

Re: Energy Cost of Ethanol

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- *From:* "cncut" <cncutwiler@xxxxxxxxxxxxxx>
 - *Date:* 27 Jun 2006 16:41:02 -0700
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cncut wrote:

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Greg Hansen wrote:

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Reviving
the topic of
Habshi's
subject line,
and hoping
to avoid the
topic of the
content,
what is the
energy cost
of
producing
ethanol?
Does
anyone
have some
solid
references?

Greg

Do you wish to start at—I
just bought one bushel of

Re: Energy Cost of Ethanol

shelled corn at
the elevator for \$2 now let's
make some ethanol--or
here, plant these
seeds and grow a bushel of
corn-- then we'll make
some ethanol. ;-))

Tut

Starting with the seeds, of course. Bushels of
shelled corn don't
appear out of nowhere.

OK--here's some data estimates in KCALS for one acre of
corn
production--
Labor 49000
Machinery 420000
Gas 797000
Nitrogen 940800
Phosphorus 47100
Potassium 63000
Seeds 68000
Irrigation 34000
Insecticides 11000
Herbicides 11000
Drying 120000
Electricity 330000
Transportation 70000

Total Inputs 2,896,800 Kilocalories per acre

For ethanol production corn need not be dried/Iowa farmers
don't
irrigate/electric fans unnecessary saving
484,000KCAL---bringing the
total inputs to 2,412,800KCAL per acre of corn.

To be continued

Some may disagree with the 2,412,800 KCAL per acre figure--and they may
be correct. The farmer for example may say--I alternate inoculated
legumes (soy beans) with corn every year. This practice fixes about
100 lbs or more usable nitrogen per acre. Also, fertilizer requirements
are diminished by returning everything back to the soil except the
seed.

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To be continued

So now we have the approx energy expended (2,412,800 KCALs) to plant and harvest one acre of corn with some variance.

How many bushels of corn can be produced on this acre?

Numbers vary—record yield is over 300 bushels per acre—average is near 150 bushels in 2005—up from 71 in 1970.

One bushel of shelled corn weighs 56 pounds—so one acre produces $150 \times 56 = 8400$ lbs of corn—therefore the energy expended to produce one pound of corn is $2,412,800 \text{KCAL} / 8400$ or 287KCAL.

To be continued

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To sum to this point—it takes 287KCAL to produce one pound of corn—or it can be purchased at the elevator for $200/56 = 3.57$ cents

Now, how many gallons of ethyl alcohol $\text{C}_2\text{H}_5\text{OH}$ ($\text{C}_2\text{H}_6\text{O}$) can be made from one bushel of corn?

Iowa State University (ISU) studies suggests that 2.5 gallons per bushel could be produced under reasonable conditions. Recent studies have also suggested that by treating ground corn with ultrasound, 30% more sugar could be attained by improving the break up of carb molecules in the corn. For this example though, let's stick with 2.5 gallons per bushel but remember that 2.74 gallons per bushel would be the probable limit from corn seeds only.

If one bushel of corn (56lbs) produces 2.5 gallons of ethanol—then $56/2.5 = 22.4$ lbs of corn will produce one gallon.

Before we start fermentation/distillation our energy/\$ cost for the corn necessary to produce one gallon of ethanol is/are:

$22.4 \text{ lbs corn} \times 287 \text{KCAL per lb} = 6428.8 \text{ KCALs}$ (corn planted and harvested)

or

$22.4 \text{ lbs corn} \times 3.57 \text{ cent per lb} = 79.96 \text{ cents}$ (corn purchased at elevator)

To be continued

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