

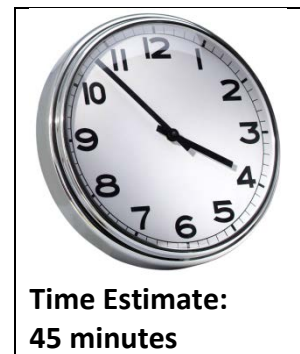
# Solar Electricity Tradeoffs

## Overview

This activity introduces students to the benefits and tradeoffs associated with developing facilities for solar electricity generation. Students examine how solar facilities may affect bird populations and wildlife habitat and require new transmission lines.

## Learning Objectives

Students will be able to (1) explain that utility scale solar facilities can be established on BLM-managed lands; (2) describe how solar facilities may negatively affect wildlife habitat, recreation areas, and other land uses; and (3) identify the criteria used by decisionmakers when choosing among energy sources for electricity generation.



## Preparation

1. Read the Background Information.
2. Make enough copies of the “Tradeoffs” handout for each student.
3. If needed, preview the two videos that explain Concentrated Solar Power and Photovoltaic systems: <https://www.youtube.com/watch?v=QTNU1JMhxA> (CSP), and <https://www.youtube.com/watch?v=0elHcPVtKE> (PV).

## Background Information

Though solar-generated electricity has significant advantages over other sources when it comes to CO<sub>2</sub> emissions, it is not entirely without environmental consequences. Solar facilities can use large areas of land, threaten wildlife habitats, harm birds, and affect the landscape’s scenic character and recreational and cultural sites. Some impacts may be mitigated but usually at an increased cost. The Tradeoffs handout provides facts that can help students make judgments about which consequences may be worth risking to get the benefits of solar-generated electricity.

## Procedure

1. **Review the benefits of solar energy:** Point out that solar-generated electricity produces almost no emissions of carbon dioxide, and note that BLM-managed lands in the southwest are among the best suited for generating solar electricity in the country. Also briefly describe the two types of utility scale solar electricity, Concentrated Solar Power, and Photovoltaic.
2. **Form groups:** Divide the class into groups of five or six students each, distribute the Tradeoffs handout, and give students 25 minutes to read the handout and discuss the questions at the end of each section. Ask groups to select one or more group members to explain their responses to the questions to the rest of the class.
3. **Class discussion:** Ask the spokesperson from each group to describe his or her group's views on the tradeoffs related to birds, recreation, desert tortoise habitat, and transmission. Conclude by asking which source of electricity each group would like to see expand and how the exercise helped them decide.

## Tradeoffs of Solar-Generated Electricity

**Directions:** Read each section to yourself, and discuss the questions at the end of each section with the others in your group.

### Introduction

Solar facilities such as Desert Sunlight and Ivanpah will help the U.S. expand our solar electricity capacity, but they come with tradeoffs. For example, solar facilities cover large areas of land that could be used in other ways (such as for recreation or conservation), can fragment habitat of wildlife such as the desert tortoise, may harm birds, may alter the landscape's scenic character, and can be more expensive than some other kinds of electricity generation. Here is a closer look at some of these tradeoffs.



### Recreation, Tourism, and Scenery

To the north of the Ivanpah Concentrated Solar Power (CSP) facility is Primm, Nevada, which is a tourism-based border town with hotels, casinos, restaurants, a shopping mall, and an outdoor amusement park. The Primm Valley Golf Club is located in California, directly east of and adjacent to the Ivanpah plant. The course advertises itself as a place for golfers to get out of the city and “enjoy the amazing desert landscape to its full extent.”

Directly west and south of the Ivanpah CSP plant is the 1.6 million-acre Mojave National Preserve, which overlooks the Ivanpah Valley. The preserve is a land of mountain ranges, sand dunes, great mesas, extinct volcanoes, and other desert landforms. At the foot of the Mojave National Preserve is the Ivanpah Dry Lake, a large open space and an international travel destination for land sailing, kite bugging, archery, and disc throwing. The remote, vast spaces and vistas provide an opportunity for visitors to discover and experience a wide variety of historical and natural features that exist nowhere else in the U.S. in such proximity to one another.

