NESEA Newsletter Content

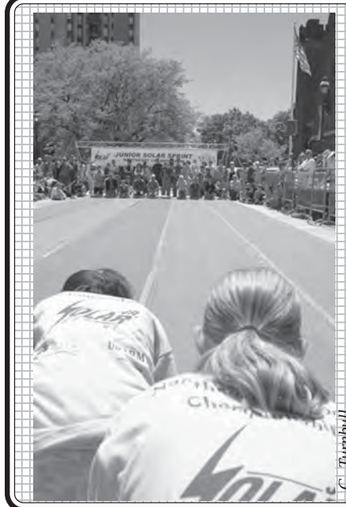
Middle School Curriculum

Created by Northeast Sustainable Energy Association (NESEA)

Click on the links below to take you to the Chapter heading:

JR. SOLAR SPRINT
c/o NESEA
50 Miles Street, Suite 3
Greenfield, MA 01301

PLEASE RECYCLE - PASS ON TO A FRIEND!



C. Turnbull

Inside this Issue

J. Green

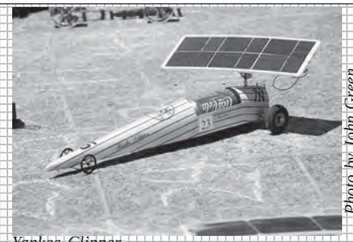


Photo by John Green

Yankee Clipper

Photo by C. Turnbull

12 Great Reasons to Bring Junior Solar Sprint to Your Classroom

1. Help your kids prepare for mandatory science testing! Starting in 2007-2008, all states are required to test students in science—*which will include technological design*. Junior Solar Sprint offers a highly motivating way to teach physical science concepts.
2. Cover many state and national science, engineering, technology and social studies frameworks all at once.
3. Promote high quality work and sportsmanship through friendly competition.
4. Explore air pollution, resource depletion, and global warming in context.
5. Learn together through an inquiry approach.
6. Encourage innovation and creativity.
7. Empower kids to solve problems.
8. Develop skills in craftsmanship.
9. Provide youth with quality engineering education.
10. Experience firsthand how renewable solar energy works.
11. Network with other educators in collaborative endeavors.
12. Access FREE curriculum and workshops.

Northeast Sustainable Energy Association • 50 Miles St., Greenfield, MA 01301
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U.S. ARMY
Many Thanks to Our Sponsor

PREMIER MIDDLE SCHOOL MODEL SOLAR CAR DESIGN COMPETITIONS — FALL 2006

J. Green

C. Turnbull

Eviscerator

C. Turnbull

Solar Knight

Grand Champion with his car, Full Throttle, at judging booth.

J. Green

2006 Junior Solar Sprint Championship

Over 100 middle school teams brought their model solar electric cars to the June 11, 2006 invitation-only Northeast Championship held at the Springfield Museums in Massachusetts to compete for speed and design awards. Kids qualify when they win top awards at area events held all over the northeastern U.S. each spring. The Northeast Sustainable Energy Association (NESEA) organizes the Championship, supports area events, and offers workshops for teachers and mentors. This year, we were treated to a rare sunny day in a rainy season. The racing action was especially thrilling, with some unexpected twists of luck, including a car that spun around midway down the track and returned to the start line! Check out the pictures throughout this issue.

Winners

Grand Champion

This young man from New Jersey stood out in a highly qualified crowd where approximately 250 kids with 100 cars were each winners in every sense of the word.

"Full Throttle," was designed and built by Eric Martin of the Northwest Christian School from Newton, NJ. His car also took first place awards in Innovation and Technical Merit.

- Continued inside -

Solar Panels: The Basics

Take a close look at a JSS solar panel. Inside the protective plastic covering, you will see the photovoltaic (PV) cells, thin blue or black pieces of a glassy material—silicon. Normally gray, it has been coated with an anti-reflective substance to minimize loss of solar energy through reflection.

- Continued inside -

"Outside the Box" Exhibition

Four students from Powder Mill School were the first to take part in the experimental "Outside the Box" exhibition. They demonstrated their model hydrogen fuel cell car, which had won top awards in the Middle School division of the Hydrogen Fuel Cell Model car competition held at NESEA's Tour de Sol in Saratoga Springs, NY in May 2006.

Share your genius, too! Student innovators incorporating clean renewable energy into a project are invited to apply for exhibit space at the JSS Championship next June. Contact Susan Reyes, sreyes@nesea.org, no later than May 20, 2007 if interested.

J. Green

Model Fuel Cell Car Exhibit

Many thanks to the financial support of our Title Sponsor, the U.S. ARMY, the donations of materials from Pitsco, and the countless hours from our generous volunteers.

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Solar Panels: The Basics

- Continued from front page -

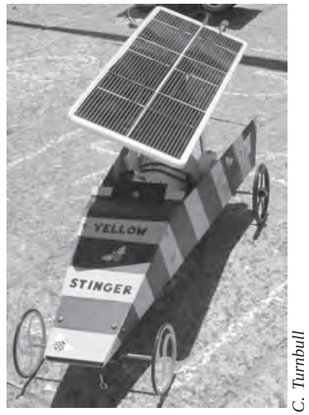
You'll note that there are no moving parts; the special materials enable electricity to be produced directly from the energy of the sun! For each cell, crystals of almost pure silicon are grown with very small amounts of other elements deliberately included to change their characteristics. There are two layers of silicon, the top one incorporating a little phosphorous throughout its crystalline structure, and the bottom layer similarly "doped" with a little boron.

The chemistry and physics that occurs at the junction of these two layers of silicon enables electrons, energized by photons from the sun, to cross the junction and travel in a single direction, flowing from the bottom of the cell to the top. In sunlight, each photovoltaic cell can produce about 0.5 volts of electricity between the top and bottom of the cell.

On top of each cell, you will see thin metal lines called fingers. There is also a metal layer that covers the entire bottom of each cell. These top and bottom metal contacts enable the PV cells to be linked together. To make a JSS panel, six cells are connected in series—the bottom of one cell is connected to the top of the next—forming a chain. When wired in series, the voltage of all cells is added to make a 3-volt panel.

You will notice that two lead wires are connected to the panel. If you look real close, you can see that one (black, if colored) is attached to the conductive fingers on the cell at one end of the chain—where electrons exit—and the other (red, if colored) to the bottom of the cell at the other end of the chain—where electrons flowing in the circuit re-enter. When you connect the wires to the electric motor, the flowing electrons are put to work—powering the JSS car!

Look to future editions of Northeast Regional News for a continuing series of articles: PV Volts and Amps; The PV p-n Junction; Solar Panel Manufacture, and PV Applications.



C. Turnbull

Yellow Stinger

How photovoltaic cells work can be understood on different levels, given increased knowledge of electricity, quantum mechanics, and other areas of physics, chemistry, and materials science. You can explore a variety of sources on the topic together with your students. Here are a couple to look at:

Solar Energy International's "Kid's Info" site: www.solarenergy.org/resources/olderkids.html, or the U.S. Department of Energy at www.eren.doe.gov/pv/howworks.htm.

C. Turnbull

Silver S.P.E.A.R.

Resources:

TO GET YOU STARTED

www.nesea.org/education - Look for a JSS workshop near you.
www.nrel.gov/education/jss_hfc.html - For a Power Point on how to build your first car.
http://eagle.csd49.org/middle/jss/Course_Instr.htm - To download 14 JSS lessons.

MOTOR AND PANELS

www.pitsco.com - Go to Alternative Energy, then Solar, then Kits
800-358-4983
www.solarworld.com - Junior Solar Sprint Kit
719-635-5125

MORE RESOURCES

www1.eere.energy.gov/education/competitions.html - For lists of relevant student competitions.
www.energyteachers.org - More great links.
www.howstuffworks.com - Information on gears, solar panels, and bearings.

NEW ! The Clean Green Power Learning Experience
Learn about a great way to kick-off your JSS with an introduction to clean, renewable energy. Interview a clean energy hero or heroine. Visit a clean energy site with your kids. Do a project. Download the Clean Green Power Teaching Guide for FREE. Get started at www.nesea.org/ycleanenergy
Get ideas for types of places to visit from NESEA's Green Building Open House listing: www.nesea.org/buildings/openhouse/

Winners *(Cont. from front page)*

Speed
Cars are hooked onto heavyweight fishing line and zip, crawl or sometimes flip or stall on the 20-meter track—exciting to watch, and sometimes tense.The top team survived the double elimination format race right till the last of 33 races.

1st Place : "Sun Streak," designed and built by Marcelina Pyzik, Kasia Filipkowska, and Donavan Carrasquillo from Slade Middle School, New Britain, CT

2nd Place: "A Rod," designed and built by Ely Banos, Olivia Rapisarda, Luz Rodrigues, and Joe Dipinto of Slade Middle School in New Britain, CT.

3rd Place: "Jungle Jim," designed and built by Brian Davies, Bart Halbig, and Brett Olsen of Greenhhills School, Greendell, NJ.

Craftsmanship
Care and precision in workmanship can make or break a car.

1st Place: "Eviscerator," designed and built by Jesse Oberg and Ryan Perst of the Northwest Christian School in Newton, NJ.

J. Green

Shish-Ka-Bob

2nd Place: "Yankee Clipper," designed and built by Mike Faber and Bryan Stankovich of Northwestern Christian School in Newton, NJ.

3rd Place: "Yellow Stinger," designed and built by Halay San Giacamo, Eric Wollers, Faith Levzarder, and Alisha Brinkerhoff of Northwest Christian School in Newton, NJ.

Innovation
Clever and unique takes top awards.

1st Place: "Full Throttle," designed and built by Eric Martin of the Northwest Christian School from Newton, NJ.

