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Alternative Energy

by

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WebQuest Description: Identifying the various forms of Alternative energy: Geothermal, Solar, wind,Nuclear
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Curriculum: Science
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Introduction

 With the increase energy bill, Jamaica has to find new ways of suppling the countries energy. The exploratoin alternative energy sources looks like a plausible solution. However, the government of Jamaica needs to act swiftly before we find ourselves in real crisis.

Tasks

You are entrusted with the task of identifying the best source for alternative energy for Jamaica. Having identified the most feasiable alterantive source you will write a report to the Ministry of Energy outlining why you have chosen this source. Maximum points will be awarded provided all criteria in the process is met

Process

 Please follow the steps below to score maximum points on your questWrite paragraphs identifying the major forms of Alternative energy Make a table indicating the various forms of Alternative energy indicating the advantages and disadvantages of each.Based on the resources available to Jamaica identify which Alternative Source best suits Jamaica's needs. Outline the chemical or physical changes involved in the production of the Alternative Energy choice you have selected.Answer one of Critical Thinking Questions on the Conclusion Page.

Evaluation

Points Available

Step 1

20

Step 2

20

Step 3

20

Step 4

20

Step 5

20

Step 6

20

Spelling/Grammar/Content/ Structure/Punctuation

10

References Cited

10

Total

140

Category and Score					Score

Category and Score					Score
				Total Score	

Conclusion

Choose one of the following questions.Should Jamaica (Ministry of Energy and Mining) invest in alternatives energy sources (Discuss)If Jamaica (Ministry of Energy and Mining) develop an efficient alternative energy source, how do you think that it would affect the governments interest in the Petrocaribe agreement ?

