

RUBRIC & INSTRUCTIONS VERSION

PLEASE USE THIS DOCUMENT FOR INSTRUCTIONS, TYPE YOUR RESPONSES INTO THE COLORED BOXES IN THE FILE LABELED “STUDENT WORK”

Slow-thinking Decision-making Framework Biofuels (60 points)

In this class you’ve read articles about this issue and you have had group and class discussions about biofuels. Now take some time to use the “Slow thinking framework: steps for high quality decision-making” to outline your thoughts about the issue. What you write in the “Student work” document should represent your own thinking, which may vary from the thinking of your group.

Remember the “decision” you are making is an individual decision that has societal impact, such as: 1) if you were to give money to support a cause, or 2) if you were to vote on a policy, or 3) if you were to write a letter to a legislator about this issue.

What you write in the “Student Work” document should represent your own thinking, which may and should vary from the thinking of your group.

1. Define the issue

How do we create a sustainable source of transportation fuel? Should we make ethanol out of corn as a biofuel?

2. Objectives/Evaluation Criteria

*To help us think about possible objectives, we asked ourselves: how are you going to choose between these alternatives? What are the important things to consider? What do you care about? When coming up with objective, we “separated the ends from the means” by asking ourselves “**why** do I care about that?” multiple times until we could go no further and have found the “ends” or the fundamental thing that we care about. Below is a list of objective based on class responses:*

1. Fewest greenhouse gas (CO₂, e.g.) emissions.
2. Economic benefit to farmers & rural communities.
3. Preserve the health of natural resources (land, water, soil, biodiversity, air quality).
4. Cheapest for people at the gas pump.

[1 point] Assign weights to each objective. Weight each objective to represent **how much** you care about it. The sum of all the weights should equal 1. Type the weights into the table in the “Student Work” document. Replace the text “Weight: type your weight into this cell” in the red boxes with the numbers representing your weights.

0 – no weights are assigned to the objective, or the weights are not clear.

2 –student assigns weights to the objective that add up to 1, and appropriately fills out the table.

3. Alternatives

Below is a list of alternatives that we’ve discussed in class, based on expert opinion about this issue.

- A. **Status quo: gasoline and diesel are dominant** (corn ethanol is primary biofuel, biofuels are supposed to increase in volume over the next 20 years)
- B. **Support second generation biofuels (corn stover, sorghum, switchgrass etc)** (by increasing federal government spending on research and development or subsidies for these fuels)
- C. **Promote and subsidize electric cars and renewable electricity** (homes and business would produce their own solar or wind energy to power vehicles)
- D. **Educate and motivate to drive less and fly less** (Effective approaches and incentives need to be determined.)

4. Information [81 points total]

We asked: What additional information do we need to know about each alternative?

Step 1: While looking for information, we thought about what would be a “metric” for each objective that would allow us to compare across alternatives in a way that is not subjective. This allowed us to compare across alternatives while reducing cognitive biases. Below are metrics we will try to use for each objective:

Objectives	Metric
1. Fewest greenhouse gas (CO ₂ , e.g.) emissions	The amount of released CO ₂ equivalents/year (or other similar measurement), or specifically how the alternative might impact CO ₂ emissions.
2. Economic benefit to farmers & rural communities	The amount of profit for each alternative, or specifically how the alternative may impact farmers.
3. Preserve the health of natural resources (land, water, soil, biodiversity, air quality)	The amount of water used, amount of land used, the number of species impacted with each alternative, the amount of air pollution or specifically how the alternative would impact land, water, soil, biodiversity or air quality. (Remember “air quality” generally refers to pollution that does not cause climate change, but causes other issues for example acid rain.)
4. Cheapest for people (at the gas pump, or in terms of vehicle purchase)	The cost of fuel under each alternative, or specifically how the alternative might impact fuel prices.

Step 2 (80 points): Research each alternative to determine– if this alternative is chosen, will in result in satisfying the objective? In other words, describe the information known about each alternative with reference to specific objective. Based on information, give an argument about what performance score should be assigned each alternative for a given objective, based on the information you found.

