Bioenergy under the Clean Development Mechanism

A forthcoming joint working paper of:

United Nations Environment Program (UNEP)
UNEP Risø Center (URC)
United Nations Conference on Trade and Development (UNCTAD)
U.N. Food and Agriculture Organization (FAO)

Biomass Conference, Berlin, 11 May 2007

Outline

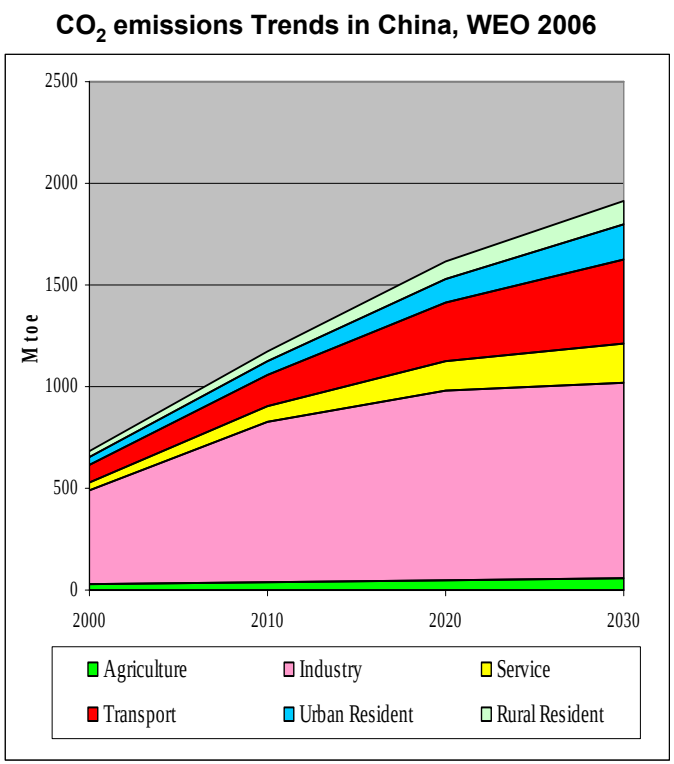
1. Objectives and rationale of working paper
2. CDM *status quo* and gaps
   - liquid biofuels in transport sector
   - displacement of non-renewable biomass in household sector
3. Challenges and recommendations
   - overall viability and additionality
   - CDM-specific methodological obstacles
   - global trade impacts
4. Future joint efforts

1. Objectives of study

- Outline status and gaps in bioenergy CDM pipeline
- Unlock potential for CDM to leverage new investment in sustainable biofuel production
- Identify and mitigate barriers to CDM approval
- Indicate which types of biofuel projects could benefit most from carbon revenues
- Contribute to development of methodologies and guidelines/tools for project implementation

Rationale

- Inefficient ‘traditional’ biomass predominant fuel in many countries
- Large scope for modern bioenergy alternatives in household, transport



- Part of GHG mitigation menu
  - fossil displacement plus bio-sequestration
  - curb rising transport sector emissions
- SD benefits potentially high at macro-level and on ground
  - energy security and foreign exchange savings (reduce vulnerability to oil prices)
  - job creation and rural livelihood strategies
  - synergies with climate vulnerability reduction

2. *Status quo* : All Projects in CDM Pipeline

CDM Pipeline, J. Fenhann, UNEP Risoe Center, May 2007

Type	Projects		kCERs/yr	Σ kCERs 2012
Hydro	392	21,01%	30220	166753
Biomass energy	380	20,36%	22342	144333
Wind	219	11,74%	18293	110089
EE industry	211	11,31%	23166	139366
Agriculture	169	9,06%	5542	39082
Landfill gas	135	7,23%	28892	177154
Biogas	106	5,68%	6275	35357
Fossil fuel switch	66	3,54%	21927	126904
Cement	30	1,61%	3818	30616
Coal bed/mine methane	30	1,61%	17041	100532
N2O	29	1,55%	40374	231048
Fugitive	20	1,07%	10859	78680
HFCs	18	0,96%	80528	504491
EE supply side	17	0,91%	1042	5623
EE service	11	0,59%	39	317
Geothermal	8	0,43%	1774	10976
Reforestation	7	0,38%	836	5420
Solar	7	0,38%	185	1151
EE households	4	0,21%	87	510
Transport	4	0,21%	295	2019
Energy distribution	1	0,05%	53	533
PFCs	1	0,05%	86	542
Tidal	1	0,05%	315	1104
Others	0	0,00%	0	0
Total	1866	100,00%	313989	1912601

