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| Unit Title: | Geothermal |  | Grade: | 8-12 |

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| Learning Styles: | All students have different learning styles, and we are using a mixture, based on seven recognized learning styles: Visual, Aural, Verbal, Physical, Logical, Social and Solitary. We believe this module incorporates different learning styles and that vicarious learning on the part of a student is critical for growth. Learning styles in this module include:  •Visual: Pictures and images used  •Verbal: Words to help convey meaning  •Social: Students should discuss |
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| Unit Description: | The Geothermal unit will address the basic theories of heat transfer and demonstrate the principles of Geothermal systems and their uses: heating and cooling. The use of residential heat pumps is most prevalent in this area; therefore, the unit will primarily focus on residential systems using heat pumps. |
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| Instructional Objectives: | The curriculum is designed to achieve the following objectives for each individual area.  Geothermal Systems  1. Heat exchangers  2. Ground source vs air source  3. Loop configurations  4. Design basics  5. Heat transfer  6. Pumping  Geothermal: Heat Pump Cycle  1. Geothermal basics  2. Sensible and latent heat  3. Basic refrigeration cycle  4. Heat transfer  5. Reversing valve |
| Estimated Time: | 4-8 hours depending on students |
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| Teaching Strategies: | Lecture: Present materials in a structured manner.  Active Learning: Promote active learning and critical thinking in discussion. Seek from students in discussion real-life applicability for the use of renewable energy resources and the concepts provided. |
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| Assessments: | At the end of each power point have the students answer questions based on the power point. At the end of the module create an assessment combining the two power points which the student can demonstrate basic knowledge of the subject. The assessment should be based upon discussions and power points. |
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| Instructional Outcomes: | The outcomes for this unit include:  1. The student will list basic equipment in a geothermal system.  2. The student will define loop configurations.  3. The student will define open and closed loops.  4. The student will summarize system operation.  5. The student will explain heat transfer in the system.  6. The student will summarize basic design considerations.  7. The student will interpret the air conditioning cycle.  8. The student will explain sensible and latent heat.  9. The student will explain the reversing valve.  10. The student will summarize the complete system. |

“This document was prepared by Northeast Iowa Community College under award EG-17-004 from the Iowa Energy Center. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Iowa Energy Center.”