1. Do you think the solar energy benefit of nearly zero CO<sub>2</sub> emissions is worth the tradeoff of threats to recreation, tourism, and scenery? Explain.

2. What more would you like to learn to be more confident in your decision?

### **Birds**

It is difficult to measure the number of bird deaths each year at the Ivanpah CSP facility. The current estimate is 3,500 bird deaths per year, with a wide range of estimates between 1,400 and 28,000. Many of these birds die flying through a “solar flux” field, between the mirrors and the towers, where temperatures reach about 800 degrees Fahrenheit. The birds chase insects that are attracted to the light reflected by Ivanpah’s mirrors. The U.S. Fish and Wildlife Service is conducting a study to determine the facility’s impact on birds and what kind of steps might keep the birds away from the solar flux.

Ivanpah’s managers are now testing methods to discourage birds from flying close to the facility, such as special lights that repel insects, recordings of raptor calls to frighten the birds, and “bird buffer” machines that spray a liquid that birds find unappealing. Actions like these are sometimes called “mitigation measures.”

Even if the highest estimate of bird deaths at Ivanpah is true (28,000), it can be compared to other causes of bird deaths. Here are the minimum estimates of birds killed each year by other means:

- Collisions with buildings: 365 million
- Stray and outdoor cats: 1.4 billion
- Electricity generating facilities that use fossil fuels: 8 million
- Communication towers: 7 million
- Power lines: 12 million

1. Do you think the solar energy benefit of nearly zero CO<sub>2</sub> emissions is worth the tradeoff of lost bird lives? Explain.

2. What more would you like to learn to be more confident in your decision?

### **Desert Tortoises**

Before the Ivanpah CSP facility was built, Ivanpah’s managers expected to find 30 desert tortoises, a species listed as threatened under the Endangered Species Act of 1973, on the facility’s 3,500 acres. Instead, they found more than 170 tortoises, so the managers moved them, first to pens and then to more remote locations. The two main threats to the desert tortoise are fragmented habitats and warming temperatures in their habitats.



BLM biologist Larry LaPre says of the tradeoff: "If there were no push toward renewable energy, animals like the desert tortoise and plants like the Joshua tree could be impacted quite a bit" by rising temperatures. So solar and other renewable energy projects may help save the desert tortoise but may threaten its habitat at the same time. Ivanpah's managers have worked to reduce or mitigate the impact of the project on the tortoise by investing \$22 million in moving tortoises to desert sites outside of the facility.

1. Do you think the solar energy benefit of nearly zero CO<sub>2</sub> emissions is worth the tradeoff of impact on the desert tortoise? Explain.
2. What more would you like to learn to be more confident in your decision?

### **Transmission**

Large solar electricity facilities need transmission lines to deliver their power to cities and towns. People usually do not want to live near a solar generating facility that sits on thousands of acres, so the power often has to travel hundreds of miles or more to reach consumers. There is currently not enough transmission capacity to handle electricity generated by new renewable energy facilities, so new lines will have to be built. New transmission lines can cost \$1 million per mile or more. Recently built lines from California's Imperial Valley to San Diego cost a total of nearly \$2 billion. Transmission lines can divide wildlife habitat, diminish the quality of views on the landscape, and cut through recreation areas used for hiking, all-terrain vehicle and horse riding, and mountain climbing.

1. Do you think the solar energy benefit of nearly zero CO<sub>2</sub> emissions is worth the tradeoff of the costs and effects of new transmission lines? Explain.
2. What more would you like to learn to be more confident in your decision?

## **Conclusion**

Utility scale solar power generates almost no carbon dioxide, but it can have a negative impact on tourism, scenery, birds, and desert tortoises. On balance, are the benefits worth the tradeoffs?

Which tradeoffs concerned you the most?