The policy, environmental and social aspects of linking bioenergy with carbon storage in a sequential decision approach to the threat of abrupt climate change

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BECS Concept

BECS combines two near-zero emissions technology types

- Bio-Energy
  - Production of biomass – waste retrieval [MSW], annual crops [sugar], plantations [which are the focus of 'being prepared'].
  - Utilisation of biomass – power production, CHP, biogas, pyrolysis to syngas, fermentation, etc.
- Fossil fuel Carbon Storage permanently (c.f. temporary sequestration in near-surface 'sinks')
  - Underground (aquifers, coal bed methane, tertiary oil recovery)
  - In the oceans (dispersed – behind oil tankers on return trips? – concentrated on ocean bed – dry ice?

COMBINE THEM
AND YOU HAVE
A NEGATIVE EMISSIONS ENERGY SYSTEM :
THE MORE GAS YOU GUZZLE THE **GREENER** YOU ARE !!
[***not quite true as there is an environmental constraint on how much land is used to produce the biomass***]

Role of bioenergy in OECD's long run climate strategy

Crucial importance of non-OECD countries because
No action by developed countries acting alone can fix the GHG problem (2nd Assessment Report)

- Developing countries have the land and growing conditions for producing biomass on the scale required to deal with:
- Abrupt climate change [the real issue – it 'haunts the problem' (3rd Assessment Report)]

NAS Report "Abrupt Climate Change: Inevitable Surprises"
(ACC is a regime change in a non-linear dynamic system)

- Typically a NLDS regime change is heralded by precursor signals
- BECS is a low cost 'be prepared' physical investment to ameliorate risks
  Noah's Ark build them at low cost : live in them at high cost if it rains

Robust Strategy

A. Start doing things with long lead times
[build the Ark before the rain starts]
B. Choose options with low sunk costs or with alternative uses
i.e.
Acquire needed information [research is relatively low cost]
- Focus climate science effort on developing capacity to recognise precursor signals [hopefully recommendation of IPCC 4th Assessment Report]
- Develop Carbon Capture and Storage technology [US DOE doing it – good]
- Explore for deep aquifer storages near potential biomass production sites

Begin land use change programme,
- whatever is the maximal rate of land use change, the earlier the start the more can be done
- sequential decisions 1 and 2 are robust due to ancillary benefits even if no ACC
- if no eventual need for bio-fuel, plantation timber will replace mined natural forest with bio-diversity and conservation benefits

Begin programme of capacity building for country-driven projects
- need for community friendliness [else sabotage risk] and hence need for large number of small and medium biomass projects
- need to develop institutional capacity to train people to start all these projects
- such 'barefoot merchant bankers' will drive sustainable rural development and growth take-off even if no ACC

Sequential Decisions

BECS on a large scale implies large scale land use change and involves decisions to:

1. Grow biomass [low cost]
- Use biomass as energy system raw material
  [low cost if no stranded assets involved]
3. Capture and store CO_2 emissions from large point sources [high cost but not undertaken unless also for competing fossil fuel]

The modelling focus is on plantations to facilitate de-coupling of carbon in atmosphere reductions from energy technology change, thus avoiding stranded assets

Sequential decisions in the North

1. Farm support; build biomass stock for energy security concerns
2. Technology development; precautionary demonstration against oil price risks
3. In response to ACC precursor signals

Sequential decisions in the South

1. End unsustainable use of natural firewood
2. Modern rural energy; energy security and econ take-off (liquid fuel exports).
3. In response to ACC precursor signals

Manhattan Project style actions taken over the following decade in response to scientific news of Abrupt Climate Change precursors

1 Retrofitting of all large point source fossil and bio fuel emitters with CCS technology
2 All new large fossil and bio fuel plant fitted with CCS technology
3 A system of gathering pipelines installed to collect captured CO_2 and deliver to below ground storages
4 All long rotation policy land converted to short rotation mainly bio-fuel production with the part grown bio-mass material used wholly for biofuel
5 Shift from half to full atp for non-fuel renewable energy and technological progress.

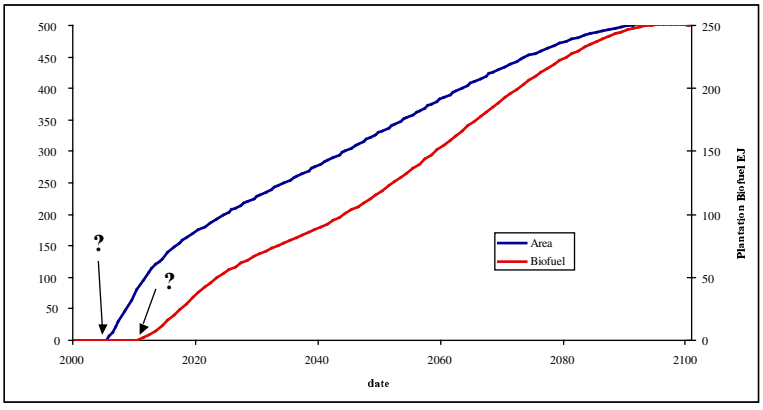
(These could be outcomes of shift to very high C-price, but other measures, such as absorption portfolios protect consumers and may be preferable)

