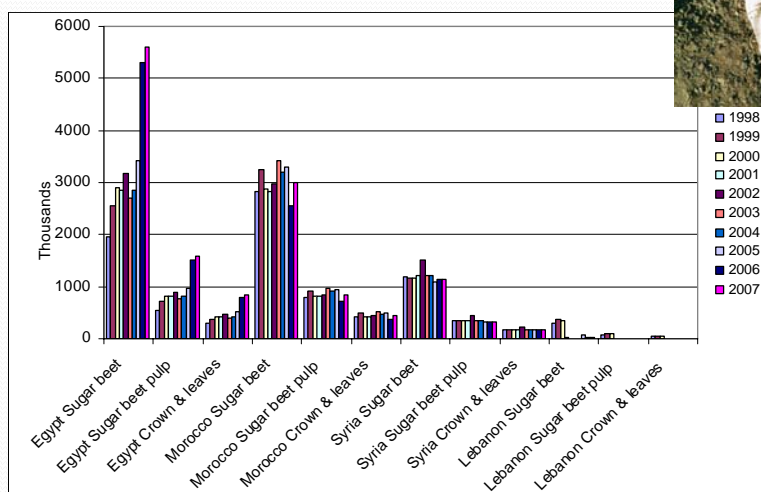
Sugar Beet



Sugar Cane Products



Sugar Beet Products



Capital and production costs for the proposed biofuel technologies

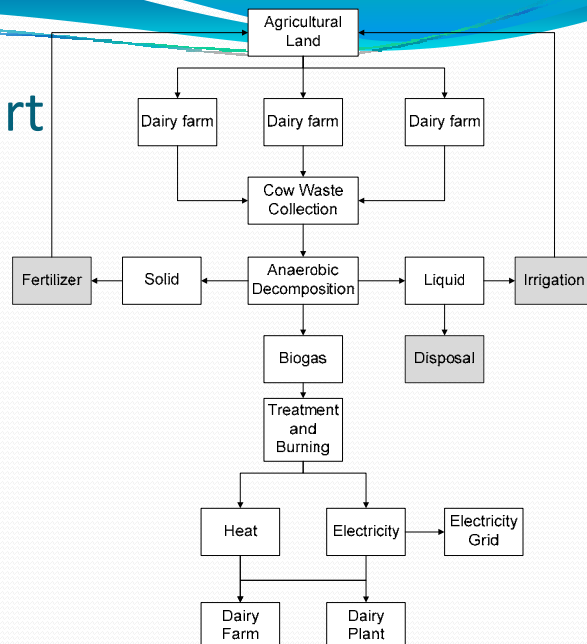
Technology	Capacity	Production	Capital costs (million \$)	Annual O&M (\$ '000)	Depreciation (\$ '000)	Total production costs (\$ '000)	Cost \$/unit of product	
							Biomass at \$6/ton	Biomass at \$10/ton
Briquetting	10 t/hr wet bagasse	5 t/hr briquettes	2.25	542	150	692	27 (briquettes)	36 (briquettes)
Gasification for steam generation	10 t/hr wet bagasse	10 t/hr steam (15-20 bar)	2.27	470	151	621	10 (steam)	13.7 (steam)
Gasification with electric generation	7.6 t/hr dry bagasse	3 MW	11.2	770	748	1,518	0.08 (kWh)	0.09 (kWh)
Ethanol	1.67 t/hr wet bagasse	0.25 t/hr	5.4	792	357	1,149	510 (ethanol)	536 (ethanol)
Biooil	8.3 t/hr dry bagasse	5 t/hr	7.5	1,167	500	1,667	45 (bio-oil)	50 (bio-oil)

Sugar beet and cane recommendations

- Should incorporate other type of feedstock
- Storage is important



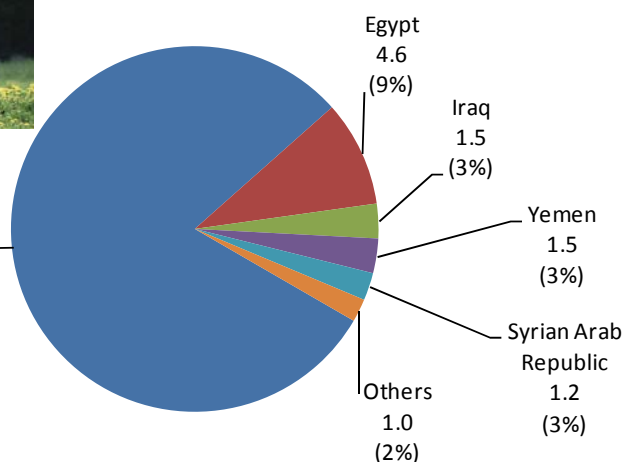
Basic flowchart for the management of dairy farm waste



Dairy cows in the ESCWA region



Sudan
39.5
(80%)



Dairy farm energy productivity from 100 cows

Slurry input (ton fresh at 8% dry matter/day)	6.6
Quantity of biogas produced (m ³ /day)	106
Net electrical energy available for export produced by CHP (kWh _e /day)	186
Net heat energy available for export produced by CHP (kWh _t /day)	138
Digester size required (m ³)	175