2nd Place:"Shish-Ka-Bob," designed and built by Albert Lowe and Dezirae Lowe of ALAD Home Learning in Winterport, ME

3rd Place: "T and J," designed and built by Josh Rivard and Tyler Grieve of the Lancaster School, in Lancaster, NH

A NEW Payload Compartment Rule was instituted in 2006 and enforced by our fastidious inspectors. Though the repair table was busy, no one was turned away. A 3-D compartment must be constructed for the empty 12 ounce soda can. Download 2007 Rules at www.nesea.org/education/jss

J. Green

Winners 2006

Technical Merit
The combined score of three separate judges makes the grade. Cars are scrutinized for the quality of three performance systems: wheel and guidancearrangement; power transmission, and utilization of a standard solar panel.

1st Place: "Full Throttle," designed and built by Eric Martin of the Northwest Christian School from Newton, NJ.

2nd Place: "Yellow Stinger," designed and built by Halay San Giacamo, Eric Wollers, Faith Levzarder, and Alisha Brinkerhoff of the Northwest Christian School in Newton, NJ.

3rd Place: "T and J," designed and built by Josh Rivard and Tyler Grieve of the Lancaster School, in Lancaster, NH.

Honorable Mention:"Yankee Clipper," designed and built by Mike Faber and Bryan Stankovich of Northwestern Christian School in Newton, NJ.

C. Turnbull

Solar Oven

C. Turnbull

AND2

Kids' Choice -Photo by D. Barclay

Kids' Choice

NEW ! Kids' Choice Award
For the first time at the Championship, kids got a chance to vote for their favorite car – any except their own! There were many favorites, but the one with the most votes was "DA Boat MMMX" by Kevin Wu, Arvin Alaigh, Anthony Chen, and Steven Flynn of Warren Middle School in Warren, NJ.

NESEA

JR. SOLAR SPRINT

Northeast Regional News

U.S. ARMY

Many Thanks to Our Sponsor

PREMIER MIDDLE SCHOOL MODEL SOLAR CAR DESIGN COMPETITIONS SPRING 2007

Get Inspired at the Junior Solar Sprint Championship

Sunday, June 10, 2007

Top winning teams from area events across the Northeast are invited to the one-of-a-kind championship event where they get an opportunity to compete for awards in speed, innovation, creativity and technical merit. The latter is awarded based on separate judging of the quality of the solar collection, wheel and guidance systems and power train.

Encouraging your kids to make it to this level of competition enhances the quality of their cars, and enriches their learning. Making it to this level earns a special t-shirt, a certificate, a free lunch, and a well-earned sense of pride.

This year, we are looking forward to exhibits such as a solar powered ice cream cooler, a college level solar car, an Electrathon vehicle, a human powered recumbent bicycle and other projects of interest. All are welcome to watch, cheer on a favorite team as "pit crew," and get inspired!

The Northeastern US JSS program has been made possible by our title sponsor, the US Army, and the many generous hours of volunteer work and contributions across the region. Please take a moment to acknowledge appreciation to others and yourself, if appropriate, for offering kids this unique and highly engaging learning experience.

Solar Cells: P-N Junction

The last issue of *JSS Northeast Regional News* described how solar-electric (photovoltaic) panels are built using several solar-electric cells, which in turn are made out of two layers of silicon each doped with minute amounts of different impurities. This article describes how those trace impurities enable silicon to turn sunlight into electric power.

Just below the surface of any photovoltaic cell is a band or layer in the silicon where materials with different types of impurities meet. This band, often referred to as the **p-n junction**, enables silicon to develop a voltage difference between the top and bottom of the cell when placed in sunlight.

In the simplest terms, the p-n junction acts as a one-way turnstile for electrons that are energized by sunlight striking the cell. Energized electrons that drift to the top of the cell cannot go back. This causes a buildup of negative charge (electrons) at

- Continued inside -

P-N Junction (cont.)

the top of the cell and a build up of positive charge (atoms with missing electrons) at the bottom of the cell. This charge distribution produces a voltage difference of about 0.5 volts between the top and bottom of the cell. This voltage difference powers an electric current when the cell is connected to an electric circuit.

Let's take a look at this phenomenon in more detail. The bottom layer of the cell is doped with impurity atoms with 3 valence electrons (e.g., silicon doped with boron). This type of semiconductor produces "holes" or deficiencies of valence electrons in the semiconductor crystal. (See Figure 1.) Because these holes effectively act as positive charge carriers, this type of semiconductor is know as a **p-type** semiconductor.

The semiconductor material making up the top slice of the cell is doped with impurities having 5 valence electrons (e.g., silicon doped with phosphorous). The fifth electron cannot fit into the valence band and becomes available for conduction. This material is called **n-type** because the primary charge carriers are negatively charged electrons. (See Figure 1.)

The band, or layer where the p-type and n-type materials join, is known as the **p-n junction**. When a p-n junction is formed, some of the free electrons in the n-type region diffuse across the junction and combine with holes to form negative ions. In so doing, they leave behind positive ions in the n-type material. (See Figure 1.) This transfer of electrons will continue until coulomb forces in the junction build up enough to prevent any further migration of electrons from the n-type material.

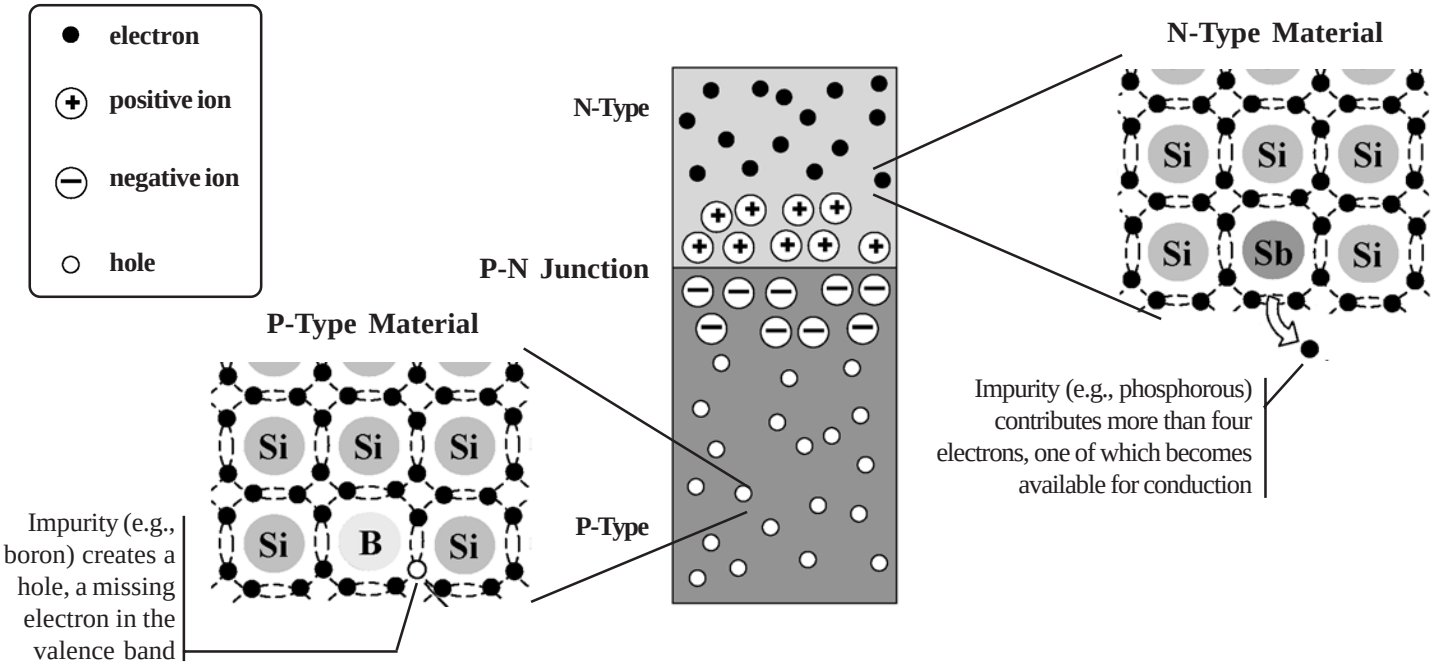
When sunlight hits the solar cell, it can penetrate through the p-n junction to strike valence electrons in the p-type crystal. Valence electrons that are hit with photons of enough energy become available for conduction and leave behind "holes" in the p-type material. These electrons can pass through the p-n junction into the n-type region where they are then held, unable to pass back across the junction. In so doing, they leave behind positive ions in the p-type region. (Electrons that do not cross the junction will eventually "drop" back into a hole and give off the energy they received from the photon as heat.)

This process will continue until the build up of electrons in the top, n-type material produces enough coulomb forces to prevent further movement of electrons from the p-type region. At this point, the solar cell will have established a voltage of about 0.5 volts.

When the cell is connected to an electric circuit, this voltage, which can be maintained as long as sunlight shines on the cell, can power an electric current. Electrons flow out the top of the cell, through the circuit, and back into the bottom of the cell, where they recombine with holes associated with positive ions. The strength of the electric current will be proportional to the surface area of the cell—the larger the cell, the greater the current.

Look to future editions of Northeast Regional News for a continuing series of articles. Still to come: PV Volts and Amps; Solar Panel Manufacture, and PV Applications.