You’ve discussed these alternatives and objective in depth during recitation after student groups gave their presentations. You may use information that was gathered by other groups in your recitation, or in other recitations, that is posted on Canvas in “Discussion” in discussion posts for each alternative and objective. However, you must write an argument about performance metrics in **YOUR OWN WORDS**. (Copy and pasting arguments from other group’s arguments will be given a zero, copying word-for-word from a friend will result in a zero.) You may choose to assign the same performance scores that were decided on in class, or you may argue for a different performance score. You may use the same references as other groups, as long as they support your argument, are explained in your own words, and are cited properly and clearly traceable to the source. You may also do additional research on your own.

Each alternative and objective combination will be eligible for up to 5 points based on:

	<i>Lacking</i>	<i>Developing</i>	<i>Meeting or Exceeding</i>
<i>Reasoning</i>	<i>0 – the argument for how an alternative meets the criterion does not go beyond assumptions that everyone makes. The reasoning has little argumentative force, and does not add clarity or insight into the consequences of choosing an alternative and if it will meet the desired objective.</i>	<i>1 - an argument for how an alternative meets the criterion has some significant gaps in reasoning, for example large assumptions that could have been supported with evidence or specific information.</i>	<i>2 - the student gives a high quality, thorough argument about the consequences of the alternative, in terms of if it will meet a given objective. The argument includes specific reasons -- how, why or how much-- the objective is or isn't met using specific, relevant information or evidence from research or from class or other sources.</i>
<i>Evidence</i>	<i>0 – no evidence or specific information is given.</i>	<i>1 - evidence/specific information that is cited is irrelevant or disconnected from the argument.</i>	<i>2 - The evidence provided connects to the students' argument about if the alternative will meet the objective.</i>
<i>Sources</i>	<i>0 – no evidence or specific information is given.</i>	<i>0.5 – it is not entirely clear what the specific information/evidence is, and it does not seem to be clearly traceable to a source. (for example, references are to "irs.gov" or "https://www.lpsnrd.org" instead of linking or referencing specific information that supports the argument).</i>	<i>1 - The source of information is cited in a way that it is clear what the specific information/evidence is, and the information is traceable to the source.</i>

Therefore, 4 objective x 4 alternatives x 5 points = 80 points total are possible

Step 3 (1 point): Assign *performance scores*. Based on the information you found, assign ***performance scores***, or a number of stars from 1(*) to up to 4 (****), with 1= the worst, and 4= the best. A different number of stars represents a **significant difference** between each alternative in meeting the objective, according to your research. (An example of how to assign performance scores is posted on Canvas. Note: If two alternatives perform the same according to the metric then they should get identical performance scores.)

0 – no performance scores are assigned, or the scores are not clear.

0.5 – student assigns performance scores inappropriately, and do not seem to be based on the research provided by the student.

1 –student assigns performance scores appropriately that align with the research provided by the student..

5. Analysis of alternatives based on the objective (tradeoffs) (2 points)

Multiply the weight of each objective by the number of stars (performance score) of each alternative (across the rows). Write the results of that multiplication in the blue cells of the table in the “Student Work” document.

Add up the weighted performance scores of each alternative (blue cells) down the columns for each alternative, and then write the results of that addition in the bottom row of the table in the green cells.

OR: use the excel sheet provided on Canvas to do the math for you! Simply type your objective weights into the red cells in the spreadsheet (titled “Plastic pollution analysis table.xlsx”), and see how it influences the total weighted performance scores of each alternative. Don’t forget to record your final values into the “Student Work” document.

0 – no total weighted performance scores are assigned, or the scores are not clear.

1 – student has a mistake in their math or inappropriately fills out the table.

2 – student does correct math and appropriately fills out the table.

6. Choice (6 points)

A) Choose an “alternative” based on the analysis undertaken.

B) [3 points] Why do you think this is the best alternative?

0—the student does not provide reasoning for their choice, or the reasoning is weak, unclear and disconnected with the objective and tradeoffs illustrated in the analysis table

1.5—the student provides reasoning for their choice that has some weak or unclear connections with the objective and tradeoffs illustrated in the analysis table

3—the student provides clear and comprehensive reasoning for their choice that clearly links the choice with the objective and tradeoffs illustrated in the analysis table

C) [3 points] What are the tradeoffs (positive and negative aspects) associated with the alternative you chose?

