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## Joint ICTP-IAEA Workshop on Uncovering Sustainable Development CLEWS; Modelling Climate, Land-use, Energy and Water (CLEW) Interactions

30 May - 3 June, 2011

FAO-Sustainable energy-water-land-management for food security and development

STEDUTO Pasquale

Water Development and Management Unit FAO Food and Agriculture Organisation Roma ITALY





































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Northern America								-			
South Asia (incl. India)			_	-				_			
Western Asia											
Western and Central Europe								_			
Central America and Caribhean											
Australia and New Zealand											
Pacific Islands											
Northern áfrica											
East Asia/incl. (hina)											
Southern (marica (Incl. Brazili)											
Exten Furner (ind Parries Ed.)											
Canada and Andrews											
Contrational Action											
Sub-Saharan Africa											
Southeast Asia										-	
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World											
0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
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	Groundv	vater Ab	stractio	n
Country	Annual Groundwater Use (km³)	Number of groundwater extraction structures (million)	Extraction per structure (m <sup>3</sup> /yr)	Percent of population dependent on groundwater
India	150	19	7900	55-60
USA	100	0.2	500,000	5-6
China	75	3.5	21,500	22-25
Omna				



















Raw Mater (litres H20)	Raw Materials (litres H20/GJ)		Transformation (litres H20/GJ)		
Traditional Gas	Minimal	Gas processing	7		
Traditional Oil	3-7	Oil Refining	25 - 65		
Enhanced Oil Recover	y 50 – 9,000				
Coal	5 – 70	Coal –to – Liquids	140 - 220		
Uranium	42 – 160 m	42 – 160 mining and processing			





FAO WATER		Barnal		A	in second the strength in
M	/ater requ	irement	s of	f biofuel	S
crop	Fuel product (energy density: Bio-diesel 35 MJ/I Ethanol 20 MJ/I)	annual obtainable yield in l/ha (indicative)	VR	Evapo- transpiration in litre / litre fuel (indicative)	Irrigation water withdrawn in litre / litre fuel (indicative)
Sugar cane	Ethanol (from sugar)	6000	I/R	2000	1333
Sugar beet	Ethanol (from sugar)	7000	I/R	786	571
Cassava	Ethanol (from starch)	4000	R	2250	-
Maize	Ethanol (from starch)	3500	I/R	1357	857
Oil palm	Bio-diesel	5500	R	2364	-
Rapeseed / Mustard	Bio-diesel	1200	R	3333	-
Soybean	Bio-diesel	400	R	10000	-
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FAO WATER			Stand of the second				
• Current transport fuels needs: 77 EJ							
• Biofuels							
Ethanol	(2004)	0.84 EJ	9.5 Mha				
Bio diesel	(2003)	0.06 EJ	0.5 Mha				
(~ 1 % of the total demand for transport fuel)							
<ul> <li>856 Mha would be required to meet current fuel needs</li> </ul>							
FOOD AND AGRICULTURE	ORGANIZATION OF THE UNIT	ED NATIONS W	ww.fao.org/nr/water				























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