

EMR and Northern Greenhouses

Objective: To understand electromagnetic radiation (EMR) and the design of Northern Greenhouses.

Introduction: Food security is a challenge for Northern communities as many are only accessible by water or ice road. Therefore, the production of food within a community is very important. To combat the cold, greenhouses may be one of the better options to at least extend a short growing season. This lesson aims to help students understand how an optimal greenhouse could be designed for their community.

Curriculum Connections:

C.1.6k, 1.8k; C1.2sts, C1.2s

Supplies / Materials:

- Computer/projector or class set of computers
- Paper and pencils for drawing
- Articles about greenhouses in the North (see **resources**) or computers to access



SCIENCE FOCUS

Lesson Subject

Physics 30

Topic

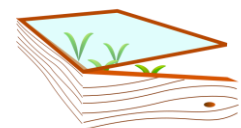
EMR and Greenhouse Design

Location

Classroom

Length

50 minutes plus project time



(cold frame)

Hook: Show students pictures of large Alaskan vegetables (Google) and ask them where they think these were grown. Reveal that they were grown in Alaska – how is this possible?

Intro Activity: Have students create a rough sketch of what they think of when they think about a greenhouse. Typically, people think of a basic rectangular structure with either a pyramidal or semi-cylindrical roof. Have students consider what angle the sun would be hitting the roof and what this means in terms of reflection and refraction of light (see resources 1 and 2 to look at these in general and to determine the elevation of the sun in your community). What are the goals of a greenhouse and how can we maximize the potential?

Main Activity: Have student read through articles about designing greenhouses for the North. See resources 3-6 as examples.

Independent Student Work: In groups, have students design an appropriate greenhouse for the schoolyard or other public space in your community. Get your students to consider location, orientation, design and what types of plants they would like to grow. If the community already has a greenhouse, consider taking your students there on a field trip. During this field trip students can be asked to evaluate the efficiency of design.

Conclusion / Review: What are some of the important features of a greenhouse and how can we effectively grow food for the North? Encourage the class to partner with a local community organization to create a small-scale green house somewhere in the community, perhaps in the school to grow vegetables, berries and herbs.

Homework: Work on design project above. Write a short reflection on how a community greenhouse could benefit their community in providing fresh and healthy food options for the local people.

Resources:

1. Reflection and refraction between glass and air: http://physics-animations.com/Physics/English/rays_txt.htm
2. A tool to look at sun angles and elevation: http://www.sunearthtools.com/dp/tools/pos_sun.php?lang=en

3. Design of a solar greenhouse for Calgary: <http://vergepermaculture.ca/blog/2011/01/09/how-we-designed-our-solar-greenhouse/>
4. 5 Northern Greenhouse examples: <http://waldenlabs.com/5-northern-greenhouse-examples/>
5. University of Saskatchewan Northern Greenhouse Guidelines: https://www.usask.ca/icngd/publications/reports/Reports-Files/Northern%20Greenhouse%20Guidelines_FINAL.pdf
6. Cold Climate prototype: <http://www.greenhousecanada.com/energy/efficiency/solar-thermal-greenhouse-prototype-for-cold-climates-20292>

Extensions:

Assess solar energy options in your community:

1. Optimal angle for solar panels:
<http://greenerenergy.ca/PDFs/Tilt%20and%20Angle%20Orientation%20of%20Solar%20Panels.pdf>
2. Colville Lake solar: https://enlighten.enphaseenergy.com/pv/public_systems/xrDs481206