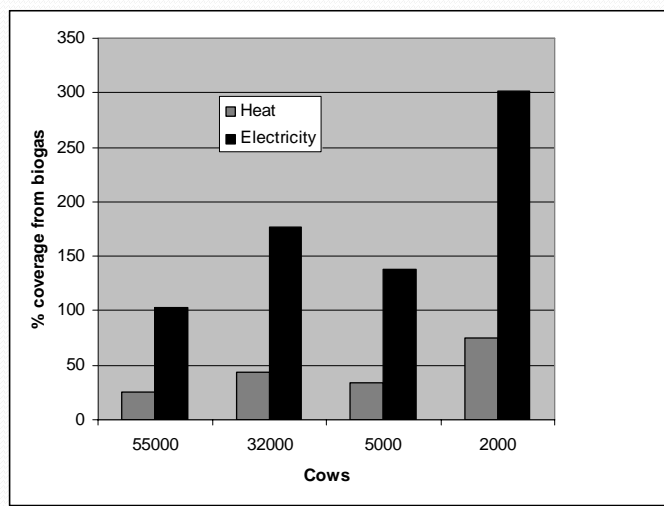


Potential in ESCWA Countries

Country	Number of cows	Thermal (GWh/yr)	CHP (GWh/year)	
			Electrical	Thermal
Sudan	39,500,000	49,612	26,821	19,908
Syrian Arab Republic	1,150,000	1,444	781	580
Egypt	4,550,000	5,715	3,089	2,293
Yemen	1,495,000	1,878	1,015	753
Jordan	69,500	87	47	35
Lebanon	77,000	97	52	39
Saudi Arabia	372,000	467	253	187
Qatar	8,000	10	5	4
Kuwait	28,000	35	19	14
Bahrain	9,000	11	6	5
Palestine	39,000	49	26	20
UAE	125,000	157	85	63
Oman	310,000	389	210	156
Iraq	1,500,000	1,884	1,019	756

Potential coverage of electricity needs: Yemen, 24%; Sudan 705%, all others less than 4%

Percent coverage of plant energy needs based on number of cows



Market for SME's

- A detailed feasibility study must be undertaken which should consider:
 - Local availability of equipment and spare parts;
 - Local availability of qualified technicians and engineers;
 - Existence of local governmental regulations promoting the use of biogas;
 - Existence of local governmental regulations restricting waste disposal;
 - Availability of appropriate dairy waste resources and their sustainability;
 - **Detailed analysis of heat versus electricity needs;** and
 - Possibility of using clean development mechanism (CDM) credits.
- An electricity cost of \$0.11/kWh is a prerequisite for the success of a biogas for electricity project.
- Farm owners, dairy plant owners, cooperatives or independent entrepreneurs have to insure a long term contract for the supply of organic waste and the opportunity to sell the energy produced whether heat or electricity.
- Potential for using other biomass resources.



CHALLENGES AND OPPORTUNITIES FOR SECOND-GENERATION BIOFUEL PRODUCTION IN THE ESCWA REGION

- The “waste” actually has a local market
- Feasibility is product and region specific
- Heating needs should be satisfied before electricity needs
- Low tech may be favored over high tech solutions.
- Government regulations regarding waste management and energy use.
- Potential for use of international funds
- Potential use of Solar energy for drying



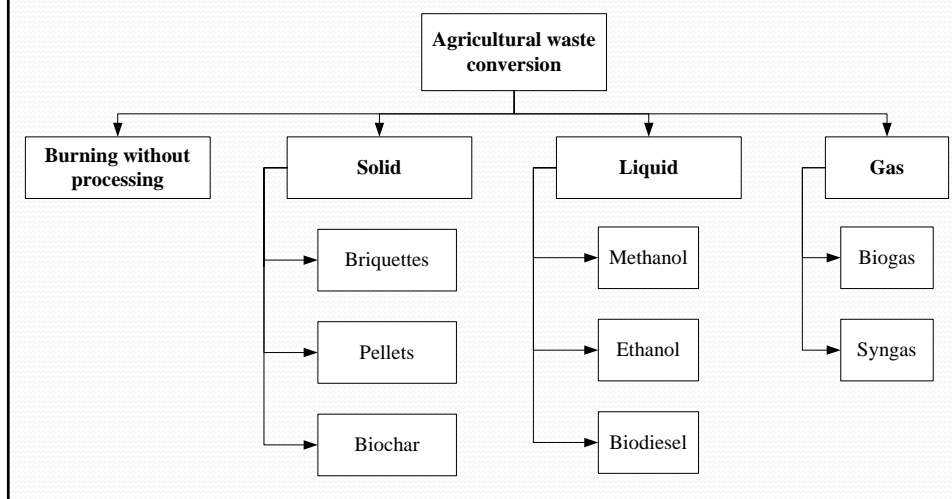
Opportunities for SME's

- Transporting agricultural waste and biofuel;
- Manufacturing equipment and machinery needed for the conversion process;
- Converting agricultural waste into biofuel;
- Manufacturing stoves or incinerators that work on biofuel;
- Marketing and promoting biofuel as an energy source;
- Energy generation from biofuel and distribution in both heat and electricity forms.

Recommendations for Biofuel Market development

- Liberalization of the electricity generation market.
- Providing electricity purchase prices to producers that, at least, meet the national cost of electricity generation rather than the subsidized cost.
- Promotion of biomass burners.
- Local capacity building and promotion of R&D in the field
- Removal of electricity subsidies (Social problems!)
- Provision of financial incentives, loans, grants, tax breaks
- Maintain a global unbiased understanding of all available options

Summary



Thank you



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