



# FUEL ALCOHOL

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## FUEL ALCOHOL: THE PRODUCTION DECISION AND WORKSHEET

Since the beginning of the ethanol fuel movement, there has been a great deal of discussion as to who should be involved in ethanol production. Of particular interest to many farmers is the idea of producing their own fuel and becoming "energy independent." Before any venture is undertaken, a feasibility analysis should be done to decide whether or not one should enter the fuel alcohol industry.

Any potential alcohol facility has to satisfy five basic requirements: (1) a market for the end products, both ethanol and distillers dried grain; (2) a sufficient feedstock supply and/or storage; (3) an adequate water supply; (4) energy for cooking, distillation, and byproduct drying if necessary; and (5) transportation of raw materials, byproducts, and end products. In addition to these are the more basic questions of financing, labor, and meeting federal and state regulations.

The following questionnaire is adapted from *Fuel from Farms—A Guide to Small-Scale Ethanol Production*. It is only a preliminary study. Completion of this exercise is no guarantee of success, but only a positive *preliminary* investigation. The next step would be a detailed technical feasibility report with a good deal more specifics.

### ORGANIZATIONAL FORM

	Yes	No
1. Is your farm operation large enough to handle an alcohol production facility as a single proprietor?	_____	_____
2. Do you need a partner to get enough feedstock for your alcohol production facility?	_____	_____
3. Is your intended production going to be of such a scale as to far exceed the needs for your own farm or several neighboring farms?	_____	_____
4. Do you need to incorporate in order to obtain adequate funding?	_____	_____
5. Will incorporation reduce your personal tax burden?	_____	_____
6. How many farmers in your area would want to join a cooperative?	_____	
7. Do you plan to operate in a centralized location to produce alcohol for all members?	_____	_____



Cooperative Extension

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 In cooperation with the United States Department of Agriculture.  
 Issued in furtherance of the Acts of May 8 and June 30, 1914, by  
 Washington State Cooperative Extension, J. O. Young, Director

- |   | Yes   | No    |
|---|-------|-------|
| 8. Is your main reason for producing alcohol to service the needs of the cooperative members? | _____ | _____ |
| 9. Is your main reason for producing alcohol to realize a significant profit?                 | _____ | _____ |

### Financing

If you are considering borrowing money, you should have a clear idea of what your chances will be beforehand. The following questions will tell you whether debt financing is a feasible approach to your funding needs.

1. If a loan must be secured or collateralized, do you have sufficient assets to cover your debts? \_\_\_\_\_

If you are already carrying a heavy debt load and/or your credit rating is low, your chance of obtaining additional debt financing is low and perhaps you should consider some other type of financing. Insufficient collateral, exorbitant interest rates, and low projected cash flow are also negative indicators for debt financing.

The choice between debt and equity financing will be one of the most important decisions you will have to face, since it will affect how much control you will ultimately have over your operation. The following questions deal with this issue, as well as the comparative cost of the two major types of financing.

2. How much equity do you already have? \_\_\_\_\_

- |   | Yes   | No    |
|---|-------|-------|
| 3. Do you want to maintain complete ownership and control of your enterprise?   | _____ | _____ |
| 4. Are you willing to share ownership and/or control if it does not entail more than a minority share?                            | _____ | _____ |
| 5. Will the cost of selling the stock (broker's fee, bookkeeper, etc.) be more than the interest you would have to pay on a loan? | _____ | _____ |
| 6. Do you live in a geographic area that qualifies for special funds?   | _____ | _____ |
| 7. Are you going to apply for grant funds as an individual, as a nonprofit corporation, or as a profit corporation?               | _____ | _____ |
| 8. Are you a private nonprofit corporation?   | _____ | _____ |
| 9. Is there something special about your alcohol facility that would make it attractive to certain foundations?                   | _____ | _____ |

You should have a good idea as to where you are going to seek your initial funding. Remember that most new businesses start up with a combination of funding sources. It is important to maintain a balance that will give you not only sufficient funding when you need it, but also the amount of control over your operation that you would like to have.

If the financial requirements are greater than the capability to obtain financing, it does not necessarily mean the entire concept will not work. Rather, the organizational form can be re-examined and/or the production base expanded in order to increase financial capability.