0—the student does not provide reasoning for their choice, or the reasoning is weak, unclear and disconnected with the objective

1.5—the student only provides positive aspects of the alternative or describes how well the alternative performs based on only 1-2 objective

3—the student provides positive and negative aspects of the alternative or describes how well the alternative performs based on all of the objective

7. Review (6 points total)

Reflect on your own decision-making process using these steps.

A) [1.5 points] Who are the stakeholders who are “winners” and “losers” if this alternative is implemented?

0—the student offers no reflection or what is offered demonstrates no thoughtfulness

1.5—the student offers reflection that demonstrates thoughtfulness, including specific examples of the stakeholders who might gain and the stakeholders who might lose if their decision is implemented.

B) [1.5 points] Some of the alternatives are not necessarily mutually exclusive, and more than one could potentially be implemented at the same time. Are there other alternatives (either the ones listed or other things that you can think of) that you would like to see implemented to help solve this problem?

0—the student offers no reflection or what is offered demonstrates no thoughtfulness

1.5—the student offers reflection that demonstrates thoughtfulness, including specific reasoning about alternatives for solving the problem

C) [1.5 points] Do you think your chosen alternative is viable to be currently implemented in our society, and would work effectively to resolve the issue? Why or why not?

0—the student offers no reflection or what is offered demonstrates no thoughtfulness

1.5—the student offers reflection that demonstrates a deep enough understanding of the issue to understand what is a viable alternative, or is thoughtful about what they don't yet understand to determine what is viable.

D) [1.5 points] Did working through the slow-thinking decision-making framework (7 steps) result in your thinking differently about the issue? How?

0—the student offers no reflection or what is offered demonstrates no thoughtfulness

1.5—the student offers reflection that demonstrates thoughtfulness, including specific examples of why the 7 steps did or did not influence their thinking about this issue.

8. Assigning resources (1 point) See the “student work” file to answer this question.

1 point- complete answer to the question, with an X indicated for each alternative..

9. Importance of issue (1 point) See the “student work” file to answer this question.

1- complete and thoughtful answer to the question “why” and a rank given

10. Impact (1 point) See the “student work” file to answer this question.

1 – the action presented by the student is clearly related to the issue.

11. Your Actions (1 point) See the “student work” file to answer this question.

1 – complete and thoughtful answer to the question.

Name: _____ Group: _____ Instructor: _____ LA: _____

SCIL 101 Biofuels Module Assessment (60 points)

STUDENT WORK GOES HERE (IN COLORED BOXES):

In the table below you will replace the text in the colored boxes with your objective weights (red), performance scores for the first two objective (purple), weighted performance scores (blue), and total weighted performance scores (green) (see the Rubrics and Instructions file).

ALTERNATIVES OBJECTIVES	Status quo: gasoline and diesel are dominant (corn ethanol is primary biofuel, biofuels are supposed to increase in volume over the next 20 years)		Support second generation biofuels (corn stover, sorghum, switchgrass etc) (by increasing federal government spending on research and development or subsidies for these fuels)		Promote and subsidize electric cars and renewable electricity (homes and business would produce their own solar or wind energy to power vehicles)		Educate and motivate to drive less and fly less (Effective approaches and incentives need to be determined.)	
	Performance score:	Performance score x objective weight:	Performance score:	Performance score x objective weight:	Performance score:	Performance score x objective wgt:	Performance score:	Performance score x objective wgt:
Fewest greenhouse gas (CO ₂) emissions Type a weight into this cell		Multiply the weight x the performance score, type it in these blue cells						
Economic benefit to farmers & rural communities Type a weight into this cell								
Preserve the health of natural resources (land, water, soil, biodiversity, air quality) Type a weight into this cell								
Cheapest for people (at the gas pump, or in terms of vehicle purchase) Type a weight into this cell								
Total weighted performance score:	Sum up the weighted performance scores in this cell							

4. Information, Step 4: justification of assigning your performance scores:

Objective – Fewest greenhouse gas (CO₂, e.g.) emissions:

Alternative 1:

Alternative 2:

Alternative 3:

Alternative 4:

Objective - Economic benefit to farmers & rural communities:

Alternative 1:

Alternative 2:

Alternative 3:

Alternative 4:

Objective - Preserve the health of natural resources (land, water, soil, biodiversity, air quality):

Alternative 1:

Alternative 2:

Alternative 3:

Alternative 4:

Objective – Cheapest for people (at the gas pump, or in terms of vehicle purchase):

Alternative 1:

Alternative 2:

Alternative 3:

Alternative 4:

6. Choice:

A) Choose an “alternative” based on the analysis undertaken.