Teacher Page

Unit of Study No. 22 RENEWABLE ENERGY AND ELECTRIC UTILITIES – 1TEACHER OVERVIEW No. 22REQUIRED MATERIALS„ copy of Reading Passage and Student Data Sheetsfor each student„ an equipment kit for each Lab Activity groupconsisting of:• computer with Internet access and presentationsoftware• list of relevant web sites• research materials, journals, data (such as foundin World Watch, newspapers, energy companies,and organizations)„ an equipment kit for each Follow Up Lab Activitygroup consisting of:• access to Texas geothermal map on the Internet• Texas highway map• markerBACKGROUND INFORMATIONAll sources of energy have advantages anddisadvantages, which can make for interestingcomparisons. Advantages to using renewable energysources include convenience, low or no cost for fuel,little or no environmental impact, sustainability,independence from reliance on other nations or regionsfor fuel, no dangerous end products to clean up as amajor expense, safety factors, and reduced pollutantemissions. Disadvantages of some non-renewableenergy sources include unstable cost, transportation ofraw materials and fuel, inconvenience, utilization ofpublic water for production, pollution, limited suppliesof fuel, non-sustainability, high cost of disposal ofresidues, dependence on foreign nations or otherregions for fuel, climate change resulting in extremeRenewable Energyand Electric UtilitiesOVERVIEWStudents will discover the great potential for usingrenewable energy resources and compare utilityresidential rates in Texas. The growing use of renewableenergy in Texas will encourage student interest.Students will conduct research on the Internet andmake presentations regarding their findings, usingtechnology to prepare their audiovisual materials.OBJECTIVESSee High School Teacher Resource Guide for TEKSobjectives and additional information regarding thisand other high school units.SUGGESTED TIMEFRAMETeacher will need to determine how many class periodsto devote to each activity, based on the suggestedtimeframe and length of classes.Time Activity DescriptionContentArea30 minutes 1 – Introduction andReading PassageScienceVocabularyReading120 minutesspread overfour or fiveperiods2 – Internet Activity –Researching RenewableEnergy3 – Group Presentationsand DiscussionScienceVocabularyReading30 minutes 4 – Assessment ScienceReading60 minutes 5 – Follow Up Activity –Geothermal EnergyScienceMathematicsVocabularyFor High SchoolUNIT OF STUDY NO. 222 – RENEWABLE ENERGY AND ELECTRIC UTILITIES Unit of Study No. 22TEACHER OVERVIEWweather patterns, decrease in agricultural productivity,possible sea level rise, and species loss. Electricgenerators and electricity providers consider all theseimpacts and more when developing new power plantsor buying energy for their customers.Largely due to the deregulation of the electric industryin Texas, many Texans have the option to buyelectricity that has been generated by renewable energysources. For example, electric customers in one Texastown can purchase energy that comes from renewableenergy sources. While the fuel charge of this “green”electricity is a bit more expensive (3.30 cents perkilowatt-hour instead of the standard charge of 2.796cents per kilowatt-hour) the rate is guaranteed through2013. The green power comes from 61 wind turbineslocated in west Texas and from a landfill biogas projectlocated near San Antonio.Texas has vast stores of potential alternative energyresources, but currently only a fraction of Texaselectricity comes from renewable sources.SUMMARY OF ACTIVITIESTeachers should read through the entire sequence ofstudent activities first. Students should review theReading Passage, “Renewable Energy and ElectricUtilities,” before starting their research project.Activity 1 – Introduction and Reading PassageExplain to the class the topic that will be covered inthis unit of study. Teachers can include material fromthe teacher background information section. Havestudents consider the following quote:“Everything that can be invented has been invented.” –Charles H. Duell, Commissioner, U.S. Patent Office, 1899This obviously is not true. Have students consider whatdrives the need to invent, what makes a good invention,and how this relates to our current energy needs inreplacing fossil fuels with renewable, cleaner energy.Each student will need a copy of the Reading Passageand the Student Data Sheets (includes readingcomprehension questions and vocabulary words).Instruct students to study the Reading Passage andcomplete the Student Data Sheet to help themunderstand the marketing and availability of sourcesof renewable energy. Key vocabulary words in theReading Passage will assist students in understandingthe Lab Activity instructions.Activity 2 – Internet Activity – ResearchingRenewable EnergyReview the Internet Activity section of the StudentData Sheets with the class. So that students will have aclear understanding of what is expected of them duringthis internet activity, a rubric is included in the StudentData Sheets that should be distributed to and reviewedwith the class before they begin the activity. Researchtells us that students perform better, learn more whenthey know what is expected from them, and find thetasks more manageable. Students will research from avariety of sources, including the Internet, to review thecurrent status of electricity production in Texas. Theywill review the current fuels being used to generateelectricity and the potential in their futures for usingrenewable energy sources. Students can research theforms of energy most feasible for Texas in the future.The web site addresses suggested in the activity are justa few possibilities for students to begin their searches.There are many links from these sites and additionalplaces to research. Instructions on the use of searchengines should also be shared.Divide the class into small groups and assign eachgroup a different renewable energy resource to research,such as solar energy (passive and/or active), windenergy, biomass, geothermal energy, hydroelectricpower and building (construction) climatology. Eachgroup can plan a division of labor.Activity 3 – Group Presentations andDiscussion1. Ask students to consider the following points whilecreating their presentations:• oral presentations will be a product of studentresearch with tables and graphs to be usedduring the presentationUnit of Study No. 22 RENEWABLE ENERGY AND ELECTRIC UTILITIES – 3TEACHER OVERVIEW• the class audience should be kept in mind, sothe most important concepts are presentedwithout lengthy details;• the materials used and produced by each groupfor their presentation (i.e. their notes, outlines,summaries, transparencies, etc) should beturned in after the presentation. Students coulduse a presentation software application, such asMicrosoft Power Point, to make transparenciesor to use directly in the presentation if an LCDprojector is available.2. Instruct the groups to give their presentationsallowing each student an opportunity to present atopic.3. Group DiscussionAfter all groups have completed their presentations,a discussion of what was learned could involvequestions such as what are:a) the safest energy sources? (Discussion can includea definition of “safest,” including worker safetyand chances of a catastrophic failure of the energysource.)b) the most efficient energy sources? (Discussionshould include a definition of “efficiency,”including relative cost.)c) the most environmentally benign sources?(Make sure students support their assertions