**Market Assessment**

1. List the equipment that you are willing to modify for straight alcohol fuel.

Equipment	Fuel Consumption (gal/yr)
a. _____	_____
b. _____	_____
c. _____	_____
d. _____	_____
e. _____	_____
f. _____	_____
g. _____	_____
h. _____	_____
i. _____	_____
j. _____	_____
k. _____	_____
l. _____	_____

Total: \_\_\_\_\_ gal yr

2. Take the total from Question 1 and multiply by 120% to obtain the quantity of alcohol for use as straight fuel in spark-ignition engines.

\_\_\_\_\_ gal/yr x 1.2 = \_\_\_\_\_ gal alcohol/yr

3. List the equipment that you will convert to dual-injection system for 50% alcohol/50% diesel fuel blend.

Equipment	Diesel Fuel Consumption (gal/yr)
a. _____	_____
b. _____	_____
c. _____	_____
d. _____	_____
e. _____	_____

Equipment	Diesel Fuel Consumption (gal/yr)
f. _____	_____
g. _____	_____
h. _____	_____
i. _____	_____
j. _____	_____
k. _____	_____
l. _____	_____

TOTAL: \_\_\_\_\_ gal/yr

4. Take the total from Question 3 and multiply by 0.5 to obtain the quantity of alcohol required for dual-injection system equipment.

\_\_\_\_\_ gal/yr x 0.5 = \_\_\_\_\_ gal alcohol/yr

5. Total the answers from Questions 2 and 4 to determine your total annual on-farm alcohol consumption potential.

\_\_\_\_\_ gal alcohol/yr + \_\_\_\_\_ gal alcohol/yr = \_\_\_\_\_ Total

6. List the number of cattle you own that you intend to feed stillage.

- a. \_\_\_\_\_ Feeder Calves  
 \_\_\_\_\_ Mature Cattle

A mature cow can consume the stillage from 1 gallon of ethanol production in one day. A feeder calf can consume the stillage from 0.7 gallons of ethanol production in 1 day. Multiply the number of feeder calves by 0.7. Add this product to the number of mature cattle to obtain the daily maximum alcohol production rate for which stillage can be consumed by cattle.

b. \_\_\_\_\_ Feeder Calves x 0.7\* + \_\_\_\_\_ Mature Cattle = \_\_\_\_\_ gal/day

7. List the number of cattle that neighbors and/or neighboring feedlots own which they will commit to feed your stillage at full ration.

- \_\_\_\_\_ Feeder Calves  
 \_\_\_\_\_ Mature Cattle

\_\_\_\_\_ Feeder Calves x 0.7\* + \_\_\_\_\_ Mature Cattle = \_\_\_\_\_ gal/day

8. Total the answers from Questions 6 and 7 to determine the equivalent daily alcohol production rate for which the stillage can be consumed by cattle.

\_\_\_\_\_ gal/day + \_\_\_\_\_ gal/day = \_\_\_\_\_ total gal/day

9. Determine the number of pigs you own that you can feed stillage.

a. \_\_\_\_\_ Pigs

Determine the number of pigs owned by neighbors or nearby pig feeders that can be committed to feeding your stillage at full ration.

b. \_\_\_\_\_ Neighboring Pigs

Total the results from a and b.  $a + b =$  \_\_\_\_\_ Total Pigs

10. Multiply the total from Question 9 by 0.4 to obtain the equivalent daily alcohol production for which stillage can be consumed by pigs.

\_\_\_\_\_ Pigs  $\times 0.4^* =$  \_\_\_\_\_ gal/day

11. Repeat the exercise in Question 9 for sheep.

a. \_\_\_\_\_ Sheep Owned

b. \_\_\_\_\_ Neighbors' sheep

$a + b =$  \_\_\_\_\_ Total Sheep

12. Multiply total from Question 11 by the quantity of linseed meal\* normally fed every day to sheep in order to obtain the equivalent daily alcohol production rate for which stillage can be consumed by sheep.

\_\_\_\_\_ Sheep  $\times$  \_\_\_\_\_ =gal/day

13. Total the answers from Questions 8, 10, and 12 to obtain the total equivalent daily alcohol production rate for which stillage can be consumed by local livestock.