Status quo : Bioenergy

Bioenergy CDM Pipeline, UNEP Risoe Center

	Number of projects				Of these			MW
	At validation	Request registration	Registered	Total	Only heat	Electricity		Total
Bagasse power	83	4	36	**123**	2	121		3016
Palm oil solid waste	6	0	8	**14**	1	13		111
Agricultural residues: other kinds	38	1	17	**56**	9	47		510
Agricultural residues: rice husk	28	2	17	**47**	0	47		330
Agricultural residues: mustard crop	1	0	4	**5**	0	5		38
Agricultural residues: poultry litter	2	0	1	**3**	0	3		8
Forest residues: sawmill waste	0	1	7	**8**	0	8		114
Forest residues: other	8	0	2	**10**	4	6		55
Forest biomass	3	0	1	**4**	3	1		1
Industrial waste	5	0	2	**7**	3	4		56
Gasification of biomass	3	0	0	**3**	1	2		4
Gasification of MSW	2	0	0	**2**	1	1		6
MSW incineration	1	0	0	**1**	0	1		0
Biodiesel	1	0	0	**1**	1			0
Ethanol	0	0	0	**0**	0			0
Biogas flaring	52	8	52	**112**	112			0
Biogas power	37	22	11	**70**	14	56		91

Unequal distribution: almost <u>no</u> transport biofuel or household sector renewable biomass projects in portfolio.

Liquid Biofuels: Projects & Methodologies

Number	Short Title	Biomass Input	Status of Approval
NM0180/ AM00047	Biolux Biodiesel Beijing	Waste oil	A, EB 29
NM0223	Western Cape Biodiesel	Soybean imports and locally produced edible oils	To be assessed at MP 27
NM0142-rev	Biodiesel Thailand	Palm Oil	C, MP 26, EB pending
NM0129-rev	Biodiesel Thailand	Sunflower seeds	C, EB 30
NM0108-rev	Biodiesel Andhra Pradesh	Jatropha, Pongamia	C, EB 30
NM0082-rev	Khon Kaen Fuel Ethanol	Sugar cane molasses	C, EB 24

Only one approved methodology, but with limited application and no small-scale. Others either not approved or pending assessment.

Non-renewable Biomass: Projects & Methodologies

- Registered:
  - Biogas Sector Partnership Nepal 1 & 2 (6500 units each)
  - Bagepalli, India Biogas Programme (5500 units)
  - Aceh, Indonesia Solar Cooker Project
- At validation:
  - Kupang, Indonesia Cook Stove Projects
  - Bagepalli, India Solar Hot Water Heater Programme
  - All used AMS-I.C, but revised 11/10/05, disallowing applicability
    - Proposed alternative assumes fossil baseline (e.g. kerosene)

Household renewable bioenergy projects are unlikely to be viable unless more plausible methodologies can be developed.

3. Challenges

- Demonstrating Additionality
- Overcoming Methodological Barriers
- Lack of clear and consistent guidance by EB
- Poor knowledge of which project types stand to gain most
- Need for more user-friendly tools for project developers

Main barrier is methodological, i.e. clear, consistent, and balanced rules for baselines and monitoring that are also workable in practice .

Additionality (1): Investment

- On purely financial basis, not clear winner
- Risky: feasibility hinges on *volatile* factors*, e.g.* oil price, sustained demand, opportunity costs
- Biofuel targets/directives may already be in place
  - free rider problem
  - how to take into account subsidies, including those for diesel?
- Carbon revenue boost small, but highly sensitive
  - World Bank estimates carbon value US 3-5 ¢/liter of petroleum fuel equivalent; net IRR gain for bioenergy projects not generating CH_4 reductions average +0.5 to +2.0%.
  - Thin margins implies high sensitivity

Carbon credits could mitigate barriers, reduce risk profile, and obviate subsidies, but tough to demonstrate investment additionality.

Additionality (2): “Barriers”

- High risk
- High initial capital costs and other financing challenges
- High degree of coordination needed
  - Upstream/downstream complementarities, fuel specifications
  - Social acceptability of new products
- Weak regulatory frameworks including renewables/IPP
- Constraints to new technology adoption
  - especially for second-generation

Clearer guidelines needed for developers using the ‘barrier test’ for CDM eligibility.