B) Why do you think this is the best alternative?

C) What are the tradeoffs (positive and negative aspects) associated with the alternative you chose?

7. Review (Reflect on your own decision-making process using these steps):

A) Who are the stakeholders who are “winners” and “losers” if this alternative is implemented?

B) Some of the alternatives are not necessarily mutually exclusive, and more than one could potentially be implemented at the same time. Are there other alternatives (either the ones listed or other things that you can think of) that you would like to see implemented to help solve this problem?

C) Do you think your chosen alternative is viable to be currently implemented in our society, and would work effectively to resolve the issue? Why or why not?

D) Did working through the slow-thinking decision-making framework (7 steps) result in your thinking differently about the issue? How?

8. Would you support these alternatives with real resources? How likely is it that you would support the following alternatives regarding water conservation? (Think about this as if you have \$10 million dollars to allocate towards any of these alternatives for solving the problem. How would you allocate the money?)

Please place an "X" in the box you agree that you would support with donations:

	Very likely to support	Somewhat likely to support	Neutral	Somewhat unlikely to support	Very unlikely to support	I don't know
Status quo: gasoline and diesel are dominant (corn ethanol is primary biofuel, biofuels are supposed to increase in volume over the next 20 years)						
Support second generation biofuels (corn stover, sorghum, switchgrass etc) (by increasing federal government spending on research and development or subsidies for these fuels)						
Promote and subsidize electric cars and renewable electricity (homes and business would produce their own solar or wind energy to power vehicles)						
Educate and motivate to drive less and fly less (Effective approaches and incentives need to be determined.)						

9. Importance of issue - Is this issue an important issue?

Rank the issue on a scale of 1 (not at all important) to 10 (one of the most important issues): _____

Why?

10. Impact - Is there anything you could do to impact this issue? What are some things you could do?

11. Your Actions - Do you think your actions regarding this issue will make a difference? Why or why not?

After you have filled everything out in purple according to the instructions, save this document with your first and last name in the file extension, then upload this document to Canvas

Week	Class Sessions	Class Topics	Step of SDM Tool
4	Lecture	Do biofuels reduce greenhouse gas emissions? How do biofuels impact the environment? (Background science, scientific uncertainty, current alternatives)	1, 2, 3
4	Lecture	Do biofuels reduce greenhouse gas emissions? How do biofuels impact the environment? (Developing deeper understanding of objectives and alternatives and the science of energy/biofuels)	2, 3
4	Recitation Meeting	Groups assigned an alternative x objective - Time for group research. Submit and receive feedback on research for next recitation session.	4
5	Lecture	Biofuel production and use in engines - guest expert speaker	3, 4
5	Lecture	Life Cycle Assessment of biofuels	3, 4
5	Recitation Meeting	½ of groups present their research + class decides performance metrics for the objective/alternative presented	4, 5
6	Lecture	Biofuels continued (economic impact, biodiversity impact etc.)	4
6	Lecture	Biofuels continued (Food versus fuel debate, municipal solid waste etc.)	4
6	Recitation Meeting	½ of groups present their research + class decides performance metrics for the objective/alternative presented	4, 5
7	Individual Assignment Due	Biofuels module assessment	4, 5, 6, 7

A sample schedule of the Biofuels Module on how the SDM tool is integrated into the course. Step 7 of the SDM tool is completed by the students individually after the final recitation meeting for the module in their individual module assessments. Lecture and recitation meetings are complementary in that lectures tend to be informational and provide background research students can use and build upon for the research and synthesis they do during recitation meetings.