

# Summary

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# What have we learned?

- Biofuel is global- US Brazil China Europe are major player
  - Japan plays by buying
  - Africa and India may join
- Biofuel is it infancy- in the US and Brazil
  - 4 million hectare in Brazil
  - 5-6 Million acre in the US
- It is small for energy but big for ag
- It is work in progress depending on policy technology&other fuels
- There is a large potential for increased cane biotech  
A big potential to increase corn biofuel in US
  - But in US cellulous is the key for large scale expansion

# The importance of complementarity

- You need adjustment at the pump and at the wheel ( the flex car) the increase demand for biofuel
- Development of a new ag industry is a two step dance
  - Need both processing capacity and production
- That lead to need for contracting and other insurance and even support effort

# It is an industrial adoption problem now

- With Sugar cane and corn the real investment is processing from corn to biofuel and residual material ( distillers grain)
- Biofuel grew where processing capacity was established. Adoption of processing technology is S shaped
- We are in the middle of a take off period
- Need to understand
  - the economics of investment in processing
  - The economics of growing biofuel crops
  - Contract and relation from farmers to processors
  - Role of policy in adoption-
    - higher subsidy .seem to induce adoption

# Ag and energy are interdependent

- The economics of biofuel depend on the price of crude
  - This is the second coming
- Need to study biofuel within context of energy and climate change
- Ag policy may be integrated with energy policy
- Biofuel is subsidized for reasons of national security and environmental externality
- Ag Policies in transition to energy emphasis
  - Modify CRP allow production of biofuel
  - Insure farmers against low biofuel prices (deficiency program for biofuel)
  - Consider Insuring processor against low energy prices

# Biofuel solves some problems and raises other

- Biofuel is good for
  - Farmers
- rural development(47 Billions)
- climate change,
  - energy independent-
- but
  - it increases food prices,
  - increase risk of shortages as inventory decline( in relative terms)
  - and may be bad for the poor.

# Biofuel -lesson in technological change

- Innovation and change are induced by economic and political realities
- It take complementary Public and Private actions
- Change combine several technological breakthrough with continuous gradual improvements
- Needed Breakthrough
  - Pretreatment of celluloits
  - Nitrogen fixation
  - Cheap and effective Enzymes i

# Evolution of technology

- Basic work is mostly done or financed by private sector
- Technology transfer leads to subsidized yet mostly private sector financed development
- Industrial evolution
  - emergence of new players (Broin) combining knowledge and finance
  - Old players reinvent themselves - mergers & acquisition
  - It take local entrepreneurship to lead and attract innovation



# Modeling issues

- Long term and short term elasticity
  - The unconstrained demand for biofuel is elastic - especially when it is a small fraction of the supply for oil. But short term demand for corn for biofuel may be inelastic because of capacity constraints.
- Residue management-
  - what will happen to the residue
  - What is the value of the residues by products
  - How distiller's grain etc affect other market
- How to model the evolution of the technology?
- How to model the IO of energy/nexus

# Modeling issue: Biofuel and energy pricing

- Fossil fuels pricing is a dynamic problem
- It is a game between Oil producers and buyers
- How Build up of alternative energy capacity changes energy pricing
- How energy pricing will affect biofuel evolution
- Complicating factor- Climate change

# Modeling framework

- There are several global food models- biofuel is added
  - Some are partial equilibrium
  - Other CGE
- Challenge
  - Incorporate policy in models
  - Move multiple market- link ag to to energy markets
  - Another linkage biofuel and byproducts
  - Have a system of sectoral models linked together
- Introduce dynamic elements
- Predict Impact on asset values
- Impact modeling requires information on key parameters

# Econometrics

- Estimation of biofuel productivity ( multi-product, multilevel) and supply
- Adoption ( risky choice) when and where new plants will develop? How incentive will affect them? Increase in capacity
- Demand ( consumer, oil company, residue product)
  - Do you study gasoline market or reduce forms?
  - How prices, policies and market situation will affect demands?
  - Residue demand
- Trade, market clearing and price transmissions (biofuel linkage to fuel, crops to livestock)
- Data is lacking - may need surveys
- Identify key parameters to be estimated for other task

# Research issue: Climate change and biofuel

- Contributing of Biofuel to build up of global warming gases
  - Substitution of fossil fuel
  - Expansion of farming
- How to compensate Biofuel within cap and trade frameworks

# Policy Research

- Ag policy emphasis shifts from payment to farmers to payment for environmental services and sustain biofuel
  - High Commodity prices remove needs for support
  - Environmental services are yet genuine
  - Biofuel would lead to adjustments
    - Support payment in time of low oil prices
    - Assurance of food availability in times of high oil prices
- Energy policy- what about taxing fuels? Other energy sources?
- Climate change policy-
  - Carbon Credit for biofuel
  - Biofuel as part of clean development mechanism
- Development issues
  - Poverty and food security impacts of bio fuel

# Science and technology policy

- Biofuel is research dependent -
  - need resources
  - Effective IPR
- Higher food productivity will reduce negative side effect of biofuel
  - Need technology regulations that will facilitate change and safety
- Research on Permitting and regulation is crucial

# We move from one temporary solution to another

- Corn ethanol is a stop gap measure
- Sugarcane will stay, as well as palm oil for bio diesel
- The yields of these crop will go up-they are not finished yet.
- But there will be a synergistic relation between developing ethanol from corn, sugarcane and research on celluloids to generate high value second generation fuels



# Ag is changing

- Biofuel is a major shift
- Ag is more than food and fiber
- Ag econ is more than “Ag+natural resources”
- Ag policy is part of resource and energy policy
- We need to build a continuous effort to build capacity to study this transition
- What is next?