\_\_\_\_\_ gal/day + \_\_\_\_\_ gal/day + \_\_\_\_\_ gal/day = \_\_\_\_\_ total gal/day

14. Multiply the total from Question 13 by 365 to obtain the total annual alcohol production for which the stillage will be consumed.

\_\_\_\_\_ gal/day  $\times 365 =$  \_\_\_\_\_ gal/year

Note: 365 may need to be altered if feed lots are not kept full or if the alcohol plant is not going to be run all year.

Compare the answer from Question 14 to the answer from Question 5. If the answer from Question 14 is larger than the answer from Question 5, all of the stillage produced can be consumed by local livestock. This is the first production-limiting consideration. If the answer to Question 14 is smaller than the answer for Question 5, a choice must be made between limiting production to the number indicated by Question 14 or purchasing stillage processing equipment.

15. Survey the local alcohol purchase market to determine the quantity of alcohol that they will commit to purchase.

- a. Dealers \_\_\_\_\_ gal/year
- b. Local Dist. \_\_\_\_\_ gal/year
- c. Regional Dist. \_\_\_\_\_ gal/year
- d. Other Farmers \_\_\_\_\_ gal/year
- e. Trans. Fleets \_\_\_\_\_ gal/year
- f. Fuel Blenders \_\_\_\_\_ gal/year
- g. Other \_\_\_\_\_ gal/year
- Total \_\_\_\_\_ gal/year

16. Combine the answers from Questions 5 and 15 to determine the annual market for alcohol.

\_\_\_\_\_ gal/yr + \_\_\_\_\_ gal/yr = \_\_\_\_\_ Total gal/yr

This is the ethanol market potential. It is not necessarily an appropriate plant size.

\*Use this amount only if you are going to feed the amount recommended in *Fuel from Farms*.

**Production Potential**

17. Which of the following potential alcohol feedstocks do you now grow, that you are willing to divert to ethanol production?

Annual	Acres	Yield/Acre	Total Production	
a. corn	_____	_____	_____	bu/yr
b. wheat	_____	_____	_____	bu/yr
c. rye	_____	_____	_____	bu/yr
d. barley	_____	_____	_____	bu/yr
e. rice	_____	_____	_____	bu/yr
f. potatoes	_____	_____	_____	cwt/yr
g. sugar beets	_____	_____	_____	tons/yr
h. sugar cane	_____	_____	_____	tons/yr
i. sweet sorghum	_____	_____	_____	tons/yr
j. other	_____	_____	_____	/yr

18. Do you have additional uncultivated land on which to plant more of any of these crops for ethanol production?

	Anticipated Acres	Potential Yield/Acre	Add'l Annual Production	
a. corn	_____	_____	_____	bu/yr
b. wheat	_____	_____	_____	bu/yr
c. rye	_____	_____	_____	bu/yr
d. barley	_____	_____	_____	bu/yr

	Anticipated Acres	Potential Yield/Acre	Add'l Annual Production	
e. rice	_____	_____	_____	bu/yr
f. potatoes	_____	_____	_____	cwt/yr
g. sugar beets	_____	_____	_____	tons/yr
h. sugar cane	_____	_____	_____	tons/yr
i. sweet sorghum	_____	_____	_____	tons/yr
j. other	_____	_____	_____	/yr

19. Can you shift land from production of any crops not mentioned in Question 17 to increase production of one that is? If so, calculate the potential increase as in Question 18.

Crop	Anticipated Acres	Potential Yield/Acre	Add'l Annual Production
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

20. Do you have access to any cull or waste feedstocks from outside sources? If so, list.

	Acres	Yield/Acre	Total Production	
a. corn	_____	_____	_____	bu/yr
b. wheat	_____	_____	_____	bu/yr
c. rye	_____	_____	_____	bu/yr
d. barley	_____	_____	_____	bu/yr
e. rice	_____	_____	_____	bu/yr
f. potatoes	_____	_____	_____	cwt/yr
g. sugar beets	_____	_____	_____	tons/yr
h. sugar cane	_____	_____	_____	tons/yr
i. sweet sorghum	_____	_____	_____	tons/yr
j. other	_____	_____	_____	/yr

21. Add the annual production values separately for each group from Questions 17, 18, 19, and 20. (This procedure can be used for other crops; however, reliable data may not be available for other crops.)