Figure 1: P- and N-Type Materials and P-N Junction



Northeastern JSS Area Event Schedule

Connecticut
Connecticut State Race
Saturday, May 19, 8am to 4pm
Mansfield Middle School, Mansfield, CT
Contact: Gregory Kane: (860) 713-6756
Gregory.Kane@ct.gov or
John Madden: jmadden02@snet.net

Delaware
Delaware State Race
Wednesday, May 16; Raindate: May 17
Polytech High School, Woodside, DE
Contact: Delaware Energy Office
Charlie Smisson: (302) 739-1530
charlie.smisson@state.de.us
Suzanne Sebastian: (302) 739-5644
suzanne.sebastian@state.de.us

Maine
Maine State Race
Saturday, June 2
Owl's Head Transportation Museum
Contact: Peter Zack: 207-625-7833
meep@psouth.net

Massachusetts
Berkshire Hudson
Saturday, May 19, 9:00 am -noon
Reid Middle School, Pittsfield, MA
Contacts: Cynthia Grippaldi:
413-445-4556 x25
cynthiag@cetonline.org

Cape and Islands
Saturday, June 2
Cape Cod Community College Tennis Courts
Contact: Self-Reliance Corporation
Rebecca Wolfson: 508-563-6633
rebeccawolfson@gmail.com

Eastern Massachusetts
Saturday, May 19; Raindate: May 20
MIT, Cambridge, MA
Contact: Henry Vandermark: 617-242-2150
hkv@solarwave.com

West-Central Massachusetts
Saturday, June 2
Western New England College
Contact: Lyn Sullivan: 413-782-1285
msulliva@wnec.edu

New Hampshire-Central Vermont
Upper CT River Valley
Thursday, May 24
CCBA, Lebanon, NH
Contact: Dr. Thomas Anderson:
603-646-4751
Thomas.S.Anderson@erdc.usace.army.mil

New Jersey
Bergen County
Friday, May 30; Raindate: June 6
Teaneck Community Charter School
Contact: Jim Manly 201-833-9600
jmanly@tccsnj.org or solarcar@tccsnj.org

Middlesex County
Date: May 12, 10 am
Edgar Middle School
Contact: Ed Ronk,
eronk@metboe.k12.nj.us

New Jersey Inter-County
Four area events feed an inter-county Sprints final:

Morris County
Thursday, May 10; Raindate: May 17
JCP&L, Madison Avenue, Morristown

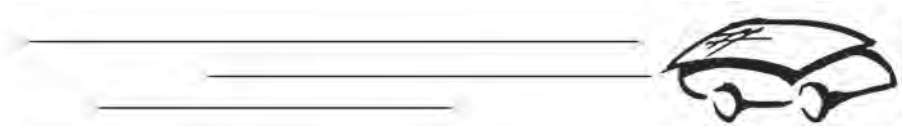
Sussex County
Wednesday: May 9; Raindate: May 16
Newton Hockey Rink

Warren County
Tuesday, May 8; Raindate May 15
Great Meadows Middle School

Suburban Passaic, Essex, and Union Counties
Friday, May 11: Raindate May 18
West Essex Regional Junior HS, North Caldwell, NJ

Inter-County Final
Tuesday, May 22; Raindate May 24
JCP&L, Madison Avenue, Morristown

For registration and additional information about Morris, Warren, Sussex or the Inter-County final, contact: Cindy Reuther at TransOptions, Inc. 973-267-7600
creuther@transoptions.org



New York
Albany-Adirondack Area
Date: Tentatively, June 2
Adirondack Community College
Contact: Lisa Sax: 518-743-2214
saxl@sunyacc.edu

Buffalo
Saturday, May 12
Jamison Road Fire Company Fire Hall
Contact: Carl Berger: 716-665-1809 or
607-277-5668
jssbuffalo@yahoo.com

Lower Hudson
Saturday, May 12; Raindate: May 19
Somers Middle School
Contact: Bill Rock: 914-277-3399 x650
wjrvc@aol.com

Southern Finger Lakes
Saturday, May 19
Cornell University or if rainy,
at DeWitt Middle School
Contact: Bob Walters: 607-277-5668
bwalters@twcny.rr.com

Pennsylvania
Philadelphia Area
Saturday, May 19
Site: TBA
Contact: Lisa Rose-Bryant: 610-667-0412
rose-bryant@verizon.net

Rhode Island
Rhode Island State
Saturday, June 9
Rhode Island Sustainable Living and Clean Energy Expo
Contact: Bekah Greenwald: 401-397-3430
bekah@apeiron.org

Vermont
Northern Vermont Area
Saturday, May 19
Williston Central School
Contact: Ben Gordesky
info@earthboundservices.com

Washington D.C.-Maryland
Washington Area
Date: TBA
Freedom Plaza
Contact: Charlie Garlow: 202-564-1088
Garlow.Charlie@epamail.epa.gov

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PLEASE RECYCLE - PASS ON TO A FRIEND!

Encourage Creativity and Team Spirit!

Liven up your local event with new challenges! Here are a few ideas:

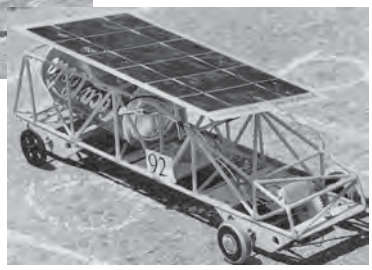
1. Combine your Sprint Race with another energy, environment or technology event.

2. Offer special prizes for kids' favorites, best use of recycled materials, most clever payload compartment, or best hill climber.

3. Acknowledge the group with the jazziest team attire, best sportsmanship, or most improved car.

A Rule Reminder

A compartment will again be required to hold the empty 12-ounce can. No virtual can-holders, please!



The idea of the payload compartment is to support the spirit of the long-standing 3-dimension rule, and to encourage variety, creativity, and innovation. Judges will consider the quality of your work here, too!

Opportunities at the Championship for Everyone

Contact Susan Reyes at sreyes@nesea.org by May 20 to volunteer or exhibit.

Volunteer at the Championship

Junior Solar Sprint programs are run mostly on volunteer energy! Get a t-shirt, a free lunch, and a great sense of fostering a kid's education by committing a day to a great event.

Exhibit at the Championship

Adults or kids share your renewable energy project with a smart and curious crowd. For kids, this can be an "Outside the Box" car or other creation which is not part of the JSS competition. Last year, four students displayed a model hydrogen fuel cell car and gave it a run on the racetrack at noon.

one-person electric car

Junior Solar Sprint Northeast News

Northeast Sustainable Energy Association 413-774-6051 x27 Fall/Winter 2008

US ARMY
Many thanks
to our sponsor

2008 Championship:
Sunday, June 8

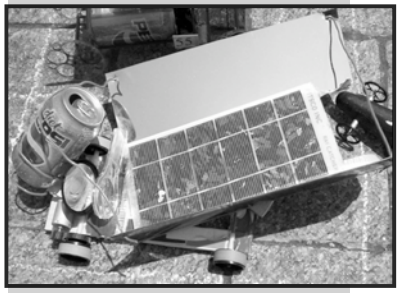
Gear Up for Junior Solar Sprint!

Sprint season is coming soon. Thanks to teachers, parents, youth leaders and other dedicated educators, it is estimated that over 100,000 kids have already participated in Junior Solar Sprint, and several young people have said that the program helped launch them into engineering and technical careers.

Middle school kids who design and build model solar cars can compete at events in their own classrooms, schools, states, and communities, and can aim for qualifying for the Northeast Championship where they vie for trophies, medallions and awards with teams from Connecticut, Delaware, Maryland, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

At last year's annual Championship Event in June 2007, the Northeast Sustainable Energy Association welcomed over 100 teams and opened the event with a color guard ceremony performed by U.S. Army JROTC cadets of the High School of Commerce in Springfield, MA. Two participants led a crowd of nearly 600 people in singing our national anthem. (Cont'd. Back of section)

Solar Panels: Amps, Volts and Power



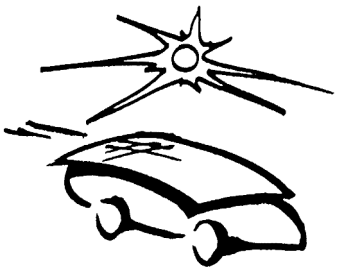
This article is the third in a series about solar panels. See the Fall 2006 newsletter for Solar Panels: The Basics, and Spring 2007 for Solar Panels: P-N Junction at www.nesea.org/education/jss

Voltage, current, power & resistance
Voltage (V, measured in volts) is the potential for electrical energy to move. Voltage is sometimes compared to water pressure in a hose or the height from which water can fall, but electricity requires a closed loop or circuit of conductive materials such as copper wires to flow. In the Junior Solar Sprint (JSS) car arrangement, the two wires from the positive (bottom) and negative (top) sides of the solar panel complete the circuit when they are both connected to the motor.

The JSS solar panels are rated at 3V. Inside the Pitsco panel, you can clearly see a series connection of six 0.5 volt cells. A series connection between photovoltaic cells means the top (negative) of one cell is electrically connected to the bottom (positive) of the next –like the top of one battery connected to the bottom of the next, where the voltage is additive: 6 pieces x 0.5V = 3V.

Test the voltage developed across your solar panel by connecting its leads to a voltmeter, or a multi-tester on the DC 20V scale. The

(Cont'd. See Solar Panels next page)



Solar Panels: Amps, Volts and Power (cont'd.)

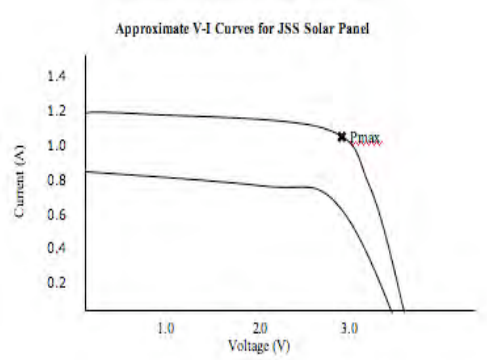
measurement you are getting is the solar panel's voltage at its maximum, which occurs when the panel is exposed to full light and yet electrons are not flowing (no current), since there is not a complete circuit of conductive material for them to flow through. We could say the resistance is infinite. Some things to figure out: Do different panels have the same maximum voltage? Does tilting the solar panel make a difference in voltage, and if so, how much?

