PAI 777 **Professor David Popp**
The Economics of Environmental Policy **Spring 2022**

Take Home Quiz #3
DUE AT THE BEGINNING OF CLASS ON WEDNESDAY, APRIL 13

This quiz is intended as an individual take-home quiz. Each student is expected to hand in their own work. While you are free to consult with me for any questions you may have, you may not discuss the quiz with other students. E-mail questions about the quiz should be sent to my personal e-mail address (dcpopp@syr.edu), rather than the class listserv. This is an open-book quiz. You are free to consult your notes and the readings from the class to complete the quiz.

Take the time to think before you write. Well-thought out, well-written answers will be rewarded. A direct, concise explanation is better than a five-page treatise. I am not just looking for how much you know, but how well you are able to communicate what you do know, which includes filtering through information to highlight the most relevant points. In addition, pay attention to the target audience. For this assignment, your will be reviewed by staff economists, so the use of economic terminology is acceptable. More generally, the assignments page of the class web site links to an article with suggestions for effective professional writing.

The quiz is due AT THE BEGINNING OF CLASS on WEDNESDAY, APRIL 13. Late quizzes give you an unfair advantage over other students in the class. As a result, late quizzes will be marked down one grade for each day late, starting AT THE BEGINNING OF CLASS on WEDNESDAY, APRIL 13. If you will not be in class on Wednesday, it is your responsibility to get the exam to me BEFORE CLASS. Do not just leave the exam in my mailbox, as I need to know when you hand the exam in. There is a sign-in sheet at the front desk of CPR for this purpose.

I. Benefit-Cost Analysis of a Wind Turbine (25%)

An electric utility is considering building a new wind turbine. The turbine will cost $1,000,000 to build. Those costs would be paid today (year 0). In year 1, the turbine will be fully operational. It will generate revenue for the utility through the sale of electricity. Its profits will be this revenue minus the annual operating costs of running the turbine. In addition to the revenue generated, the turbine also generates social benefits through reduced pollution, as the electricity generated will replace electricity currently generated at a local coal plant.[1] Below are the costs and benefits that will accrue in year 1:

Revenue from sale of electricity in year 1:	$1,500,000
Operating costs in year 1:	$500,000
Environmental benefits in year 1:	$75,000

a) Using a 7% discount rate, calculate the net present value of this project from the perspective of the utility. Is investing in the wind turbine worthwhile to the utility? (5 points)

b) Repeat your calculation, looking at the project from the perspective of society as a whole. Is investing in the wind turbine beneficial to society as a whole? (5 points)

c) The firm expects there is a 50% chance that the government will offer a $75,000 subsidy in year 1 to compensate the utility for the environmental benefits experienced by society as a whole.

Using a 7% discount rate, what is the expected value of the wind turbine to the firm? (*Hint*: Which number from above represents the net present value to the firm if it receives the subsidy? Which number from above represents the net present value to the firm if it does not receive the subsidy? You can use these two values to find the expected value.) (5 points)

d) Repeat your calculations from above using a 3% discount rate. Do any of your conclusions change? Why or why not? (10 points)

Please show all of your work.

[1] For simplicity, you can assume that the turbine only operates for just one year. A more realistic example would allow the plant to operate for multiple years, but would require a more complicated net present value calculation.

II. Valuing Environmental Damage along the Gulf Coast (75%)

Along the Gulf Coast of Mississippi, occasional algae blooms cause problems for coastal communities. The thick coating of algae in the water makes beaches unsafe for swimming and damage local oyster beds. The algae blooms are a result of increased freshwater flowing into the Gulf of Mexico. A combination of heavy rains and warmer temperatures from climate change are making algae blooms more common.

Algae blooms have a negative impact on Mississippi Gulf Coast communities. Potential impacts include:

- On a typical weekend, approximately 20,000 visitors come to Mississippi beaches along the Gulf. During a recent algae bloom event, this number fell to 4,000. In addition to losing revenue from admission fees, local hotels and restaurants experience reduced business as a result.
- Repeated algae blooms are killing the state's oyster beds. These oyster beds are an important source of local employment. After a 2019 algae bloom outbreak, state officials estimated it would take five years for oyster beds to fully recover.
- Both people and animals can become sick if they have contact with the algae blooms. At this time, no other fish or aquatic life has been affected, but that could change as algae blooms become more common.

You have been asked by the Mississippi Department of Environmental Quality to propose a study to evaluate the potential economic impact of more frequent algae blooms. In a 3-5 paged memo (single-spaced is acceptable), please describe a plan for evaluating potential damages from increased algae blooms along the Mississippi Gulf Coast. The proposal should identify the effects that need to be valued, taking into consideration how climate change is affecting the frequency of algae bloom events.

The proposal should also discuss methods you will use to place dollar values on these impacts. While you should use the information provided above as a starting point, you are welcome to consider other potential impacts that you think should be included in your study. Please discuss the method(s) you will use to value the damage related to each impact you include in your proposed study. Your memo should discuss the pros and cons of each method you propose, as well as justifying why that method is the best choice for the evaluation you propose.

Finally, please note that you are not expected to carry out your analysis or make a recommendation in this memo. Rather, you are simply being asked to propose a set of methods that could be used to evaluate this issue. Your proposal will be reviewed by economists at the appropriate environmental agencies, so the use of economic terminology is acceptable. However, not all of these officials are environmental economists. Thus, you will need to explain carefully each method you propose, as well as its strengths and weaknesses.