	Cereal Grains bu/yr	Potatoes cwt/yr	Sugar Beets tons/yr	Other	
a.	_____	_____	_____	_____	
b.	_____	_____	_____	_____	
c.	_____	_____	_____	_____	
d.	_____	_____	_____	_____	
e.	_____	_____	_____	_____	
	_____	_____	_____	_____	Totals
	Column I	Column II	Column III	Column IV	

22. Multiply the Question 21 answers from:

a. Column I by 2.5 to obtain annual potential alcohol production from cereal grains:

$$\underline{\hspace{2cm}} \text{ bu/yr} \times 2.5 \text{ gal/bu} + \underline{\hspace{2cm}} \text{ gal alcohol/yr}$$

b. Column II by 1.1 gal/cwt to obtain annual potential alcohol production from potatoes:

$$\underline{\hspace{2cm}} \text{ cwt/yr} \times 1.1 \text{ gal/cwt} = \underline{\hspace{2cm}} \text{ gal alcohol/yr}$$

c. Column III by 20 gal/ton to obtain annual potential alcohol production from sugar beets:

$$\underline{\hspace{2cm}} \text{ ton/yr} \times 20 \text{ gal/ton} = \underline{\hspace{2cm}} \text{ gal alcohol/yr}$$

d. Column IV by appropriate yield per unit measure to obtain gallons of alcohol/yr:

$$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \text{ gal alcohol/yr}$$

23. Total the answers from Questions 22a, 22b, 22c, and 22d to determine total *potential* production capability. (This is not necessarily the plant size to select, as the following series of questions demonstrates.)

$$\underline{\hspace{2cm}} \text{ gal/yr} + \underline{\hspace{2cm}} \text{ gal/yr} + \underline{\hspace{2cm}} \text{ gal/yr} + \underline{\hspace{2cm}} \text{ gal/yr} = \underline{\hspace{2cm}} \text{ gal/yr}$$

If the answer to Question 23 is greater than the answer to Question 16, the *maximum* size of the plant would be the value from Question 16.

### Plant Size

Neither the size of the market nor the production potential are sufficient to determine the appropriate plant size although they do provide an upper limit. A good starting point is to fill your own fuel needs (answer to Question 5) and not exceed local stillage consumption potential (answer to Question 14). Since the latter is usually larger and the equipment for treatment of stillage introduces a significant additional cost, the value from Question 14 is a good starting point. Now the approximate revenues and savings must be compared to current earnings from the proposed ethanol feedstock to determine if there is any gain in value by building an ethanol plant. Assume all feedstock costs are charged to production of alcohol.

### Fuel Savings

24. Multiply the total of Question 1 by the current price you pay for gasoline in \$/gal.

$$\underline{\hspace{2cm}} \text{ gal/yr} \times \underline{\hspace{2cm}} \text{ \$/gal} = \underline{\hspace{2cm}} \text{ \$/yr}$$

This is the savings from replacing gasoline with alcohol.



25. Multiply the answer from Question 4 by the current price you pay for diesel fuel in \$/gal.

$$\underline{\hspace{2cm}} \text{ gal/yr} \times \underline{\hspace{2cm}} \text{ \$/gal} = \underline{\hspace{2cm}} \text{ \$/yr}$$

This is the savings from replacing diesel fuel with alcohol.

26. Total Questions 24 and 25 to obtain the total fuel savings.

$$\underline{\hspace{2cm}} \text{ \$/yr} + \underline{\hspace{2cm}} \text{ \$/yr} = \underline{\hspace{2cm}} \text{ total \$/yr}$$

### Feed Savings

27. Total the answers from Questions 5, 8, 10, and 12.

$$\underline{\hspace{2cm}} \text{ gal/day} + \underline{\hspace{2cm}} \text{ gal/day} + \underline{\hspace{2cm}} \text{ gal/day} = \underline{\hspace{2cm}} \text{ total gal/day}$$

28. Multiply the answer to Question 27 by 6.8 to obtain the dry mass of high-protein material material represented by the whole stillage fed (if using cereal grain feedstock).