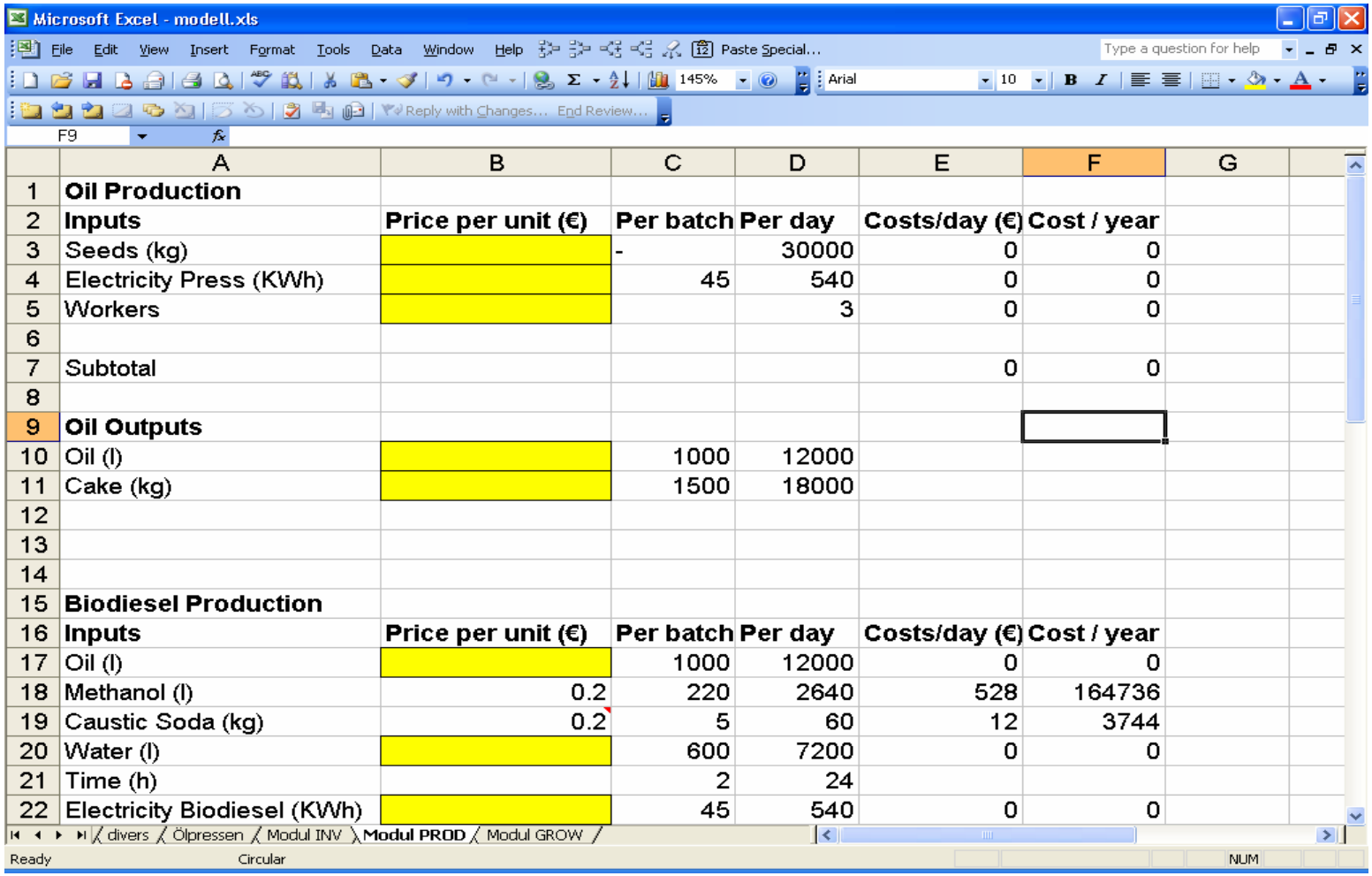
Methodological Challenges

- Scope of project boundary: production, conversion & consumption
- Producers versus consumers debate: logical to prioritize producers
- Avoiding double counting of CERs
  - How to handle exports
  - Checking consumption against production, feedstock vs. final products trade and use for net fossil energy replacement
- Equal treatment of upstream and downstream emissions between baseline and project case
  - emissions from fertilizer use and land-use changes should be included for dedicated energy plantations
- Land-use leakage, including deforestation
  - can use existing AR methodologies, if applicable
  - may be out of control of individual project developer and best handled outside of CDM institutions