withscientific and engineering information, not justopinion.)d) the most economical sources? (This will dependon the geographic area. The cost of renewableenergy is expected to decrease over the next 10years and may soon become competitive. However,if the environmental cost of non-renewable energyconsumption is included in the calculation,renewable energy may already be cheaper.)e) the most abundant sources in the surroundinggeographical area? (Answers will vary. In Texas,wind energy is abundant in the high plains andthe far west. Solar energy is widely available, butmore available toward the western part of theState.)"Jigsaw" Method for Research and GroupPresentationsAn alternative way to organize the student research andpresentation groups is known as "jigsaw." First studentsare assigned to a Peer Group for the unit consisting of4 or 5 students. Each student from each Peer Groupis assigned a different renewable energy resource toresearch. After doing some individual, initial research, allstudents regroup according their research topics (solar,wind, biomass, etc.) and form a Research Topic Group.Each Research Topic Group develops a presentation ofthat topic, complete with assessment instruments andquestions that follow the presentation. Students then goback to their Peer Groups, and each student, who is nowan "expert" in his or her subject area, presents the researchto the group. Students should develop assessment criteriaby which they will complete a peer evaluation for eachstudent's presentation. By teaching each other, researchtells us that students learn much more than just passivelylistening. Also, having a peer evaluation instills a sense ofaccountability in each student for the quality of his or herresearch and presentation.Activity 4 – AssessmentDistribute a copy of the Assessment Questions to eachstudent. Instruct each student to work alone and answerthe short answer and multiple-choice questions. Collectthe handouts, grade and return them to the students.Activity 5 – Follow Up ActivityThe Follow Up Activity involves researching Texas'potential for geothermal energy, creating a map of thelocation of these resources and proposing a geothermalpower plant for your community. Review the FollowUp Activity section of the Student Data Sheets withthe class. Students should work with their original LabActivity group.ADDITIONAL ACTIVITYResource ListStudents can compile library resources for future use toinclude the following: videotapes, journals, magazines,newspapers, and books. This list can assist the librarianin ordering new materials.4 – RENEWABLE ENERGY AND ELECTRIC UTILITIES Unit of Study No. 22No. 22 TEACHER OVERVIEWHIGHLIGHTS• The Texas electric industry ischanging• Texas is becoming a leader inrenewable energy development• Customers now have electricprovider choicesINTRODUCTIONDue to a set of laws and rules changinghow power is bought and sold in Texas,we now have a system of competitive andchoice-driven electric companies, muchlike telephone service, in which you canchoose and change your supplier. Texaslaw required big, publicly owned electricutilities, such as those in Dallas andHouston, to open their markets in 2002.Rural electric cooperatives and municipalutilities, such as those owned by Austinand San Antonio, were not required toopen their market base to competition,but may choose to do so in the future.The outcome is more choices for morecustomers, including the ability to chooseenergy generated from the state's clean,renewable energy resources like wind,solar and biomass power.NEW RULES CATAPULTRENEWABLESRenewable Portfolio Standard (RPS)The law that defined the new electricstructure for Texas requires that all electricservice providers sell a minimum amountof renewable energy. The law requires thatRenewable Energyand Electric UtilitiesCLEAN, LOW COST ELECTRICITY FOR TEXAS Wind farmssimilar to this one in the west Texas mountains near Van Horncould become a major source of home-grown power in the future.SOURCE: LLOYD HERZIGERREADING PASSAGEUnit of Study No. 22 RENEWABLE ENERGY AND ELECTRIC UTILITIES – 5No. 222,000 megawatts (MW) of new renewablegenerating capacity be installed by 2009and added to the 880 MW already in Texasat the time the law was passed in 1999. Thisconcept is called a "Renewable PortfolioStandard," and while Texas was only the 6thstate to adopt such a rule, its RPS is shapingup to be the most effective