Current (I, measured in amps) is the rate of flow of electricity. In a hose, it's like the flowing water when the water is on. Note that the size of the hose is important too, as a hose that is too narrow for the water pressure coming through would cause a lot of friction and resist the flow of water. The hose analogy relates to the size wires we use in our circuit, as wires too small or too long would create an undesirable level of resistance to the electrical flow. We usually use 22 or 20 gauge wire in our JSS configurations. You can find tables on the resistance figures for different wire sizes and even how to use lengths of wire to make your own accurate resistors at this interesting web site on Practical Electronics : http://www.awrr.com/descorn.html

Go ahead and short-circuit your solar panel —it doesn't harm the panel, but do not short circuit a battery pack, as you will heat up the batteries and this can cause problems. If your solar panel leads are hooked together with no load, the electrons are zipping around at their maximum rate. Here you are getting the maximum current from the cell, about 1.2 amps. Use an ammeter or your multi-tester to test the short circuit current of your JSS solar panels. How do they compare? Test the panel in direct sun; try it with the sun striking the panel at lower angles (tilt the panel). You should see that solar input is an important factor for current output. You can also compare the short circuit current of various other solar panels and solar cell arrangements.

To increase the current from an arrangement of solar cells, you would connect them together in parallel, where the tops are electrically connected to each other and the bottoms are also connected to each other.

Here is a graph plotting current (I) vs. voltage (V) for a solar panel, called the V-I Curve. From this curve, you can calculate the maximum power output of the panel. The vertical y axis, is intersected by the V-I line where V=0 and I = short circuit current (maximum). The horizontal x axis is intersected by the V-I line where V=open circuit voltage (maximum). Note the shape of the graph. It looks like there is a knee. At this point ✖, you can read voltage from the x axis and the current from the y axis and multiply them together to get the Pmax or maximum power of the panel.



Note: The higher curve represents direct incoming sunlight. The lower curve represents light coming in at a lower angle.

Power (P measured in watts) = Electrical potential (Volts or V) x Current (amps)
P = V x I
Electrical power (measured in wattage) indicates how rapidly electricity is delivered or used—it is a measure of the amount of energy delivered or used in a unit of time. Kids may be familiar with seeing power (watt) or current (amps) ratings on appliances and light bulbs. Electric companies charge us for the amount of electricity we use per month based on kilowatt-hours, or how many kilowatts we have used for how much time. Kids can look up the power requirements on their home appliances and electronics and see a wide range of different power needs. if an appliance has only a current rating given in amps, they can multiply it by household voltage of 120 V to get the power rating in watts. Then they can calculate and compare the monthly electricity they consume with each device. This is done simply by

(cont'd. on p. 3)

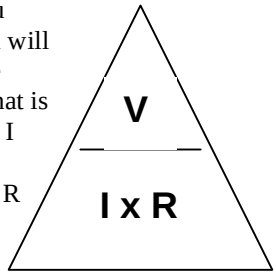
Solar Panel: Amps, Volts and Power (cont'd.)

multiplying the power (watts) times the time(hours) to get watt-hours. Since a kilowatt is 1000 watts, simply divide by 1000 to get kilowatt-hours.

Try this sample problem: How much more electricity would five 100 watt bulbs use in a month compared to five 20 watt energy saving compact fluorescents if you had the bulbs on for four hours each day? What is the cost difference?
How to get the answer: If you used five 100 watt light bulbs for 4 hours each day, in a 30 day month, you have used 5 light bulbs x 100 watts x 4 hours/day x 30 days = 60,000 watt-hours of electricity or 60 kilowatt-hours in 30 days. At $ 0.15 per kilowatt, using those light bulbs this way would cost you $9.00 that month. Repeat the calculations for five 20 watt light bulbs and compare. Kids can do an inventory of different appliances in their home, check wattage ratings, estimate hours used over a month, and calculate the electricity usage and costs using real figures from their electric bill.

Electrical resistance (R) is measured in Ohms. It is a measure of an objects' resistance to current flowing through it.

This little triangle can be helpful. If you cover one symbol with your finger, you will reveal the equivalent relationship of the remaining two. For ex., cover V and what is left is I x R, so V= I x R. Also note that I =V/R and R =V/I: V stands for voltage (volts), I stands for current (amps), and R stands for resistance (R).

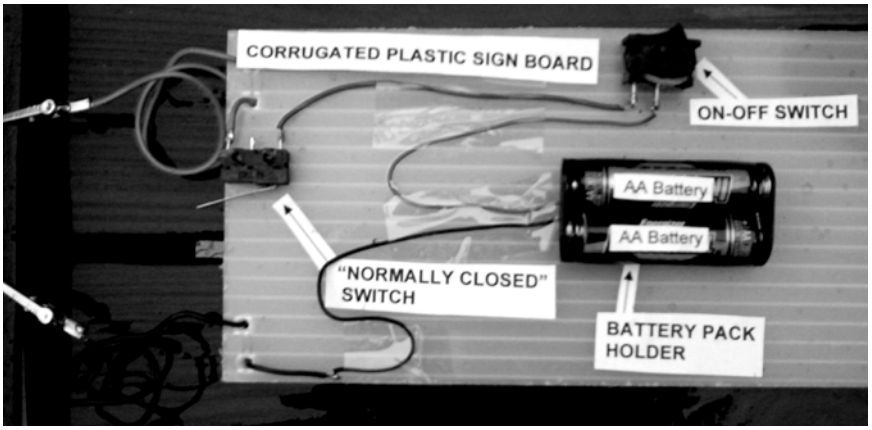


More solar panel ideas for the classroom:

1. **Explore your solar panels.** What affects the panels' current output? You need solar panels, aluminum foil, multi-testers, protractors, pencils, dowels, & clipboards & a sunny day or a 150 watt bulb in a lamp. What happens if you shade parts of the panel? What if you shade ½ of an individual cell?
Do foil reflectors that shine more light on the panel make a difference? At what angle is the sun striking the ground? Point a dowel toward it till you see no shadow & measure angle from the ground. Tie or tape string to base of protractor near the 0 and align the base of the protractor with the surface of the panel without shading it. Use the string to help tell what angle the panel is relative to the sun. Where do you get the most amperage? Compare current of panels that have been warmed slightly (don't let them get too hot) by the sun or lamp to those chilled in a refrigerator. Is there a difference?
2. **Calculate your own panels' V-I curves**. Do this by adding increments of a load of known resistance to the circuit, such as resistors in 0.5 Ohm increments, measuring voltage, and then using the mathematical relationship to figure out the current so you can make the V-I graph.
3. **Calculate how big a photovoltaic system (kilowatts)** would be required to power electricity usage at home—usually a surprisingly high number. First calculate usage. Then consider these factors: When exposed to 1 full sun-hour, the panels will produce 100% of their rated output. Though the sun is up for 8-12 hrs./day, the average equivalent for the U.S. is only 4 full sun-hours per day (watts x hours)/1000=kWH. Add 1.5% to total estimated home needs to account for energy loss in the inverter. An inverter changes direct current (DC) from the panel to alternating current (AC), which we use in the home. If using battery storage to cover cloudy days, add 10 to 40 % more electricity depending on battery efficiency. www.islandenergy.net gives a how-to on this topic.

More Resources and Reading:

1. I-V curve & more: www.chuck-wright.com/projects.html
2. SchoolPowerNaturally JSS & other solar lessons are available at http://www.powernaturally.org. Go to Solar (PV), and then Level II and solar kit lessons.
3. Komp, Richard J., *Practical Photovoltaics, Electricity From Solar Cells*, 3rd Edition revised, 2001 aatec publications, PO Box 7119 Ann Arbor, MI



Make Battery Pack Panels

Have fun and fair races inside, too.

Ready...set....go....

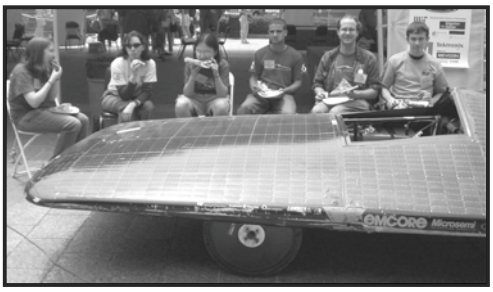
The battery pack panel at left enables all the students at a race to simply let go of their switches at once. This closes the circuits (with "normally closed" switches). Also add on-off switches so kids can use both hands when they are hooking their cars to the track.

The packs can be quickly attached to solar panels with elastics.

Championship (cont'd. from p.1)

Trophies were awarded for Speed, Innovation, Craftsmanship and Technical Merit. First place winners received a wind turbine kit from KidWind.org. There were also medallions awarded for Kids' Choice and Best Use of Recycled Materials. Exhibits aimed at inspiring youth about future renewable energy projects included a dual fuel vehicle, a high school Electrathon ride-in car, solar cookers, toys & gadgets, and a visit from the MIT solar car team in their full-size vehicle.

Youth or adults with a renewable energy projects to exhibit at the Championship should contact us by May 20, 2008.



Northeast Sustainable Energy Association

Contact
Junior Solar Sprint:

413-774-6051 x27
Fax: 413-774-6053

sreyes@nesea.org

Visit the web:
www.nesea.org/
education/jss

Get official JSS motors and panels at:

1. Pitsco: 800-835-0686
   www.shop-pitsco.com
   Type Junior Solar Sprint in the Search menu.
2. Solar World: 800-246-7012
   http://www.solarworld.com/JuniorSprint.htm

Attend a FREE JSS Workshop (Feb., Mar. '08):
See **www.nesea.org/education/jss** & register.
Learn how to lead JSS, build a car, get tips,
network with local JSS teachers,
get JSS & global warming curriculum, and
you might win a Pitsco solar panel in the raffle!

