efargo

Energy Challenge 4.0

TEACHER'S GUIDE

NOTE

efargo is a research group at the Department of Architecture and Landscape Architecture at North Dakota State University (NDSU).

The **efargo Energy Challenge** empowers the students, teachers, administrators and facility managers to reduce energy use in their school through educational activities and actions. We aim to educate and empower our children to contribute their creativity, knowledge, enthusiasm and actions for creating a better future for our community.

As a research group, efargo does not endorse any company or person selling or otherwise promoting products or services. Please feel free to contact us with any questions about efargo at info@efargo.org.

Opposite: Drawings of Waste-A-Watt by participants of Party for the Planet hosted by the Red River Zoo April 24, 2015.


Cedrik


fargo@efargo.org


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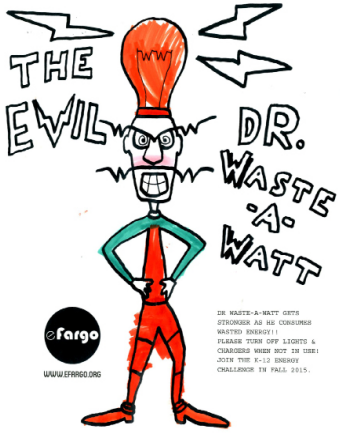
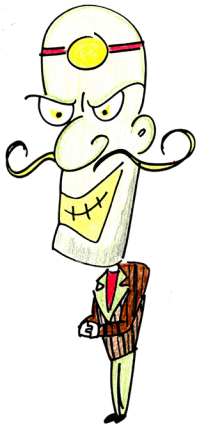

THE
EVIL
DR.
WASTE
-A-
WATT
efargo
WWW.EFARGO.ORG
DR WASTE-A-WATT GETS STRONGER AS HE CONSUMES WASTED ENERGY!!
PLEASE TURN OFF LIGHTS & CHARGERS WHEN NOT IN USE!
JOIN THE K-12 ENERGY CHALLENGE IN FALL 2015.

Madelyn


Alexzel
STOP
THE
EVIL
DR.
WASTE
-A-
WATT
ON
OFF
efargo
WWW.EFARGO.ORG
TURN OFF SWITCHES
WHEN NOT IN USE!!


NOOR



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INTRODUCTION

CHALLENGE

All classrooms are invited to participate in a four-week Energy Challenge organized by efargo to promote energy efficiency and provide opportunities for the sustainability leaders of tomorrow.

GOALS

1. Educate students about the science of energy consumption and resulting impacts.

2. Empower students to create and sustain change to their own environments through everyday energy-use practices.

3. Reduce the impact that our schools have on the environment by reducing energy use in school buildings.

4. Help Fargo become a more energy-efficient community.

TEAM

1. Class-based team (students, teachers, facilities managers and staff, principals, and administrators)

2. Energy Challenge events can be incorporated into a classroom activity or school-wide activity. Each school should have one project champion that is either a teacher, facility manager or administrator. We strongly encourage each classroom to also have a student leader.

RECOGNITION

Students and student leaders will receive participation and recognition certificates.

If donations are received, all Energy Challenge participants will receive tree saplings.


WASTE-A-WATT'S
STORY

Waste-A-Watt is a greedy super-villain who gains power from energy that is wasted. When energy is wasted throughout the city, Waste-a-Watt grows stronger. His goal is to make us waste more energy so he can become super-powerful and take over the city. Luckily, we have the ability to stop him in his tracks!

With efargo, we can dream and make possible an energy-saving Fargo where no energy is wasted! We can come together to end energy waste and capture Waste-A-Watt before he conquers Fargo. As we waste less, he becomes weak. He is getting weaker due to energy savings in 2016 + 2017. Let's work to eliminate him!

All we need to do is make sure that we are not wasting energy. It can be as simple as turning the lights off when leaving a room or unplugging unused electronics.

efargo is inviting all schools to help defend the City of Fargo and surrounding community and capture the evil Waste-a-Watt. Take the role of Energy Superheroines and Superheroes to push your class and your school to become more energy-efficient. We have the power to make a big change!