one to date.Renewable Energy Credits (RECs)The cornerstone of the new Texas rulesis the ingenious yet simple creation of atradable certificate called a RenewableEnergy Credit. Renewable energygeneration projects certified in the statecreate one (1) REC per megawatt hour(MWh) of electricity produced.On an annual basis, every Retail ElectricProvider (REP) selling electricity in thecompetitive areas of the state must showthat it has purchased its share of therequired renewable energy generation.That share will be determined by proratingthe required benchmarks for renewableenergy generating capacity based on thecompany's share of the electricity market.The REP will prove it is meeting its MWcapacity benchmarks by the number ofRECs it possesses.The demand for RECs will result in thebuilding of new renewable energy projects,thereby displacing electricity that wouldotherwise be generated from traditionalresources. The kilowatt hour (kWh) ofrenewable electricity is not tied to the REC.Each may be sold separately. Claims ofrenewable energy use in Texas will dependBaseline Capacity when law passed, 1999 880 MWNew Capacity Targets:Deadline Increment Cum. TotalBy 2003 400 MW 1,280 MWBy 2005 450 MW 1,730 MWBy 2007 550 MW 2,280 MWBy 2009 600 MW 2,880 MWPROJECTED INCREASES IN NEW RENEWABLE ENERGY POWER PLANTS THROUGH 2009The Texas Renewable Portfolio Standard provides targets for installing new renewable powerplants that will increase the state's total renewable generating capacity from 800 MW in 1999 to2,880 MW by 2009.READING PASSAGE6 – RENEWABLE ENERGY AND ELECTRIC UTILITIES Unit of Study No. 22No. 22solely on ownership of RECs and not wherethe commodity energy flows.This market-based system has beenextraordinary in stimulating the Texasrenewable energy market. During 2001as much renewable energy generatingcapacity came on-line in the state asduring the previous 100 years. That isquite a success story! And because ofthe large volume of new construction,renewable energy has become moreaffordable, leading to more opportunitiesfor customers wanting cleaner electricity.RENEWABLES FOR ELECTRICCONSUMERSIt is important to understand just whatenergy resources are included in any"Green Power" product offered by anelectricity marketer. In Texas, only areference to the term "renewable energy"in such marketing is a reference to thoseresources clearly defined as renewablein the electric utility restructuring law.This would include electricity generatedfrom solar, wind, biomass, geothermaland hydro resources, and clearly excludesany fossil-based resources. Other powerproducts using Texas natural gas resourcescan still be marketed as "green" due tothe low emissions associated with naturalgas power plants.Some companies specialize in selling100% renewable power with reliabilitythat is identical to what customers areWhat to look for in theelectricity you buy:All retail electric providers arerequired to disclose certaininformation enabling customersto make educated decisionsabout choosing among competingoffers. Here are some importantcharacteristics to consider:1. Types of renewables2. Content of new renewableenergy3. Emissions impact4. Other factors important to you,such as fixed price, companycontributions to environmentalcauses, use of union labor, etc.used to. Others offer power with variouspercentages of renewable energy. Insome cases they offer renewable powercontracts at fixed rates, while rates forconventional electricity rise and fall withfossil fuel prices.It is exciting that Texas has becomethe nation's best wholesale marketfor renewable energy, and it will beinteresting to see how Texas customerscontinue to respond at the retail level forcleaner electricity.READING PASSAGEUnit of Study No. 22 RENEWABLE ENERGY AND ELECTRIC UTILITIES – 7No. 22Understanding the Reading PassageBased on the information from the Reading Passage, answer the following questions:1. What change made it possible for consumers to purchase renewable energy directly?_____2. Which electric utilities were required to open their markets to competition?_____3. By what amount is renewable energy capacity expected to increase between 1999 and 2009? _____What is the percentage increase? _____VocabularyBased on the Reading Passage, write down your understanding of these words or word pairs and verify yourdefinitions in a dictionary, on the Internet if available or with your teacher:biomass