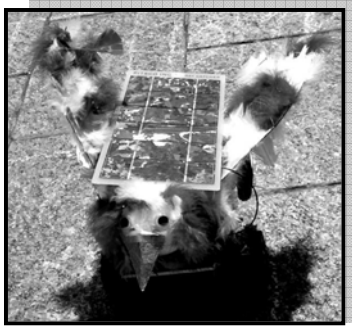
Northeast Sustainable
Energy Association
50 Miles St., Suite 3
Greenfield, MA 01301

NESEA

Junior Solar Sprint Northeast News

Northeast Sustainable Energy Association 413-774-6051 x27 Spring 2008

EDUCATIONAL, INSPIRATIONAL and FUN!



Northeastern JSS Events on the Roll!

This May's schedule is busy with students refining the performance and jazzing up the looks of their cars, as they prepare to enter their sprint cars in local race and design competitions all over the northeast.

Top winning teams will be offered invitations to the annual Championship event to be held June 8, 2008 in Springfield, MA, where trophies will be awarded for Speed, Innovation, Craftsmanship and Technical Merit (solar collection, power train and wheel and guidance system are considered). We also plan to continue to offer Kid's Choice and Best Use of Recycled Materials awards.

2008 Area Junior Solar Sprint events are listed p. 3. Join one, or start your own area event. See details inside.

Northeast Junior Solar Sprint Championship

Sunday, June 8, 2008

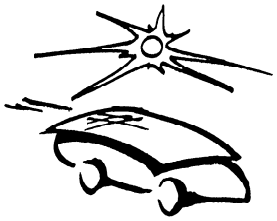
Where: Springfield Museums Quadrangle, Springfield, MA
What: Invitation-only event for competitors who qualify at an area event in the northeastern US.
What else:
EXHIBIT a renewable energy project or cool product for youth & families.
VOLUNTEER for the day. It's fun & you can get community service letter plus an event t-shirt and lunch.
Or…JUST COME CHEER!

Solar Panels: Manufacture

Note: This is the fourth in a series of articles about Solar Panels appearing in the Northeast News.

Silicon can be thought of as one of the "active ingredients" of the photovoltaic cells inside your Junior Solar Sprint solar panel. Purified, raw silicon is extracted from the silicon dioxide (SiO_2) in crushed quartz and quartzite in a special furnace where the oxygen combines with carbon and gets released. Molten silicon may be seeded to yield a single large crystal (monocrystalline) or to yield

(Cont.'d next page.)



Solar Panels: Manufacture (Cont.'d)

multiple crystals (polycrystalline). Once the rod or block of silicon, called an ingot, is cooled, it is sliced with a highly precise diamond saw into thin wafers.

In Junior Solar Sprint, the Solar World panel utilizes monocrystalline cells, while the Pitsco panel uses polycrystalline cells. Both panels were tested at the National Renewable Energy Laboratory and produced comparable power.

Silicon, a semiconductor, has four valence electrons and all of them are used for in bonding in a pure silicon crystal lattice. To work as a photovoltaic cell, some electrons need mobility. Two layers of silicon, each treated with a different element, are fused together. The top silicon layer has been treated or "doped" with phosphorus gas that was allowed to diffuse through the material at high temperature. With its five valence electrons, phosphorous enhances the availability of free electrons and this is used for the negative type (N-Type) top layer in the cell. Just beneath it is a layer doped with boron with its three valence electrons. The deficiency of electrons relative to the crystalline silicon creates positive holes and is called the P (positive)-Type layer. The junction of the two layers creates an electric field, and a potential difference of 0.5 V is created in each cell. This causes the electrons to move in one direction toward lower potential energy.
To harness the electrons, the bottom and top surfaces have conductive, metallic contacts. The bottom layer is coated with aluminum, and conductive silver fingers are screened on the top surface and connected to larger conductive strips that connect one cell to another in a series arrangement. External lead wires are connected to both the top and bottom metallic contacts, and enable attachment to a motor which is run by the electrons' work.

Silicon is shiny and gray, and one unwanted effect of this is that sunlight could be reflected. Therefore, an anti-reflective (AR) coating, usually titanium dioxide is added to the surface facing the sun. This makes the surface look a blue to black color.

Some additional existing or emerging technologies of interest include amorphous silicon photovoltaics, Copper-Indium-Gallium-Selide (CIGS) cells, triple junction thin film, organic semiconductors, applications of nanotechnology, and solar concentrators.

Resources with Pictures & Charts:
1.Manufacture with diagrams: www.madehow.com/Volume-1/Solar-Cell.html
2. Products & efficiencies: www.pvresources.com/en/technologies.php
3. Solar cell furnace pictures: www.crystec.com/crysolae.htm
4. Soldering photovoltaic cells: www.youtube.com/watch?v=qYeynLy6pj8 Check out JSS while there!

Northeastern US JSS Area Event Schedule

Connecticut
Connecticut State Race
Date: Saturday, May 17
at Mansfield Middle School,
Mansfield, CT
Contact: Jeff Bechard (860) 225-6395 or jkbechard@aol.com

Delaware
Delaware State Race
Wednesday, May 14
Raindate: Thursday, May 15 at
Polytech High School,
Woodside, DE
Contact: Delaware Energy Office
Charlie Smisson: (302) 739-1530
charlie.smisson@state.de.us or
Suzanne Sebastian (302) 739-5644

Maine
Maine State Race
Saturday, May 31
At Owl's Head Transportation Museum, Owls Head, ME
Contact: Peter Zack at
meep@psouth.net or 207-625-7833

Massachusetts
Berkshire Hudson
Saturday, May 31 at
Reid Middle School, Pittsfield, MA
Contact: Cynthia Grippaldi at
cynthiag@cetonline.org
413-445-4556 x25

Cape and Islands
Saturday, May 10
at Cape Cod Community College Tennis Courts
Contact: Angela L'Heureux at
alheureu@gmail.com
(508) 457-7679

Eastern Massachusetts
Saturday, May 17
Site: TBA
Rain date: Sunday, May 18
Contact: Henry Vandermark
hkv@solarwave.com 617-242-2150

West-Central Massachusetts
Saturday, May 31 at
Western New England College
Contact: Lyn Sullivan at
msulliva@wnec.edu

New Hampshire-Central Vermont
Upper CT River Valley
Contact: sreyes@nesea.org
Inquire with Northern Vermont or Massachusetts or start an event.
Coordinator Needed

New Hampshire-Keene Monadnock
NEW EVENT 2008
Thursday, May 22, 2008
Peterborough Rec Area Tennis Courts
Contact Nancy Gambel at
nfgambel@ambien.com of the Harris Center for Conservation Education. Limited to selected schools.

New Jersey
Bergen County
Wed. May 21, 2008; Rain date: May 28
at Teaneck Community Charter School
Contact: Craig Messmer at
solarcar@tccsnj.org 201-833-9600

Middlesex County
Date: TBA
at Edgar Middle School
Contact: Ed Ronk,
eronk@metboe.k12.nj.us

New Jersey Inter-County
Four division events feed the Inter- county final: Mon. June 2
Raindate: Wed. June 4
Site: JCP & L, Madison Ave,
Morristown, NJ

Division 1: Mon. May 19; Rain: May 23
Great Meadows Middle School, Great Meadows, NJ

Division 2: Tues. May 20; Rain: May 27
Newton Hockey Rink, Newton, NJ

Division 3: Wed. May 21; Rain: May 28
JCP&L, Madison Ave., Morristown, NJ

Division 4:Thurs. May 22; Rain: May 29
West Essex Regional HS,
North Caldwell, NJ

For questions about any Division Event or the NJ Intercounty Final, contact:
Contact: Cindy Reuther at
TransOptions, Inc. 973-267-7600
creuther@transoptions.org

New York
Albany
Inquire with MA Berkshire-Hudson, Lower Hudson or Western New York area events, or start one.
Coordinator Needed

Buffalo
Saturday, May 3 at
Jamison Road
Fire Company Fire Hall
Contact: Carl Berger at
jssbuffalo@yahoo.com
716-665-1809

Southern Finger Lakes
Saturday, May 17 at
Cornell University or if rainy,
at DeWitt Middle School
Contact: Bob Walters
bwalters@twcny.rr.com
607-277-5668

Pennsylvania
Philadelphia Area
Saturday, May 31; Rain: June 1
Site: Wissahickon Charter School
Contact: Joe Bruno at
joegbruno@comcast.net
610-639-1813

Rhode Island
Rhode Island State
Saturday, May 17; Rain: May 18
Contact: Bekah Greenwald
at bekah@apeiron.org
401-397-3430

Vermont
Northern Vermont Area
Saturday, May 17
at Williston Central School
Contact: Mike Thomas
THOMASM@wsdvt.org

Washington D.C.-Maryland
Washington Area
Thursday, May 29
at Freedom Plaza
Contact: Charlie Garlow
Garlow.Charlie@epamail.epa.gov
202-564-1088

Run a Race on Your Own Two Tracks

TIP: Make your own race tracks for test drives or your classroom event.

1. Get these or comparable materials:
*4 - 2 ft lengths closet dowel
*2 - 75 ft lengths #60 fish line
*4 sm. wood blocks, 1.5 cm high
*4 solid concrete bricks 2 x 6 x15”
*4 pads to protect lines under bricks
*Chalk/color tape to mark start/finish
dowel, for the fish line
2. Drill a hole in the center of each.
3. Tie fish line ends to dowel holes.
4. Lay out on a tennis court, hockey rink, etc. If too rough, lay & duct tape 80 ft of 4 ft. landscape fabric.
5. Stretch line & weight with bricks.
6. Mark start; measure 20 m. & mark finish line. Leave room for the kids.
7. Put wood spacer blocks under line at each end to raise the line 1.5 cm.

