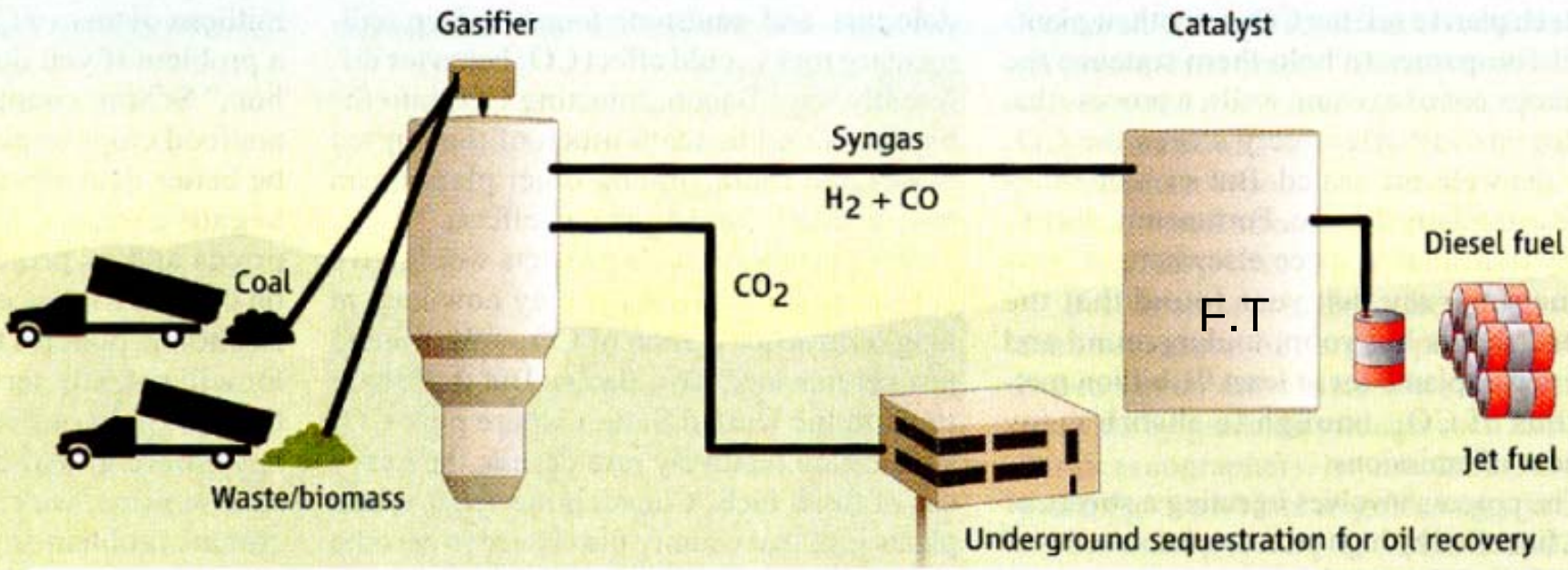
-7- (4) Carbon dioxide andGreen fuel from biomass

- byproducts from agricultural activities such as corn steve
- Waste treatment
- Biomass from microalgea

The Greening of Synfuels

An old, dirty technology to make transportation fuels from coal could fight global warming, say proponents. The trick is using more biomass and burying the carbon dioxide that's generated

It's a gas. Traditional synfuels plants take coal and turn it into syngas. The gas is then catalyzed into various liquid fuels. Proposed plants would also store underground the CO_2 that is created. Greater reliance on biomass would make the process more carbon friendly.



- Board ENERGY (Vancouver, Washington US) – 5 10^9 $ plant in Wellsville OHIO → 50.000 barrels/day of diesel
- RENTECH Inc (Los Angeles, California US) – 2011 – Natchez, Mississippi → 30.000 barrels/day of fuel

Financial limit : cost of a barrel of oil ≥ 50 $

www.sciencemag.org **SCIENCE** VOL 320 18 APRIL 2008

Decarbonized synfuels and electricity from coal + biomass with CCS

E.D.Larson,G.Fiorese,G.Liu,R.H.Williams,T.G.Kreutz,S.Consonni energy environ.sci.2010,3,28-42

Goal:coproduction Fisher Tropsch liquid (FTL) fuels and electricity from co- feed of biomass and coal with CCS

- Modelling of supply systems from **corn stover or mixed grass**

Energy content:coal:30.506 MJ/Kg_{HHV}

corn stover:17.415 MJ/Kg_{HHV}

Energy per delivered tonne :MJ/dry T

corn stover 1.14MJ/dT

(fertilizer include) 167Kg co2/dT

average cost 66$/dT or 3.8$/ GJ_{HHV}

Oil price breakeven 72$/barrel

CLT plant for a 50000bbl/day of FTL

*Biomass feed stock cost :3.8$/$GJ_{HHV}$

In Illinois for 1 million Tons/Year of corn stover

*Coal cost (Ilinois) :1.44$/$GJ_{HHV}$ ($ 2007) or 37$/T coal

19.650 T/day coal

3805 dT/day biomass or 9%of FTL

C input (feedstock)161 KgC/second

*C in FTL(liquid fuel): 24.3%

*C stored as CO2:51.3% or 1087 T/H

Injection of 2500T/day of CO2

Electricity sale price 60$/MWh+636kgCO2/MWh

Cost of GHG:20$/T; IEA estimate 2030 :120$/T

Optimisation of greenfuel from coal and biomass

- **Synfuel price breakeven 72$/barrel (2010)**
- **For a mixture of 91% coal and 9% of biomass (corn stover)**

- **E.D.Larson,G.Fiorese,G.Liu,R.H.Williams,T.G.Kreutz,S.Consonni**
- **energy environ.sci.2010,3,28-42**
- **Princeton University/Politecnico de Milano/Beijing University**

L'envol des matières premières agricoles se poursuit

La Tribune Infographie

Source et photos : Bloomberg

Biodiesel from microalgae

Vegetal oil production d=0.912kg/l

Chemical transformation:→ Energy efficiency:10 photons per CO2

Trans esterification –→ methyl ester d=0.864 : **Triglyceride+6 CH3OH=3 methyl ester**

****energy storage from sun light: max10%**

*Oil content in dry algae 20%to 50% ,80% ex: Nitzschia sp 45% to 50%

Botryococcus braunu 29% to 75%

***comparison** * **colza 1g/m2.day** 1190l/ha

* palm oil 5690l/ha

* sugar cane 10g/m2.day

* **algae 50g/m2.day** 136900l/ha (max)

1 Kg of bioalgea = 1.8 Kg of CO2

algea oil cost: 1.4 to 2.6$/l and may be 5$/l

shell exits algea venture with Cellana CEN 7/feb/2011)