TEACHERS' ROLE

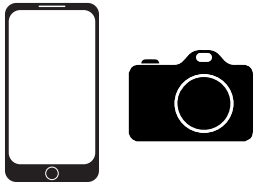
TEACHERS AS HELPERS

Expect students to come to you for help when they see this apple next to an activity in their booklet.

Bonus, Lighting, Devices, Heating/Cooling, and Activist Friday activities that require your help are listed on pages 16-20 of this booklet.

We recommend that you take a look at the students' book to see the rest of the activities that they will be engaged in!

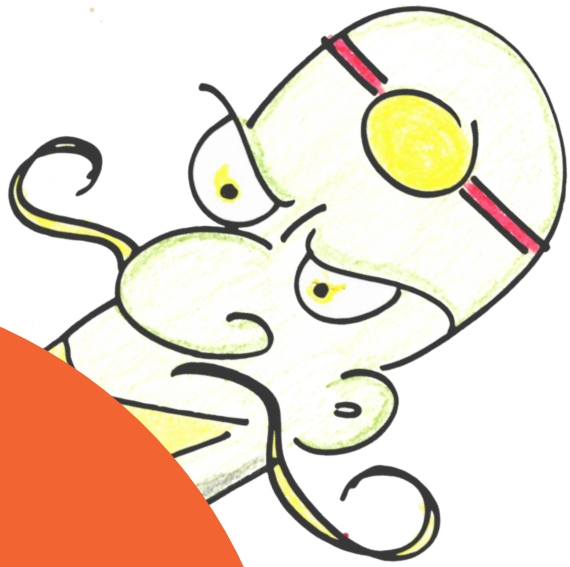
TEACHERS AS PHOTOGRAPHERS



While students are engaged in activities, we encourage you to observe and **take images** of them. These images help the efargo team evaluate how interested and involved students are in certain activities.

The efargo team would love to see how the Energy Challenge unfolds in your classroom!

Send images via,
email: info@efargo.org
or text: (612)209-7745



PROPOSED TIMELINE

PRE-GAME SURVEY Ask Students to fill out the given surveys. The efargo team will collect them at the end of the Energy Challenge. These surveys help us derive game statistics and efficiently redesign components of the Energy Challenge.

WEEK 1 - KICK-OFF

During the first week, students are gradually introduced to Energy-Saving Actions that they are expected to do throughout the 4-week Energy Challenge. The goal is to develop these Energy-Saving Actions as everyday habits.

MONDAY

KICK-OFF

K1

APPOINT A CLASSROOM LEADER
(15 minutes)
Help your students appoint a student leader who will lead the entire class through this Energy Challenge.

1. Explain the leader's duties: helping record points, following the time line, and giving reminders.
2. Ask interested students to write their names on a piece of paper and add it to a pile of other students' names.
3. Randomly pick a name -- that students will be the leader!

TUESDAY

L1 L2
LIGHTING DAILY HABITS

K2
ENERGY CARDS
(30 minutes)

K3
TAG THE WASTE
(15 minutes)

WEDNESDAY

L1 L2
LIGHTING DAILY HABITS

D1 D2
DEVICES DAILY HABITS

K4
TAKE A PLEDGE
(10 minutes)
Ask your students to write on the board one way in which they intend to reduce their classroom's energy use to help capture Waste-A-Watt!

THURSDAY

L1 L2
LIGHTING DAILY HABITS

D1 D2
DEVICES DAILY HABITS

HC1 HC2
HEATING/COOLING DAILY HABITS

K5
HOME ENERGY-SAVING VIDEO
(3 minutes)

FRIDAY

ACTIVIST FRIDAY: SPREAD THE WORD

A1
POSTER CONTEST
(45 minutes)

A2
HOME GAME
(20 minutes)

Help your students take a picture of the current dashboard and send it to: *info@efargo.org*

Then, help them start a new dashboard for next week!

All the activities are listed in the STUDENT GUIDE.