Give your track a try. Invite friends.! Start an event if none is near!

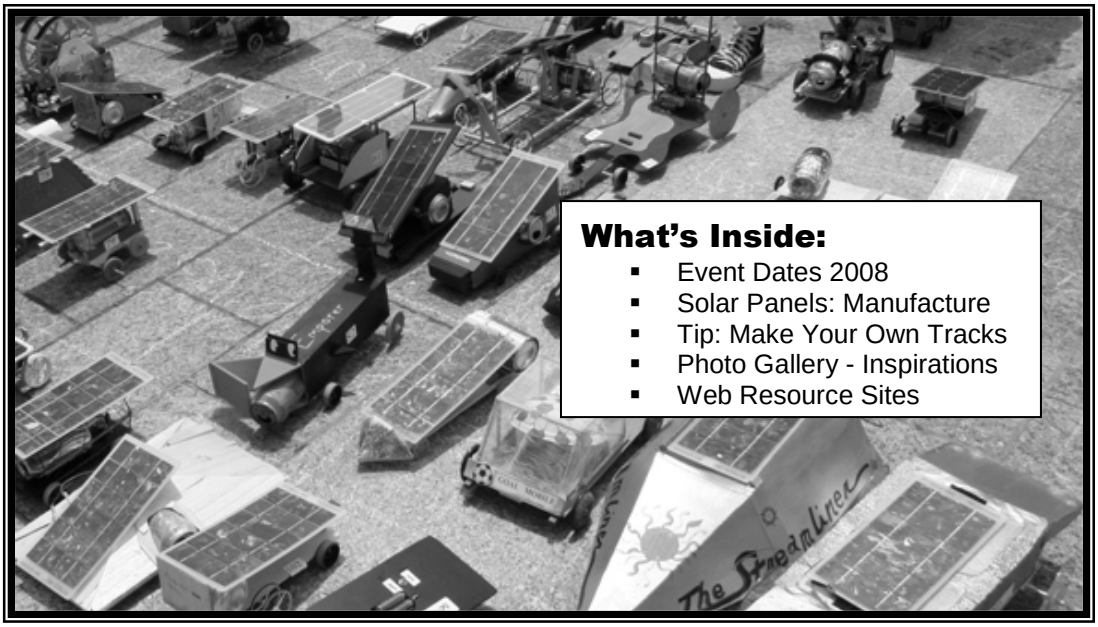
Northeast Sustainable Energy Association

Contact Junior Solar Sprint:

413-774-6051 x27
Fax: 413-774-6053

sreyes@nesea.org

Visit the web:
www.nesea.org/education/jss



What’s Inside:

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Junior Solar Sprint Northeast News

Northeast Sustainable Energy Association 413-774-6051 x27 Winter 2009

Grand Champions 2008

EDUCATIONAL, INSPIRATIONAL and FUN!

The Winning Difference

Perseverance, resourcefulness, creativity and an orientation to detail are some important qualities that can lead to the development of a winning car. The time and effort shines at northeastern U.S. area events and at the invitation-only annual Northeast Championship! Often a team's first car design doesn't work well. This experience can be an opportunity to re-evaluate, redesign and rebuild –- part of the inquiry and engineering process.

Learn more about what to expect with Junior Solar Sprint and how to guide youth through a successful experience. Come to a workshop. You'll also get curriculum resources; a Pitsco kit and chance to build a car; teaching tips; an opportunity to network, and a professional development letter. Area coordinators often come to answer your questions and offer support. At some workshops, you might even win a door prize, such as a solar panel!

Sign up for a FREE Winter 2009 Junior Solar Sprint Workshop Today!

1. Go to www.nesea.org, K-12 Education, Junior Solar Sprint, then "Workshops for Teachers and Leaders 2009" to find the one closest to you.

2. Download a registration form & FAX or email us the information.

Solar Panels: PV Applications & More

Once kids see how well a small photovoltaic (PV) panel can generate electricity to power their model cars, they might want to explore some other applications of PV technology. Just what are some uses of photovoltaic technology, besides running cool kids Junior Solar Sprint cars? You name it! There are exciting and diverse applications for photovoltaic solar energy, from small kids' toys and household goods to rural and emergency electrification systems to grand scale power generating plants. Currently, the world's largest PV

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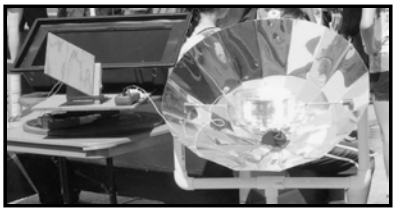
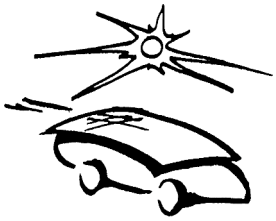




Solar Panels: PV Applications (Cont.'d)

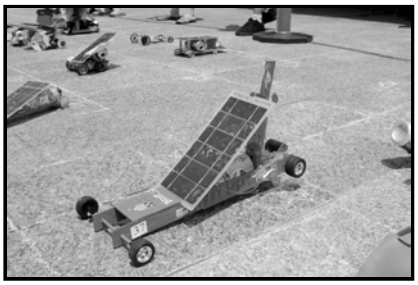
power plant is in Spain, rated for 60 megawatts (MW) of power. That translates to enough electricity for roughly 16,000 residential homes. In the U.S., the 280 MW Solana Generation Station Project in Arizona is projected to be running in 2011. Visit www.solanasolar.com to see a photovoltaic solar power project on a grand scale and explore more potential for PV at the web site of the International Energy Agency – Photovoltaic Power Systems Programme (IEA-PVPS), which promotes international collaboration to develop and implement photovoltaic solar energy: http://www.pvresources.com

Ideas for the classroom & beyond: Interview some people who use electricity from photovoltaic cells, or who heat water or air with passive solar energy. Kids can learn how to distinguish photovoltaics from other forms of solar technology, and then take a scavenger hunt around the community looking for different types of solar power and different applications of photovoltaic cells, visiting a site if possible. They can search the web to find as many applications as possible and create a group poster. With a quality educational PV kit, they can try out some activities. Thames & Kosmos is among those who offer one, or go to www.schoolpowernaturally.org and click on Solar Kits where you will find 15 solar lessons and tips on how to find materials.

At NESEA's Clean Green Power Program, you will find a guide rich

in resources: interview questions for your guest or site visit; distinctions between solar hot water collectors & PV panels to help with your solar energy scavenger hunt; a quiz and a survey on renewable energy; renewable energy glossaries with web links; project ideas for kids of all ages, and an opportunity to get the whole family up to date on renewable energy. Kids as young as 5 can earn the Clean Green Power Champion patch & certificate together with their Junior Solar Sprint siblings, and there are special patches for Girl Scouts. Go to our web site and follow K-12 Education links to the program.

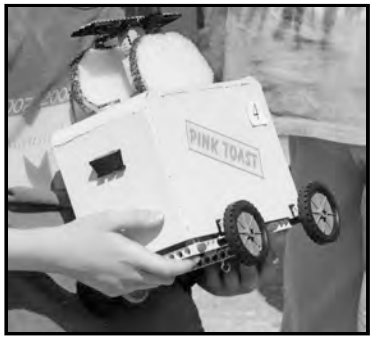
SPRINT INSPIRATION GALLERY



Save the date!
Northeast Championship
Sun., June 14, 2009

The Championship 2008 was held at the Springfield Quadrangle for the 7th year in a row, organized by the Northeast Sustainable Energy Association and funded by the US Army.

Sun & clouds kept competitors on their toes with cars running on either battery packs or photovoltaic solar energy according to the call of the track master. The cars you see in this gallery offer a sampling of the amazing array brought to the Championship from around the northeastern USA. The teams of middle schoolers who created them qualified through competition in one of the 20 or so area events around the Northeast that took place in May and early June. They were invited to show their best in speed, and several design categories. Separate judges reviewed the quality of solar collection, the power train, the wheel and guidance system, craftsmanship and innovation. Kids voted for favorite cars besides their own for the Kids Choice Award. Awards for Best Use of Recycled Materials and a new award for Artistic Merit were also offered. Go online to www.nesea.org to see color images of the top winners representing New Jersey, Vermont, Maine, Delaware, Massachusetts, Connecticut, and Pennsylvania this year and their fabulous cars!



Teacher Tip: Follow the Rules!

Aiming for the Championship? Make sure kids are familiar with the JSS Rules and Regulations 2009 on our web site. The rules can be presented as engineering specifications for the project. There are two suppliers for the official JSS motors and panels:

Pitsco: www.shop-pitsco.com
Type Junior Solar Sprint in the search menu 800-835-0686

Solar World: 800-246-7012
http://www.solarworld.com

Inside:
Solar Panels: PV Applications
Sprint Inspiration Gallery
More Resources, Tips & Links

Northeast Sustainable Energy Association

Contact Junior Solar Sprint:

413-774-6051 x27
Fax: 413-774-6053

sreyes@nesea.org

Visit the web:
www.nesea.org and go to K-12 Education Junior Solar Sprint

Northeast Sustainable Energy Association
50 Miles St., Suite 3
Greenfield, MA 01301

NESEA Arianna Grindrod

From: NESEA K-12 Education Department [agrindrod@nesea.org]
Sent: Thursday, April 08, 2010 9:57 AM
To: agrindrod@nesea.org
Subject: NESEA K-12 Spring 2010 - Solar Energy Education

NESEA™
NORTHEAST SUSTAINABLE ENERGY ASSOCIATION

Inquiry-based, science and engineering education provides students with the tools necessary to assess and make healthy choices for themselves, their families, and their communities. The work of the K-12 Education Department is to provide opportunities that nurture the development of informed and pro-active citizens, infused with a team-spirit approach to face the challenges that lie ahead with dignity and resourcefulness.