$$\underline{\hspace{2cm}} \text{ gal/day} \times 6.8 \text{ lb dry mass/gal alcohol} = \underline{\hspace{2cm}} \text{ lb dry mass/day}$$

29. Multiply the answer to Question 28 by the protein fraction (e.g., 0.28 for corn) of the stillage on a dry basis.

$$\underline{\hspace{2cm}} \text{ lb dry mass/day} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \text{ lb protein/day}$$

(protein fraction)

30. a. Determine the cost (in \$/lb protein) of the next less expensive protein supplement and multiply this number by the answer to Question 29. (Answer this question only if you buy protein supplement.)

$$\underline{\hspace{2cm}} \text{ \$/lb protein} \times \underline{\hspace{2cm}} \text{ lb protein/day} = \underline{\hspace{2cm}} \text{ \$/day}$$

b. Multiply the answer to Question 30a by 365 (or the number of days per year you keep animals on protein supplement) to obtain annual savings in protein supplement.

$$\underline{\hspace{2cm}} \text{ \$/day} \times 365 \text{ days/yr} = \underline{\hspace{2cm}} \text{ \$/yr}$$

### Revenues

31. a. Multiply the answer from Question 28 by the reasonable market value of the stillage you produce.

$$\underline{\hspace{2cm}} \text{ lb dry mass/day} \times \underline{\hspace{2cm}} \text{ \$/lb} = \underline{\hspace{2cm}} \text{ \$/day}$$

b. Multiply the answer obtained in Question 31a by the number of days during the year that this quantity of stillage can be marketed, up to 365.

$$\underline{\hspace{2cm}} \text{ \$/day} \times \underline{\hspace{2cm}} \text{ day/yr} = \underline{\hspace{2cm}} \text{ \$/yr}$$

This is the total stillage sales you will realize each year.

32. If anhydrous alcohol (200 proof) is going to be produced, the appropriate adjustments in the remainder of this questionnaire must be made. This questionnaire is based on 190 proof maximum.

33. Subtract the answer to Question 5 from the answer to Question 23 to obtain the alcohol production potential that remains for sale.

$$\underline{\hspace{2cm}} \text{ gal/yr} - \underline{\hspace{2cm}} \text{ gal/yr} = \underline{\hspace{2cm}} \text{ gal/yr}$$

34. Multiply the answer from Question 33 by the current market value for ethanol.

$$\underline{\hspace{2cm}} \text{ gal/yr} \times \underline{\hspace{2cm}} \text{ \$/gal} = \underline{\hspace{2cm}} \text{ \$/yr}$$

This is the annual ethanol sales potential.

35. Total the answers from Questions 26, 30b, and 34 to obtain the total revenues and savings from this production rate.

$$\underline{\hspace{2cm}} \text{ \$/yr} + \underline{\hspace{2cm}} \text{ \$/yr} + \underline{\hspace{2cm}} \text{ \$/yr} = \underline{\hspace{2cm}} \text{ total \$/yr}$$

36. Divide the answers to Question 22 by:

a. 2.5 gal/bu if the feedstock to be used is cereal grain.

$$\underline{\hspace{2cm}} \text{ gal/yr} \text{ divided by } 2.5 \text{ gal/bu} = \underline{\hspace{2cm}} \text{ bu/yr}$$

b. 1.1 gal/cwt if the feedstock to be used is potatoes.

$$\underline{\hspace{2cm}} \text{ gal/yr} \text{ divided by } 1.1 \text{ gal/cwt} = \underline{\hspace{2cm}} \text{ cwt/yr}$$

c. 20 gal/ton if the feedstock to be used is sugar beets.

$$\underline{\hspace{2cm}} \text{ gal/yr} \text{ divided by } 20 \text{ gal/ton} = \underline{\hspace{2cm}} \text{ tons/yr}$$

d. Other

$$\underline{\hspace{2cm}} \text{ gal/yr} \text{ divided by } \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