_____green pricing
_____prorate
_____public utility
_____renewable energy
_____solar energy
_____wind energy
_____STUDENT DATA SHEET8 – RENEWABLE ENERGY AND ELECTRIC UTILITIES Unit of Study No. 22No. 22Rubrics for Research PresentationName: _____ Teacher: _____Date of Presentation: _____ Title of Work: _____Criteria Points1 2 3 4OrganizationAudience cannotunderstandpresentationbecause there isno sequence ofinformation.Audiencehas difficultyfollowingpresentationbecause studentjumps around.Student presentsinformation inlogical sequencewhich audiencecan follow.Student presentsinformation inlogical, interestingsequence whichaudience canfollow.____ContentKnowledgeStudent doesnot have graspof information;student cannotanswer questionsabout subject.Student isuncomfortablewith informationand is able toanswer onlyrudimentaryquestions.Student is at easewith content, butfails to elaborate.Studentdemonstrates fullknowledge (morethan required)with explanationsand elaboration.____Visuals Student uses novisuals.Studentoccasional usesvisuals that rarelysupport text andpresentation.Visuals relateto text andpresentation.Student usesvisuals toreinforcescreen text andpresentation.____DeliveryStudent mumbles,incorrectlypronouncesterms, and speakstoo quietly forstudents in theback of class tohear.Studentincorrectlypronouncesterms. Audiencemembers havedifficulty hearingpresentation.Student's voiceis clear. Studentpronounces mostwords correctly.Student used aclear voice andcorrect, precisepronunciation ofterms.____Total —> ____STUDENT DATA SHEETINSTRUMENT ADAPTED FROM WWW.TEACH-NOLOGY.COMUnit of Study No. 22 RENEWABLE ENERGY AND ELECTRIC UTILITIES – 9No. 22Internet Activity – ResearchingRenewablesIntroductionThe purpose of this activity is to gain anunderstanding about renewable energy in Texasand its feasibility.Before You StartReview the vocabulary words from the ReadingPassage. Ask your teacher if you are unsure of anyof the meanings.Materials• computer with Internet access and presentationsoftware• list of relevant web sites• research materials, journals, data (such asfound in World Watch, newspapers, energycompanies, and organizations)PreparationThe teacher will direct your groups as to how thetopic for research will be chosen and the workdistributed among individuals.Performing the ActivityYour group should collect data on the currentstatus of your renewable energy source, the benefitsand disadvantages for its use, global impact andother topics of your choice. Determine who will beresponsible for each research topic.STUDENT DATA SHEETYour group should consider at least these pointswhile researching your topic:• How much energy does the assigned energysource currently produce in Texas, compared toits future potential production?• How important is this source likely to become?• What are the assigned energy source'sadvantages and disadvantages?• What position would the local electriccompany take regarding this source in youropinion?• Is the source constant and reliable?• Will the technology be improved over the next15 years?• Is the resource affordable?• How does this energy affect the environment(greenhouse gases, land, water)?Points that your group should consider whilecreating your presentations are:• Your presentation will be a product of yourresearch. Include tables and graphs to illustrateinformation you have gathered.• Consider your class, which is the audience. Themost important concepts should be presentedwithout lengthy details.