NESEA K-12 SPRING 2010 E-NEWS

Spring has marched into our lives and is showering its warming rays upon us. Time to get out those model solar panels and get your students outside exploring the science and applications of solar energy!

Sample Experiment:
PARTS OF A SOLAR PANEL
Relates to School Power…NaturallySM Solar Kit Lesson #4

Materials: multi-testers (multi-meters); magnifying lens; a 3 V, 1.2A Junior Solar Sprint (JSS) solar panel from Pitsco or Solar World; 1 V 400mA mini-panels; small solar cells (request pieces from a solar installer - visit NESEA.org Sustainable Green Pages for a listing of PV installers near you).

Basic Explanation:
A solar panel and solar cells are examined and the solar panel is mentally "reverse engineered" to gain a deeper understanding of the way it works.

SOLAR PANEL SAFETY: Don't bend solar panels, and don't drop them. The cells are like thin pieces of glass. Be careful not to cut yourself on them. If doing experiment indoors with a lamp, keep solar panels at least 10 cm from lamp & don't leave them unattended or sitting there. Remove them before they feel too hot to the touch. The plastic covering can easily warp, shrink, or melt.

Tasks for students:
___ Using a magnifying lens, carefully examine the cells on both sides and make note of observations.

Upcoming Educator Workshops:
Visit http://www.nesea.org/k-12/events/ for a full description and to register.

4/15 Wind Wisdom for School Power Naturally, Manhattan, NY, 4:00 - 6:30 pm
4/17 Wind Wisdom for School Power Naturally, Staten Island, NY 1:00 - 4:00 pm

Junior Solar Sprint!
SAVE THE DATE:
Northeast JSS Championship, **Sunday, June 13**
To qualify for participation in the Championship, student teams must be invited by winning at their area or state race.

Contact NESEA if you are interested in volunteering or

One side of cell:
Other side of cell:
Which side do you think should face the light? If you didn't already know the answer, what led you to choose a particular side?

___Set up your multi-tester. Set the dial on 20V DC. Lay the red lead flat against the most solid area of the white grid of one of the small cells & touch one of the center strips on the top of the blue-black side. Measure other cells if time permits.

Cell #1 _____V Cell #2 _____V Cell #3_____V

___Compare the results for the different cells. What did you notice?

____Move the red banana plug to the top of the three holes on the multi-tester and measure the current: _____Amps

___Examine a solar panel under a magnifier. Imagine you are deconstructing the panel. Describe all the parts and details you can, and try to figure out a function and/or explanation for the observed detail.

___Diagram the inside and outside wiring of the solar cells in a mini panel.
Note where each connection is coming from and where it is going to.
Note which lead is + and which is – and how it is attached to the panel.

__Diagram the cell-to-cell and lead wiring of solar cells in a JSS panel:
Note which lead is + and which is – and how it is attached to the panel

___What do you think accounts for the difference in voltage & current between the JSS & mini panels? Hint: Each cell is 0.5V regardless of size, which you might have discovered in the cell exploration.
cells in each:
JSS- Mini-

Note series connections – bottom of one to top of another:
JSS- Mini-

Note parallel connections
JSS- Mini-

___What is the difference between a solar cell, a solar panel and a solar array?

Have students complete activity in pairs or small groups and regroup to discuss findings.

A special notice to New York educators:
Solar Sails New York Program
Through a service contract with the New York State Energy Research

exhibiting a renewable energy project at the Northeast Championship.

The JSS Process:
Through hands-on experimentation, students learn how to design, build,and race model solar cars and tackle issues in the engineering process, properties of materials, forces and motion, electricity and magnetism, ratios and geometry.These young engineers deepen their understanding about solar energy, math, physical science and craftsmanship.

Meet your JSS Area & State Event Coordinators

Area Events:
Connecticut
Connecticut State Race
Date: Saturday, June 5
Contact: Jeff Bechard, Slade Middle School
jkbechard@aol.com

Fairfield County Date:
Date: TBA
Contact: Amar Gada
amar_gada@hotmail.com

Delaware
Delaware State Race
Date: Wednesday, May 12
Contact:Suzanne Sebastian, Delaware Energy Office
suzanne.sebastian@state.de.us

Maine
Maine State Race
Date: Saturday, June 5, 2010
Site: Owls Head Transportation Museum, Rockland, ME
Contact: Peter Zack, Maine Energy Education Program
meep@psouth.net

and Development Authority (NYSERDA), NESEA is offering free workshops: *A Solar Kit for the Classroom*; created for grades 3 -12 with a strong focus at the middle school level; and *Wind Wisdom for School Power...Naturally*, appropriate for grades K-6.

At the workshop teachers and non-formal educators will receive:

- engaging, hands-on science and engineering activities that support New York State Learning Standards and Core Curriculum, addressing specific performance indicators; and
- a free energy education kit and support materials for your classroom, center, or institution.

Take a look at the deluxe solar kit that compliments the Solar Kit lessons:

For more information on the ***Solar Sails New York*** program and a workshop schedule visit http://www.nesea.org/k-12/solarsailsnewyork/

NOW AVAILABLE FOR FREE DOWNLOAD
Wind Wisdom for School Power Naturally
Two curricular units: K-4 and 5-6
http://www.nesea.org/k-12/solarsailsnewyork/
or at SchoolPowerNaturally.org

The Solar Sails New York program is sponsored by NYSERDA & the *School Power...Naturally* program.

NYSERDA
New York State Energy Research and Development Authority

JSS Rules and Regulations Updates

Junior Solar Sprint Rules and Regulations Northeast Championship rules have been updated for 2010, mostly for clarification. Updates arose from feedback of teachers and participants and were discussed among area coordinators at the coordinator conference last November and were carefully considered. Particular attention was given to the compartment and payload rules, which are now addressed separately. A simple way for kids to think about the payload is that it can represent

Massachusetts
Berkshire-Hudson Area
Date: Saturday, June 5
Contact: Cynthia Grippaldi,
Center for Ecological Technology
cynthiag@cetonline.org

Cape and Islands
Date: Saturday, June 5
Contact: Megan Amsler
Cape and Islands Self-Reliance
megan@reliance.org

Eastern Massachusetts
Date: TBA
Contact: Henry Vandermark,
Boston Area Solar Energy Association,
hkv@solarwave.com

West Central Massachusetts
Date: Saturday, March 5
Contact: MaryAnn Berselli,
Western New England College
mberselli@wnec.edu

New Hampshire
Upper Connecticut River Valley
Date: TBA
Contact: Jen Tate, Thayer School of Engineering at Dartmouth College
Jennifer.A.Tate@dartmouth.edu

Keene - Monadnock Area
Date: Wednesday, June 2
Contact: Susie Spikol,
Harris Center for Conservation
spikol@harriscenter.org

New Jersey
Bergen County
Date: Friday, June 4
Contact: Craig Messmer, Teaneck Community Charter School
solarcar@tccsnj.org

Middlesex County
Date:TBA
Contact: Ed Ronk, Edgar Middle

either a person or cargo. As such, the can should not be required to hold up or hold together any part of the car including the solar panel. The payload (person or cargo) shouldn't be altered in any way (eg crushed or cut up), shouldn't be held in place with a stick (skewered) and should be removable and re-insertable in the same condition at any time. As for the compartment, it is intended to be a 3D structure of the vehicle, remaining the same shape with or without the payload. Get the specific language in the JSS Rules and Regulations document found on our web site.

It is important to note that the rules for the Northeast Championship may be varied at area events, allowing for experimentation and a dynamic program. Please be sure to check with your area coordinator about specifics for each area event. Download your Junior Solar Sprint Rules and Regulations at our web site at www.nesea.org/k-12/juniorsolarsprint

Check out a winning model solar car: This team won First Place in Technical Merit at the 2008 Northeast Championship.

The CECE Experience: "Outside the Box" Exhibits

Have you, your students or someone you know created a renewable energy project that is "outside the box," meaning that it doesn't fit the criteria for a Junior Solar Sprint model solar electric car, and maybe it isn't even a car at all, but would be great to showcase at the Championship? If it is a light, small model vehicle similar to JSS cars, we may be able to offer an exhibition run on the track at lunchtime. Here is a starter list for potential exhibit items:

-Did you make a model solar car where you used a different panel arrangement or soldered your own solar cells to make a panel?
-Do you have an alternative fuel or electric powered model, ride-in or real car, cart or bike or other machinery?
-Did you have a human powered device?
-Have you crafted a wind powered kinetic sculpture or vehicle?
-Have you tinkered around with solar ovens or solar concentrators?

Send a description, a photo and your contact information by May 20, 2010 to sreyes@nesea.org and we will consider including it at the Northeast Championship on June 13.