- Ensuring consumption/blending in host country can be monitored
  - Existing guidance not practical
  - blending entities ideal as no other substitutes
- Data limitations
  - most GHG lifecycle analyses not appropriate for LDCs, often don't include impacts of secondary products
  - too costly *ad hoc,* need approved default factors
- Programmatic CDM unripe
  - biofuel programs good test case, but modalities poorly clarified

Key methodological issues have been identified; they are challenging, but not insurmountable. Clear and consistent decisions needed. Analysis offers solutions to balance accuracy and workability.

Financial Model (1): production



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	A	B	C	D	E	F	G
1	**Oil Production**						
2	**Inputs**	**Price per unit (€)**	**Per batch**	**Per day**	**Costs/day (€)**	**Cost / year**	
3	Seeds (kg)		-	30000	0	0	
4	Electricity Press (KWh)		45	540	0	0	
5	Workers			3	0	0	
6							
7	Subtotal				0	0	
8							
9	**Oil Outputs**						
10	Oil (l)		1000	12000			
11	Cake (kg)		1500	18000			
12							
13							
14							
15	**Biodiesel Production**						
16	**Inputs**	**Price per unit (€)**	**Per batch**	**Per day**	**Costs/day (€)**	**Cost / year**	
17	Oil (l)		1000	12000	0	0	
18	Methanol (l)	0.2	220	2640	528	164736	
19	Caustic Soda (kg)	0.2	5	60	12	3744	
20	Water (l)		600	7200	0	0	
21	Time (h)		2	24			
22	Electricity Biodiesel (KWh)		45	540	0	0	

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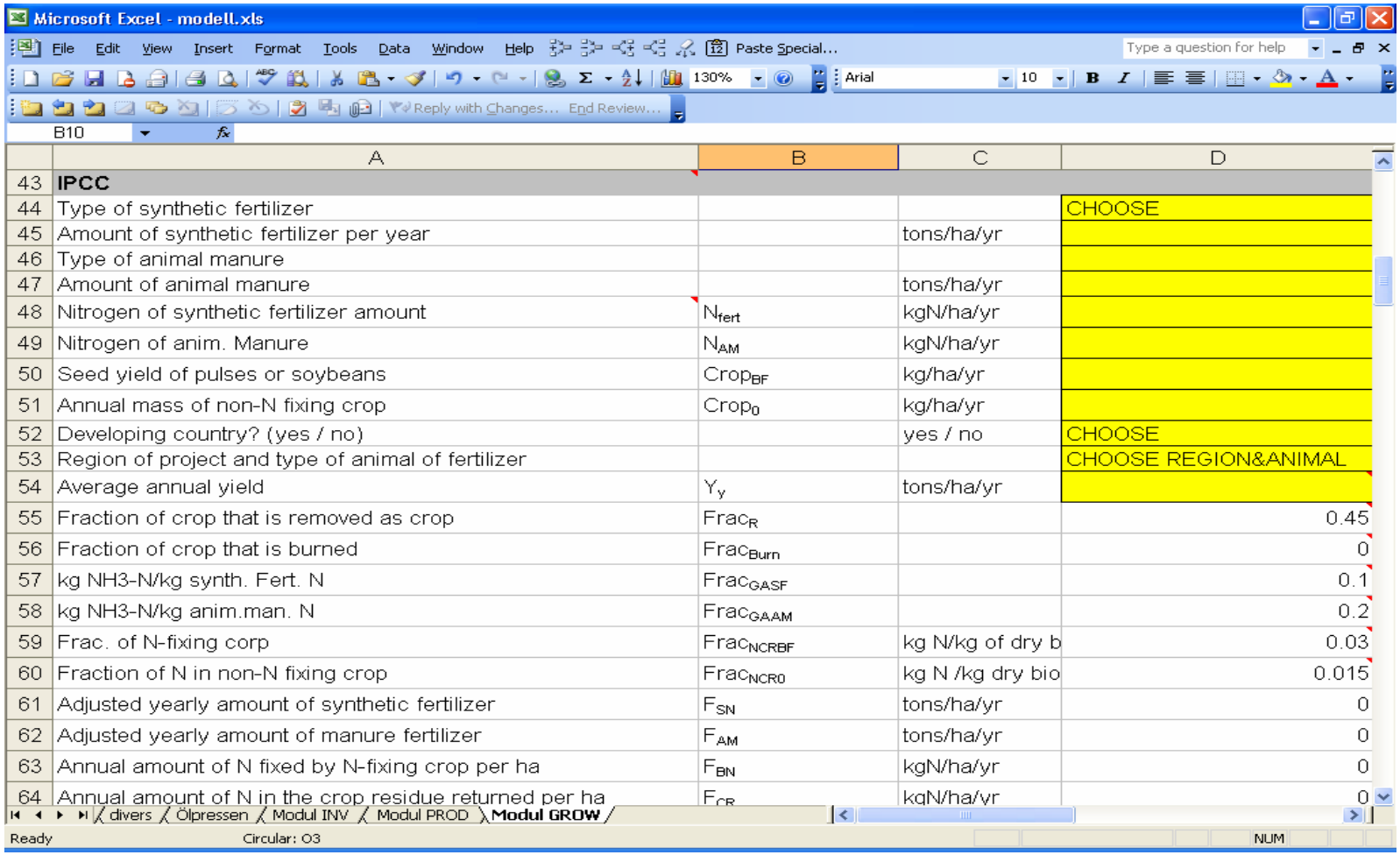
Financial model (2): CDM