• The materials your group uses and producesfor the presentation (i.e. notes, outlines,summaries, transparencies, etc) should beturned in after the presentation.There are many printed information sources, aswell as Internet sites to utilize.10 – RENEWABLE ENERGY AND ELECTRIC UTILITIES Unit of Study No. 22No. 22WEB SITESSTUDENT DATA SHEETNational Renewable Energy Laboratorywww.nrel.govThe National Hydropower Associationwww.hydro.orgNorth Carolina Solar Centerwww.ncsc.ncsu.eduNortheast Sustainable Energy Associationwww.nesea.orgRenewable Energy: The Infinite Power of Texaswww.infinitepower.orgRenewable Energy Policy Projectwww.repp.orgSolar Energy Industries Associationwww.seia.orgTexas Solar Energy Societywww.txses.orgUnion of Concerned Scientistswww.ucsusa.orgUS Department of Energy, Energy Efficiency andRenewable Energywww.eere.energy.govU.S. Department of Energy, Bioenergybioenergy.ornl.govU.S. Environmental Protection Agencywww.epa.govWorldwatchwww.worldwatch.orgAlliance to Save Energywww.ase.orgAmerican Council for an Energy EfficientEconomywww.aceee.orgAmerican Electric Powerwww.aep.comAmerican Solar Energy Societywww.ases.orgAmerican Wind Energy Associationwww.awea.orgArizona Solar Centerwww.azsolarcenter.comCenter for the Analysis and Dissemination ofDemonstrated Energy Technologieswww.caddet-re.orgCenter for Renewable Energy and SustainableTechnology and the Renewable Energy PolicyProjecthttp://solstice.crest.orgEl Paso Solar Energy Associationwww.epsea.orgFlorida Solar Energy Centerwww.fsec.ucf.eduIntegrated Waste Services Associateswww.wte.orgMidwest Renewable Energy Associationwww.the-mrea.orgUnit of Study No. 22 RENEWABLE ENERGY AND ELECTRIC UTILITIES – 11No. 22ADDRESSES & PHONE NUMBERSAmerican Solar Energy Society2400 Central Ave G-1Boulder, Colorado 80301(303) 443-3130American Wind Energy122 C. Street NWWashington, DC 20001(202) 383-2505Austin Energy721 Barton Springs RoadAustin, Texas 78704(512) 322-6300El Paso Solar Energy AssociationP.O. Box 25384El Paso, Texas 79926(915) 772-7657 (SOLR)Public Utility Commission of Texas1701 N. Congress Ave.Austin, Texas 78701(512) 936-7120National Renewable Energy Laboratory1617 Cole Blvd.Golden, Colorado 80401-3393(303) 275-3000Texas Renewable Energy Industries AssociationP.O. Box 16469Austin, Texas 78761(512) 345-5446Texas Solar Energy SocietyP.O. Box 1447Austin, Texas 78767-1447(512) 326-3391STUDENT DATA SHEET12 – RENEWABLE ENERGY AND ELECTRIC UTILITIES Unit of Study No. 22No. 22Assessment Questions1. What have the new rules described in the Reading Passage done for renewable energy in Texas?_____
_____
_____2. Describe a Renewable Energy Credit (REC) in your own words._____
_____
_____3. What is "Green Power" and what are eligible resources in Texas?_____
_____
_____Multiple Choice QuestionsSTUDENT DATA SHEET1. Consumers want their energy sources to be:a) cleanb) renewablec) affordabled) all answers a, b, and c2. The rules governing electricity suppliers in Texasmean that:a) consumers in rural cooperatives and municipalutility territories can now choose their electricsupplier.b) consumers in publicly owned utility territoriescan now choose their electric supplier.c) consumers in publicly owned utility territoriescan not choose renewable energy sources ofelectric power.d) consumers in rural cooperatives and municipalutility territories will never be able to choosetheir electric supplier.3. Green pricing means:a) paying extra money to use renewablesb) cost of treesc) prices in east Texasd) none of the answers4. Renewable energy resources include:a) wind energyb) solar energyc) biomassd) all answers a, b, and c5. Regarding renewable energies:a) you would strongly support their useb) they are of little importancec) they are important to the futured) a and cUnit of Study No. 22 RENEWABLE ENERGY AND ELECTRIC UTILITIES – 13No. 22FOLLOW UP ACTIVITY – GEOTHERMAL ENERGYIntroductionSolar is not the only source of renewableenergy on Earth. The hot rocks beneath thesurface of