The Clean Energy for a Clean Environment (CECE) Program empowers youth and educators to explore topics in energy efficiency and

School
eronk@metboe.k12.nj.us

Inter-County Final
Date: Wednesday, June 2
Contact: Cindy Reuther, TransOptions, Inc.
creuther@transoptions.org

Buffalo Area
Date: Saturday, May 8
Contact: Carl Berger, Buffalo JSS
jssbuffalo@yahoo.com

Southern Finger Lakes
Date: Saturday, May 22
Contact: Bob Walters, DeWitt Middle School
bwalters@icsd.k12.ny.us

Pennsylvania
Philadelphia Area
Date: Saturday, May 22, 2010
Contact: Joe Bruno, Philadelphia Solar Energy Association
joegbruno@comcast.net

Rhode Island
Rhode Island State Race
Date: Saturday, June 5
Contact: Elisabeth Bux, Apeiron Institute for Sustainable Living, 401-397-3430 or
elisabeth@apeiron.org

Vermont
Northern Vermont
Date: TBA
Contact: Mike Thomas, Williston Central School, Williston, VT
THOMASM@wsdvt.org

Washington D.C. & Maryland
Date: Friday, May 21
Contact: Charlie Garlow, Electric Vehicle Association of Greater Washington, D.C.
Garlow.Charlie@epamail.epa.gov

renewable energy resources. Students explore the science and applications of renewable energy and can earn a Clean Green Power Champion Patch by completing hands-on projects that they then share with their school and/or community. Consider the JSS Northeast Championship as your place to showcase!

What age can participate in area events and the Northeast Championship?

The official Northeast Junior Solar Sprint competition network is for middle school students up to 8th grade or equivalent ages of middle schoolers. There has been some flexibility at different area events for younger students. A guiding rule should be that parents and adults, while they may teach about engineering process; applicable principles of physical science; solar photovoltaics and other components, as well as various crafting techniques and successful features of a well designed car, should not have built any part of the car or told the child how to design their vehicle. At the Championship, teams are expected to handle all aspects of managing their vehicles from problem solving to soldering repairs, without adult hands involved. Within limits of safety, youth should be allowed to experience their own successes and failures with good sportsmanship. That said, kids of all ages benefit from making model solar cars, so teachers are encouraged to build their own programs and classroom and school competitions. We love to hear how your unique events are going and encourage creativity.

JSS in the northeast is coordinated by NESEA and sponsored by the U.S. Army Educational Outreach Program.

Energy Thinking

Energy—where we get it and how we use it—can be expected to change radically during the lifetimes of our children. Through activities in this unit, students will implement an easy-to-use structure—the Energy Thinker's Diagram—to analyze and evaluate energy use in their lives and propose changes that could reduce unwanted consequences of energy use that students consider important. Students examine the scientific concepts of energy sources, forms, transformations, efficiency, and heat transfer. (Curricular units currently available in MA & PA)

NESEA K-12 is now on Facebook.

Become a fan! Let's start some discussions. What are your interests in renewable energy education? What are your needs? Let's help one another. Share lessons that really work. Post your challenges and accomplishments.

NESEA videos on YouTube

Watch the JSS promos from footage of the 2009 Northeast Championship. 10 min. & 4min The original video is also available on YouTube or you can purchase a DVD through NESEA.

The NESEA K-12 Education Department offers professional development opportunities and resources for teachers and non-formal educators, and curriculum and programs on energy efficiency and energy conservation, and on forms and applications of renewable energy. NESEA employs best practices in creating grade-specific and age-appropriate curriculum that meet state and federal academic *Learning Standards*.	**Contact the K-12 Education Department!** 413-774-6051 x 21 or x 27 agrindrod@nesea.org sreyes@nesea.org

Junior Solar Sprint Northeast News

Northeast Sustainable Energy Association 413-774-6051 x27 Winter 2010

The Grand Champion Car of 2009

EDUCATIONAL, INSPIRATIONAL and FUN!

Many thanks to our sponsor

Sprint Coordinators Convene in Massachusetts

Northeast Junior Solar Sprint area coordinators met in Deerfield, Massachusetts for the first Area Coordinator's Conference November 20-22, 2009. The Northeast Sustainable Energy Association (NESEA) organized the weekend gathering to facilitate the exchange of resources, ideas and information specifically for those who organize area events for teams from different schools and organizations. We held a number of group discussions around topics of special interest including grants and funding sources for the programs; rules & their interpretation; race & battery management; race track surfaces and lines; outreach strategies; participant diversity; JSS veterans; registration and documentation; photography; volunteers and judging; recycling and sustainability; adult and parental involvement, and fostering creativity. Coordinators received JSS DVDs and curriculum for Junior Solar Sprint as well as climate change curriculum & slides as a potential context for introducing JSS. Coordinators & events are listed at **www.nesea.org/k-12/juniorsolarsprint**

More Junior Solar Sprint Teacher/Mentor Trainings Coming in Spring 2010

1. Go to **www.nesea.org**, K-12 Education, Junior Solar Sprint, then "Workshops for Teachers and Leaders 2010" to find the training closest to you.

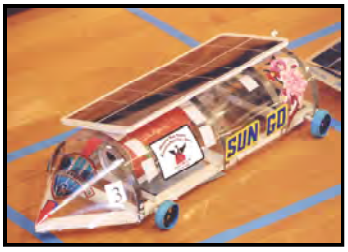
2. Download a registration form & FAX or email us the information.

Repeat attendance is welcome.

Teacher Tip: Getting Started With Gears

Gear transmission is an important option for transmitting rotation from the motor shaft to the axle of a JSS car. Working with gears can be a challenge for some students and beginning JSS teachers/mentors alike. In a simple arrangement, one gear is attached to the motor shaft and another is snugly and firmly affixed to the axle, their teeth are in contact (meshed together) and this transmits the turning of the motor to turn the axle and its attached wheels. If you are unfamiliar with how gears work, learn and experiment with gears before making your first JSS car.

(Cont. See Basic JSS Gears on p. 2)



Basic JSS Gears (cont.)

Suggestions:

1. Be sure gears you plan to use together have teeth of the same shape and pitch (# of teeth per distance). If you are recycling toys, you can keep different sets of gears in different plastic bags along with their axles.
2. Mark a tooth on each gear so you can better keep track of its turns.
3. See and compare circumferences of different size gears with lines on paper by rolling the gears and marking the start and finish of one complete turn. Measure the lines. Divide each one into the other to get a couple possible gear ratios. Then count teeth on each gear, divide and compare what you get. Counting teeth is an option for comparing gear sizes.
4. Mesh sets of two different size gears together. Be sure they move freely but don't come apart. Experiment and answer:

a. Can a gear arrangement change direction of turning?

b. Can a gear arrangement change speed?

c. What are the possible gear ratios for each combination? You can get two gear ratios for each combination. For example, with the low gear ratio, one turn of a gear results in the other making only a quarter turn, whereas with the high gear ratio, one turn of a gear results in four turns output.

d. Can a gear arrangement change the amount of turning force on an axle? To figure this out, you can build cars with different gear ratios and see which ones actually work. Think of your experiences in high and low gear on a bike.

5. In making your JSS car, there is a trade-off in how fast the gear turns the axle and how forcefully the axle is turned. This trade-off is commonly referred to as a speed vs. torque trade-off. It may be counterintuitive, but you have to favor the high torque over high speed arrangement with your JSS car or it will not start. You can let your students figure this out by trial and error. See picture.

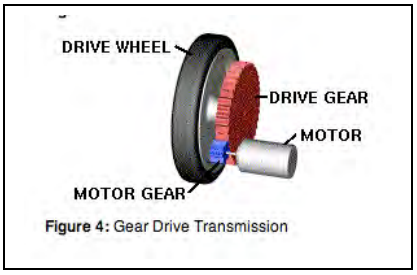
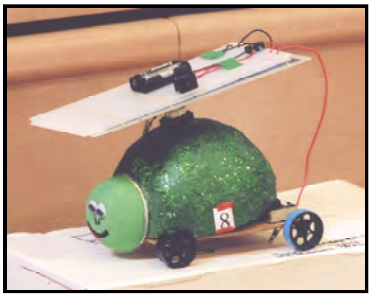


Figure 4: Gear Drive Transmission

6. Check out the Chimacum JSS Curriculum with its explanations and activities on gears: **http://eagle.csd49.org/middle/jss/Course_Instr.htm**
Better yet, come to a JSS Teacher workshop & get a hard copy of the Chimacum JSS Curriculum and many more resources.



CHAMPIONSHIP GALLERY

Aim for the next Championship! Sun., June 13, 2010

Championship participants came from all over the northeastern USA to compete for a variety of awards for their model solar electric cars on June 14, 2009. For the first time in over seven years, the Northeast Championship was held inside in a gymnasium due to rain. Among other things, this means running a car designed for solar power on a battery pack. Top performing teams had to know their car well, present it to various judges, and be capable of responding and adjusting their vehicle to conditions and demands at the site.

Every participant deserves kudos for the motivation and perseverance that brought them to this annual invitation-only event and sustained their dynamic performance throughout!

Awards with winners' states: Grand Champion (NJ); Speed (NJ); Innovation (NJ); Technical Merit (MA & PA); Craftsmanship (MA, ME & CT); Kids Choice (NJ); Artistic Merit (MA & NJ); Team Spirit (NH & NJ), and a Special Sportsmanship and Sprint Spirit award (Washington, DC)

Award winners, inspirational photos and an informational video filmed at the 2009 Championship can be found at our web site at **www.nesea.org/k-12/juniorsolarsprint.** The video is also at the program sponsor's site at **www.usaeop.com.** NESEA also has two promotional videos on You Tube to help spread the word about JSS.

No. 2 Pencil is car #2 by chance

Get Supplies - Official panels & motors and more:

Pitsco: 800-835-0686
Type Junior Solar Sprint in the search menu **www.shop-pitsco.com**

Solar World: 800-246-7012
www.solarworld.com

Explore additional hobby, science & technology education stores and/or recycled or reused materials for the rest.

nks

Northeast Sustainable Energy Association

Contact Junior Solar Sprint:

413-774-6051 x27
Fax: 413-774-6053

sreyes@nesea.org

Visit the web: www.nesea.org and go to K-12 Education Junior Solar Sprint

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