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	A	B	C	D
43	**IPCC**			
44	Type of synthetic fertilizer			CHOOSE
45	Amount of synthetic fertilizer per year		tons/ha/yr	
46	Type of animal manure			
47	Amount of animal manure		tons/ha/yr	
48	Nitrogen of synthetic fertilizer amount	N_{fert}	kgN/ha/yr	
49	Nitrogen of anim. Manure	N_{AM}	kgN/ha/yr	
50	Seed yield of pulses or soybeans	$Crop_{BF}$	kg/ha/yr	
51	Annual mass of non-N fixing crop	$Crop_0$	kg/ha/yr	
52	Developing country? (yes / no)		yes / no	CHOOSE
53	Region of project and type of animal of fertilizer			CHOOSE REGION&ANIMAL
54	Average annual yield	Y_y	tons/ha/yr	
55	Fraction of crop that is removed as crop	$Frac_R$		0.45
56	Fraction of crop that is burned	$Frac_{Burn}$		0
57	kg NH3-N/kg synth. Fert. N	$Frac_{GASF}$		0.1
58	kg NH3-N/kg anim.man. N	$Frac_{GAAM}$		0.2
59	Frac. of N-fixing corp	$Frac_{NCRBF}$	kg N/kg of dry b	0.03
60	Fraction of N in non-N fixing crop	$Frac_{NCR0}$	kg N /kg dry bio	0.015
61	Adjusted yearly amount of synthetic fertilizer	F_{SN}	tons/ha/yr	0
62	Adjusted yearly amount of manure fertilizer	F_{AM}	tons/ha/yr	0
63	Annual amount of N fixed by N-fixing crop per ha	F_{BN}	kgN/ha/yr	0
64	Annual amount of N in the crop residue returned per ha	F_{CR}	kgN/ha/yr	0

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5. Next steps (1)

- Draft for comment at UNCTAD inter-governmental Expert Meeting and to interested parties

- Establish partnerships and links to work plans
  - Global Bioenergy Partnership
  - UNCTAD Biofuels Initiative
  - UN Energy
  - UNEP Forestry/Bioenergy CDM Project in 7 African countries (funded by FFEM)

- Support definition of cost-effective monitoring schemes and certification protocols for biofuel trade

Next steps (2)

- Contribute toward methodology development process
  - Analysis toward EB-approvable methodologies
    - Biofuel GHG data for non-Annex I countries
- Develop analytical tools to assist CDM developers
  - Finalize CDM financial analysis model
    - Business models and SME support
    - pinpoint scale and other critical thresholds for viability
    - guidebooks and CDM templates
  - Resource assessments and sustainable production guidelines
- Collaborate with donors and CDM developers on pilots

This is the first phase of a cooperative effort.
We welcome your participation!