37. Multiply:

a. The answer from Question 36a by the appropriate market value for cereal grains to obtain the potential earnings for direct marketing without alcohol production:

$$\underline{\hspace{2cm}} \text{ bu/yr} \times \underline{\hspace{2cm}} \text{ \$/bu} = \underline{\hspace{2cm}} \text{ \$/yr}$$

b. The answer from Question 36b by the appropriate market value for potatoes:

$$\underline{\hspace{2cm}} \text{ cwt/yr} \times \underline{\hspace{2cm}} \text{ \$/cwt} = \underline{\hspace{2cm}} \text{ \$/yr}$$

c. The answer from Question 36c by the appropriate market value for sugar beets:

$$\underline{\hspace{2cm}} \text{ tons/yr} \times \underline{\hspace{2cm}} \text{ \$/ton} = \underline{\hspace{2cm}} \text{ \$/yr}$$

d. The answer from Question 36d by the appropriate market value:

$$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \text{ \$/yr}$$

38. Total the answers from Questions 37a, 37b, 37c, and 37d to obtain the potential earnings from directly marketing the crops without making alcohol.

$$\underline{\hspace{2cm}} \text{ \$/yr} + \underline{\hspace{2cm}} \text{ \$/yr} + \underline{\hspace{2cm}} \text{ \$/yr} + \underline{\hspace{2cm}} \text{ \$/yr} = \underline{\hspace{2cm}} \text{ Total \$/yr}$$

Compare the answers from Questions 38 and 35. If Question 38 is as large, or nearly as large as the answer from Question 37, the construction of an ethanol plant of this size cannot be justified on a purely economic basis. Consider scaling down to a size that fills your own fuel needs and recompute Questions 24 through 38. If Question 35 is considerably larger (2 to 3 times) than Question 38, you can consider increasing your plant size within the bounds of the answers to Question 16 (market) and Question 23 (production potential). Care must be taken to assess local competition and market share as you expand plant size.

If a market share exists or if there is good reason to believe that you can acquire a share by superior techniques, the initial plant sizing must accurately reflect this realistic market share.

39. a. Multiply the initial plant production capacity (in gallons alcohol/hr) by 16 gallons of water per gallon alcohol production capacity.

$$\underline{\hspace{2cm}} \text{ gal alcohol/hr} \times 16 \text{ gal H}_2\text{O gal alcohol} = \underline{\hspace{2cm}} \text{ gal H}_2\text{O/hr}$$

b. Can the answer to Question 39 be realistically achieved in your area? If yes, no adjustment to chosen plant size needs to be made to account for water availability. If no, reduce plant size to realistically reflect available water.

### Approximate Costs of Plant

The cost of the equipment you choose will be a function of the labor available, the maintenance required, the heat source selected, and the type of operating mode.

### Labor Requirements

How much time during the normal farming routine can you dedicate to running the ethanol plant?

40. a. Do you have any hired help or other adult family members, and if so, how much time can they dedicate to running the ethanol plant? \_\_\_\_\_

b. Can you or your family or help dedicate time at periodic intervals to operating the ethanol plant?

\_\_\_\_\_ yes          \_\_\_\_\_ no

If labor is limited, a high degree of automatic control is indicated.

**Maintenance**

41. What are your maintenance capabilities and equipment?

**Heat Source**

42. Determine the least expensive heat source available.

**Equipment**

43. List all of the plant components and their costs.

1. Feedstock Preparation Equipment

- a. storage bins \$ \_\_\_\_\_
- b. grinding mill \$ \_\_\_\_\_
- c. feedstock handling equipment \$ \_\_\_\_\_
- d. boiler fuel handling equipment \$ \_\_\_\_\_

2. Plant Equipment

- a. cookers \$ \_\_\_\_\_
- b. fermenters \$ \_\_\_\_\_
- c. distillation columns \$ \_\_\_\_\_
- d. boiler \$ \_\_\_\_\_
- e. other \$ \_\_\_\_\_

3. Finished Product Storage

- a. storage tanks (product & coproduct) \$ \_\_\_\_\_
- b. pumps \$ \_\_\_\_\_
- c. pipes and valves \$ \_\_\_\_\_
- d. metering controls \$ \_\_\_\_\_

4. Byproduct Equipment

- a. storage tanks (stillage) \$ \_\_\_\_\_
- b. stillage treatment equipment \$ \_\_\_\_\_
- c. CO<sub>2</sub> handling equipment \$ \_\_\_\_\_

TOTAL \$ \_\_\_\_\_

44. Determine operating requirements for cost.

Plant capacity = \_\_\_\_\_ gallons of ethanol per hour.