WEEK 2 - LIGHTING

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
KICK-OFF K6 SET GOALS (10 minutes) Help your students set daily goals on the dashboard. Encourage them to aim for a larger goal during the second week. LEARNING ACTIVITY K7 FOOT-CANDLE LIGHT METERS (30 minutes) Use the light meter given in the box.	**PLAY** L3 LIGHTING ENERGY PATROL (5 minutes) L4 LIGHT BULB VIDEO (2 minutes) L5 LIGHT IT RIGHT! GAME (15 minutes)	L6 MISSION LIGHTING GAME (5 minutes) L7 LIGHT BLACKOUT HOUR (1 hour)	L8 LIGHT POWER DAY (all day) L9 CLASSROOM DESIGN (30 minutes) L10 LIGHT BULB COMPARISON (30 minutes)	**ACTIVIST FRIDAY:** SPREAD THE WORD A3 ADOPT A HALLWAY (all day) A4 MINIMIZE LIGHTING (30 minutes) Help your students take a picture of the current dashboard and send it to: *info@efargo.org* Then, help them start a new dashboard!
L1 L2	L1 L2	L1 L2	L1 L2	L1 L2
D1 D2	D1 D2	D1 D2	D1 D2	D1 D2
HC1 HC2	HC1 HC2	HC1 HC2	HC1 HC2	HC1 HC2

DAILY HABITS

All the activities are listed in the STUDENT GUIDE.

WEEK 3 - DEVICES

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
KICK-OFF K6 SET GOALS (10 minutes) Help your students set daily goals on the dashboard. Encourage them to aim for a larger goal during the next week. LEARNING ACTIVITY K8 KILL-A-WATT METERS (45 minutes)	D3 DEVICES ENERGY PATROL (5 minutes) D4 SCHOOL UNPLUG (1 minute) D5 ENERGY STREET, ENERGY CONSERVATION GAME (15 minutes)	**PLAY** D6 DEVICES BLACKOUT HOUR (1 hour) D7 NIGHT UNPLUG (5 minutes)	D8 VENDING MACHINE UNPLUG (5 minutes) D9 PHANTOM WASTE (10 minutes) D10 ESTIMATING HOME ENERGY (30 minutes)	**ACTIVIST FRIDAY:** SPREAD THE WORD A5 COLD LUNCH DAY (15 minutes) A6 SPREAD YOUR DAILY HABITS! (5 minutes) Help your students take a picture of the current dashboard and send it to: *info@efargo.org* Then, help them start a new dashboard!
L1 L2	L1 L2	L1 L2	L1 L2	L1 L2
D1 D2	D1 D2	D1 D2	D1 D2	D1 D2
HC1 HC2	HC1 HC2	HC1 HC2	HC1 HC2	HC1 HC2

DAILY HABITS

All the activities are listed in the STUDENT GUIDE.

WEEK 4 - HEATING/COOLING

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
KICK-OFF SET GOALS (10 minutes) Help your students set daily goals on the dashboard. LEARNING ACTIVITY K8 VIRTUAL REALITY (15 minutes) *AND/OR* K9 ONLINE 360 (15 minutes)	**PLAY** HC3 SHADING ENERGY PATROL (5 minutes) HC4 THERMOSTATS (5 minutes) HC5 SCHOOL THERMOSTAT (5 minutes)	HC6 AFTER-HOURS THERMOSTAT (5 minutes) HC7 SOLAR DEFENDERS GAME (10 minutes)	HC8 ENERGY SOURCE (5 minutes) HC9 SOLAR COOKERS (30 minutes) HC10 INSULATION EXPERIMENTS (30 minutes)	**ACTIVIST FRIDAY:** SPREAD THE WORD A7 REDUCE SOLAR HEAT GAIN (30 minutes) A8 CLASSROOM AWARENESS (30 minutes) Help your students take a picture of the last dashboard and send it to: *info@efargo.org*
L1 L2	L1 L2	L1 L2	L1 L2	L1 L2
D1 D2	D1 D2	D1 D2	D1 D2	D1 D2
HC1 HC2	HC1 HC2	HC1 HC2	HC1 HC2	HC1 HC2

DAILY HABITS

All the activities are listed in the STUDENT GUIDE.

FOOT-CANDLE LIGHT METERS

K7

Footcandles are units of illuminance from a uniform source of light projected on a one square foot surface. Using the given light meter (make sure the units are set to fc):

1. Work with your students to measure lighting levels in different parts of the school.
2. Compare the measured values with these recommended lighting levels:

Classroom 30 fc
Auditorium 7.5 fc
Corridor 25 fc
Rest room 18 fc

3. Bring to their attention that spaces are usually more illuminated than they need to be. Decreasing that lighting will save energy!