Earth can also supply energy. Theword “geothermal” comes from Greek wordsfor Earth and heat. Geothermal energy isused in Italy and New Zealand. Because ofits unique location right on the MidatlanticRidge, Iceland has been able to developgeothermal energy production to providenearly 50% its energy needs.There is some evidence that Native Americansused hot springs in the Big Bend area of westTexas to bathe and to cook food. However,geothermal energy in Texas has much broaderpotential.Earth’s core is very hot, around 6000 K. Heatfrom the deep core slowly moves toward Earth’ssurface. In some places, this thermal energyappears as volcanoes, hot springs or geysers.The only places where hot springs couldprovide sufficient steam to generate electricityare in Yellowstone National Park and in partsof California. Yellowstone National Park isprotected, but some geothermal developmenthas taken place in California.Almost all power plants use steam to generateelectricity. The high-pressure steam rotatesa turbine that is connected to an electricalgenerator. The steam can come from waterheated by burning fossil fuels, from waterheated by nuclear energy, or from steam fromgeothermal sources. There are three types ofgeothermal power plants: dry steam, flashsteam, and binary cycle.Dry steam power plants draw steam directlyfrom underground resources. The steam is pipeddirectly to the power plant, where it turns aturbine. The only dry steam reservoirs are innorthern California and under YellowstoneNational Park in Wyoming. Thus California hasthe only dry steam plants in the United States.Flash steam power plants are more common.They pipe water from deep wells withtemperatures greater than 360°F (182°C). Thewater flows under its own pressure. At thistemperature, water flashes instantly to steamat atmospheric pressure. The steam is thenseparated from the water and used to power aturbine connected to a generator. After runningthe turbine, the condensed steam is mixed backwith the water and both are pumped back intothe ground to replenish the reservoir.Binary cycle power plants use even lowertemperature water of about 225°–360°F(107°–182°C). The thermal energy from thiswater is used to boil another fluid with a lowerboiling point in a heat exchanger. (Thus thereare two separate fluid cycles, hence binarycycle.) The hot vapor from the working fluidturns a turbine. The water is then injectedback into the ground to be reheated and theworking fluid condenses and is recycled.Small-scale geothermal power plants (under 5megawatts) have the potential for widespreadapplication in rural areas, possibly even asdistributed energy resources. Distributed energySTUDENT DATA SHEET14 – RENEWABLE ENERGY AND ELECTRIC UTILITIES Unit of Study No. 22No. 22 STUDENT DATA SHEETresources refer to a variety of small, modularpower-generating technologies that can becombined to improve the operation of theelectricity delivery system.Materials• Texas geothermal map on the Internet• Texas highway map• markerStep I. Evaluating Geothermal Potential1. Examine the Texas geothermal map found atwww.infinitepower.org/resgeothermal.htm2. Locate your community on the Texashighway map.3. Locate your community on the Texasgeothermal map.4. Determine the temperature of wateravailable in the geothermal reservoir underyour community.Step II. Choosing a Geothermal Power Plant1. Based on the information in theintroduction, decide which kind ofgeothermal power plant, if any, might besuitable for your community.2. In some areas of Texas, insufficient hot wateris available to harvest energy from hot water.Investigate other geothermal applications,such as radiant heat for buildings.Data Analysis1. What is the temperature of the geothermal reservoir in your community? _____2. If any, which of the three types of geothermal power plants is suitable for your community?_____3. Are there any other ways in which your community could exploit geothermal energy besideselectric power generation?_____ _____Unit of Study No. 22 RENEWABLE ENERGY AND ELECTRIC UTILITIES – 15Understanding the Reading Passage1. Deregulation of the electric utility industry andpassage of the Renewable Portfolio Standard2. Publicly owned utilities were required to opentheir markets. Rural co-ops and municipally ownedutilities may choose to participate or not.3. Capacity is expected to increase by 2000 MW,which is a percentage increase of 227%.Assessment Questions1. The new rules have stimulated the Texas renewableenergy market. During 2001 as much renewableenergy generating capacity came on-line in thestate as during the previous 100 years. Renewableenergy has become more affordable, leading tomore opportunities for customers wanting cleanerelectricity.2. Students answers should contain the followinginformation: a REC is a tradable certificate whereone (1) REC is the equivalent megawatt hour(MWh) of electricity produced by a source ofrenewable energy. Retail electric providers in Texasare required to have a certain number of RECs intheir portfolio, so the establishment of RECs is aTEACHER ANSWER KEYway to encourage more renewable energy powerplants to be developed in Texas.3. Green power describes electricity produced by sourcesthat are less harmful to the environment than fossilfuels. Eligible sources in Texas include: solar, wind,biomass, geothermal, and hydro resources. Naturalgas resources can still be marketed as “green” due tothe low emissions associated with natural gas powerplants, but are not considered renewable energy.Multiple Choice Questions1 d; 2 b; 3 a; 4 d; 5 d (best answer)Follow Up Lab Data Analysis1. Answers will vary but should be between 90 and160 °C.2. In most areas of Texas, the temperature of thewater is too low to generate electricity. Binarycycle power plants might be marginally feasiblein a few communities. Along Texas’s Gulf Coast,deep reservoirs are available, but drilling into thesereservoirs is impractical.3. Using heat exchangers for space heating remains auseful application.Vocabulary Definitionsbiomass – plant and animal materials (wood, hay, vegetable residues, etc.) which have chemical energystored in their organic moleculesgreen pricing – a program offered by some utilities to charge money above the standard fee, to customerswho agree, in order to promote using renewable energiesprorate – divide or asses in proportionate parts of the wholepublic utility – a service, as electricity or water, essential to the community; a company providing such aservice, controlled by a nationalized or private monopoly and subject to public regulationrenewable energy – forms of energy that derive and quickly replenish from the natural movements andmechanisms of the environment, such as sunshine, wind, movement of the seas and the heat of the earthsolar energy – energy radiated from the sun used directly (solar thermal, passive solar and photovoltaic) orindirectlywind energy – air in motion; kinetic energy related to the motion of the atmosphere; air heated by the sunwhen rising replaced by cold airInfinitePower.orgFinancial Acknowledgement This publication was developed aspart of the Renewable Energy Demonstration Program and wasfunded 100% with oil overcharge funds from the Exxon settlementas provided by the Texas State Energy Conservation Office and theU.S. Department of Energy. Mention of trade names or commercialproducts does not constitute endorsement or recommendation for use.State Energy Conservation Office111 East 17th Street, Room 1114Austin, Texas 78774Ph. 800.531.5441 ext 31796www.InfinitePower.orgTexas Comptroller of Public AccountsPublication #96-824B (03/05)

Reviews

Footer

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