Ancillary Benefits

- Stimulation of the pattern of land use change that is needed to meet the raw material demands of the bio-energy component embodied in most low emissions scenarios (i.e. address market coordination failure and other barriers to entry facing bio-energy)
- Hence earlier and lower CO_2 reductions than under Kyoto style focus on 'domestic action'
- Restoration of the pre-industrial tree coverage (differently located, owing to human settlement, but restoring the former capability of forests to act as lungs to the living earth)
- Empowerment of many developing countries to initiate their own 'country-driven' projects as the building blocks of their own sustainable energy development path
- Potential export led growth for such countries as bio-based liquid fuels take an increasing role in global transportation fuel supply, stimulating global macro-economic growth
- Improved security of liquid fuel supplies, and reduced dependence on unstable mid-East oil supplies
- Improved farm support in agricultural surplus developed regions

That covers the motivation part of this presentation

And these programmes are needed anyway in any low emissions scenario that responds effectively to Gradual Climate Change [Kyoto weakness on land use change – see Concluding Question]



A back of Envelope calculations

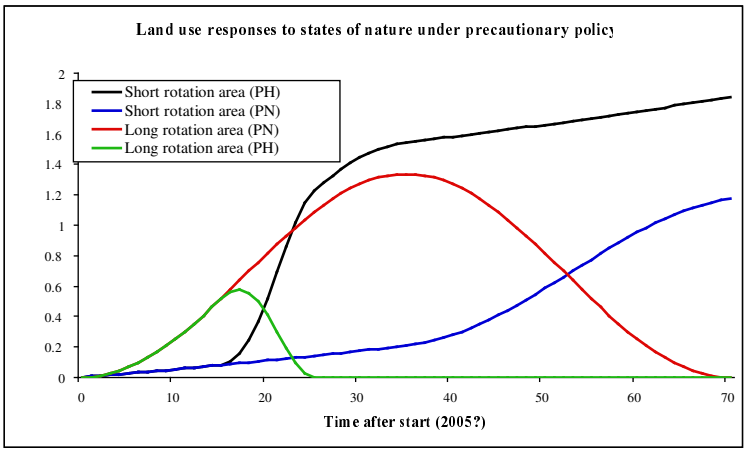
1. Energy security

500 GJ/Ha-yr x 500 million Ha = 250 EJ annually
[[half current best commercial practice in Brazil
x
40 per cent of cultivable land said by IPCC to be available after allowing for growing food supplies]]

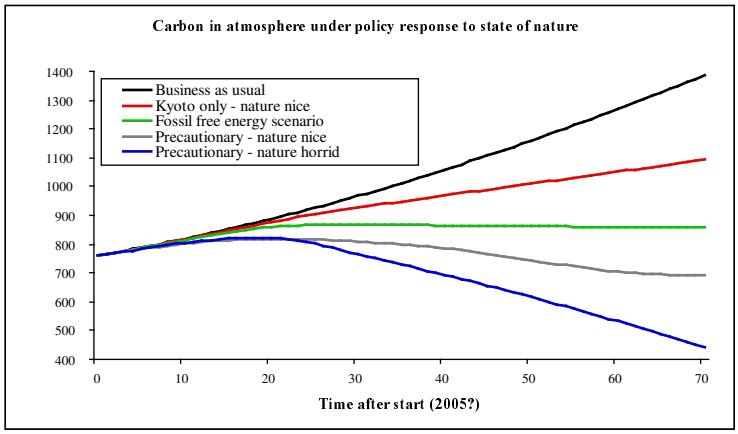
30 per cent conversion displaces 75 EJ gasoline annually = 120 EJ crude
(assuming 5/8 high value fractions)

= 12,000EJ per century = 12,000 x 24 mtoe = ~ 2.2 millions of millions of barrels of oil, over twice global proved reserves
Say 1½ allowing for a slow start in first few decades.

Policy driven global land allocations under a 'be prepared For Abrupt Clmate Change with and without precursor signals two decades hence (H=nature horrid, N=nature nice)



Gigatons C in atmosphere (= ~2 x ppm C_{at}) for three reference scenarios and with 'be prepared' policy related to 'Kyoto' case with and without response to ACC precursors after 2020. Note that negative emissions energy system is needed to get below 330ppm.



IN CONCLUSION: A question

Why, given its win-win-win-win potential, is the global bio-energy solution to the Climate Change issue ignored or down-played in policy formation ??

Win 1 – early and effective stabilisation and medium term reductions in atmospheric carbon.
Win 2 – potential to respond effectively to Abrupt Climate Change
Win 3 – increased energy security and resistance to potential oil price increases
Win 4 – sustainable economic prospects for landowners both in developed and developing countries

A Possible answer

- Market co-ordination failure between suppliers of bio-energy raw material and potential users separated by decades, oceans, language and culture

- Unfortunate self-perpetuating error in the negotiations [that ended, almost – i.e. all bar Russia – at Marrakesh] due to maintained assumption that best policy is to price up carbon through TEPs, ignoring need to drive technology change.

- Too complex: wind generators and PV are 'bankable' and understood by policy makers, bio-energy too complex.

- Need for capacity building and related inhibitions about land use change

Maybe it's time to try again in context of Art 3.3 of the 1992 Rio Convention, looking at the grounds for early action provided by threats of ACC, hence realizing the 4-win potential.