Production = \_\_\_\_\_ gallons per hour x hours of operation per year = \_\_\_\_\_ gallons per year

Feed materials = Production \_\_\_\_\_ gal/yr divided by \_\_\_\_\_ gal/bu = \_\_\_\_\_ bu/yr

A. Operating Costs	\$/yr	\$/gal
Feed materials grain (\$/bu divided by gal ethanol/bu = \$/gal)	_____	_____
or (\$/bu x bu/yr = \$/yr)	_____	_____
Supplies		
Enzymes	_____	_____
Other	_____	_____
Fuel for plant operation	_____	_____
Waste disposal	_____	_____
Operating labor (operating crew x hrs of operation/yr x \$/hr = \$/yr)	_____	_____
Add these costs together to give the total operating costs:		
Total Operating Costs:	_____	_____
B. Maintenance Costs	\$/yr	\$/gal
Routine scheduled maintenance	_____	_____
Labor (maintenance crew staff x hrs/yr x \$/hr)	_____	_____
Supplies and replacement parts	_____	_____
Maintenance equipment rental	_____	_____
Unscheduled maintenance (estimate)	_____	_____
Labor	_____	_____
Supplies	_____	_____
Maintenance equipment	_____	_____
Total Maintenance Costs:	_____	_____
C. Capital or Investment Costs		
Plant equipment costs	_____	_____
Land	_____	_____
Inventory		
Grain	_____	_____
Supplies	_____	_____
Ethanol	_____	_____
Spare parts	_____	_____
Subtotal:	_____	_____
Taxes	_____	_____
Insurance	_____	_____
Depreciation	_____	_____
Interest on loan or mortgage	_____	_____
Subtotal:	_____	_____
Total Capital or Investment Costs	_____	_____
Total Costs (Add A, B, And C together)	_____	_____

**Financial Requirements**

	Cost Estimate	Considerations
45. Capital Dollars Required		
Real Estate	_____	_____
Buildings	_____	_____
Equipment (43)	_____	_____
Equipment delivery	_____	_____
Business formation	_____	_____
Equipment installation	_____	_____
Total:	_____	_____
46. Operating Costs		
Labor	_____	_____
Maintenance	_____	_____
Taxes	_____	_____
Supplies	_____	Includes raw materials, additives, enzymes, yeast, water
Expenses	_____	Includes electricity, fuel (s)
Insurance	_____	_____
Insurance on debt	_____	Includes interest on long- and short-term loans
Bonding and Licensing	_____	_____
Total Operating Costs:	_____	_____
47. Working Capital		
Total Operating Costs (46)	_____	_____
Mortgage	_____	Principal payments only
Cash to carry accounts receivable for 60 days	_____	_____
Cash to carry a finished goods inventory for 30 days	_____	_____
Cash to carry a raw materials inventory for 30 days	_____	_____
Total Working Capital:	_____	_____
48. Total Start-Up Costs, Question 46 + Question 47.		
(46) _____	+ (47) _____	= TOTAL COSTS _____

**Synopsis of Feasibility Worksheet**

I. Market Assessment		
No. 16. Ethanol market potential	_____	gal/yr
II. Production Potential		
No. 23. Potential ethanol production capability	_____	gal/yr
III. Plant Size		_____ gal/yr
IV. Revenue and Savings		
No. 35. Potential revenues and savings from producing ethanol	_____	\$/yr
No. 38. Potential revenues not producing ethanol	_____	\$/yr
V. Costs		
No. 48. Total start-up costs	\$ _____	
VI. Returns		
Average cost per gallon if used on farm. (Average from Line 20 on Alcohol Cost Worksheets)	\$ _____	/gal

This questionnaire is only a preliminary study. If the results of this study are positive, there is still need for a more detailed study; i.e., written letters of commitment from suppliers and users.

**Reference**

*Fuel From Farms—A Guide to Small-Scale Ethanol Production*, A Product of the Solar Energy Information Data Bank. Solar Energy Research Institute, Operated for the U.S. Department of Energy by the Midwest Research Institute. Under Contract No. EG-77-C-01-4042. February 1980.

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