KILL-A-WATT METERS

K8

This activity will help students learn about the **amount of energy being used by a device when it is turned on and off** and the **yearly cost associated with it**. Kill-a-Watt Meters are devices that can measure, monitor, and assess how efficient your appliances are.

1. Use a Kill-a-Watt Meter given in the box and plug it into an outlet.
2. Plug a device into the meter and demonstrate to students the difference in electricity consumption between devices when they are on (in use), off (unplugged), or in stand-by mode (plugged but not in use).
3. Let students write down how much energy (in watts) is being used by different devices.
4. Then help them calculate how much that device costs per month through the steps mentioned on this page: *bit.ly/2H62O9G*
5. Encourage students to go around the classroom and measure more devices.

VIRTUAL REALITY

K9

Help your students scan the QR code with a mobile device and place it in the designated spot in the VR glasses.

CLASSROOM DESIGN

L9

Help your students re-arrange the desks and chairs to maximize natural day-lighting. They can orient their desks toward windows to minimize the use of lighting throughout the day. After your design rearrangement, try to switch off a few lights to show students the direct energy saving result of re-designing their classroom. Make sure desks are not blocking heat vents.

LIGHT BULB COMPARISON

L10

This activity is intended to help students compare incandescent, CFL, and LED bulbs along with their respective energy use, costs, and carbon emissions.

1. Open this link: *https://climatekids.nasa.gov/light-bulbs/*
2. Project it for the students on the board or make print outs for them.
3. Read through it with them to help them learn about the different types of light bulbs.
4. Encourage the students to go around the room/school and identify the different types of light bulbs used.

ESTIMATING HOME ENERGY

D10

Following the same steps of the Kill-A-Watt Meters Activity, help students estimate how much energy they might be using at home and how much that is costing them per month, year:

1. Use a Kill-a-Watt Meter given in the box and plug it into an outlet.
2. Plug a device into the meter and demonstrate to students the difference in electricity consumption between devices when they are on (in use), off (unplugged), or in stand-by mode (plugged but not in use).
3. Let students write down how much energy (in watts) is being used by different devices.
4. Then help them calculate how much that device costs per month through the steps mentioned on this page: *bit.ly/2H62O9G*
5. Encourage students to go around the classroom and measure more devices.

SOLAR COOKERS

HC9

This activity will teach your students about the power of solar energy and the ease with which we can make direct use of it. Solar cookers are devices that use the energy of direct sunlight to heat its contents. Making solar cookers can be a great outdoor activity for your students!

1. Follow the steps in this video tutorial to make a solar cooker: *bit.ly/2DYr9eK*
2. Encourage the students to heat a snack in their solar cookers so they could see that it actually works!

INSULATION EXPERIMENTS

HC10

This activity will allow students to investigate the insulating properties of different materials.

1. Start by using ice or hot water in a container wrapped by different materials (cloth, fabric, bubble wrap, etc).
2. Project this video for the classroom, which explains building insulation at home and ways in which students can improve their home's insulation performance: *bit.ly/2unNqDk*
3. After the video, ask students about how they can improve insulation in their classroom/school building.

POSTER CONTEST

A1

Help students create signs and posters that remind them and their classmates about energy saving actions. Hang these all around the school: in classrooms, rest rooms, gyms, etc. Teachers are encouraged to sketch and put up some posters too!

REDUCE SOLAR HEAT GAIN

A7

South building facades receive a lot of solar heat gain from the sun, which would require more a/c energy to offset the heat. Planting trees in front of these facades would provide shade in the warmer months and thus reduce solar heat gain.

1. Tell each student to sketch a tree on a paper.
2. Direct your students to parts of the school (this might be their own classroom) that receive solar heat gain.
3. Allow the students to hang up their tree sketches where they believe a tree would shade the building from the sun.

CLASSROOM AWARENESS

A8

Help your students prepare a quick verbal presentation that they will deliver to various classrooms within the school to educate them about the benefits of energy-saving daily habits and their roles in the Energy Challenge so far.


Next Generation
Science Standards

Next Generation Science Integration

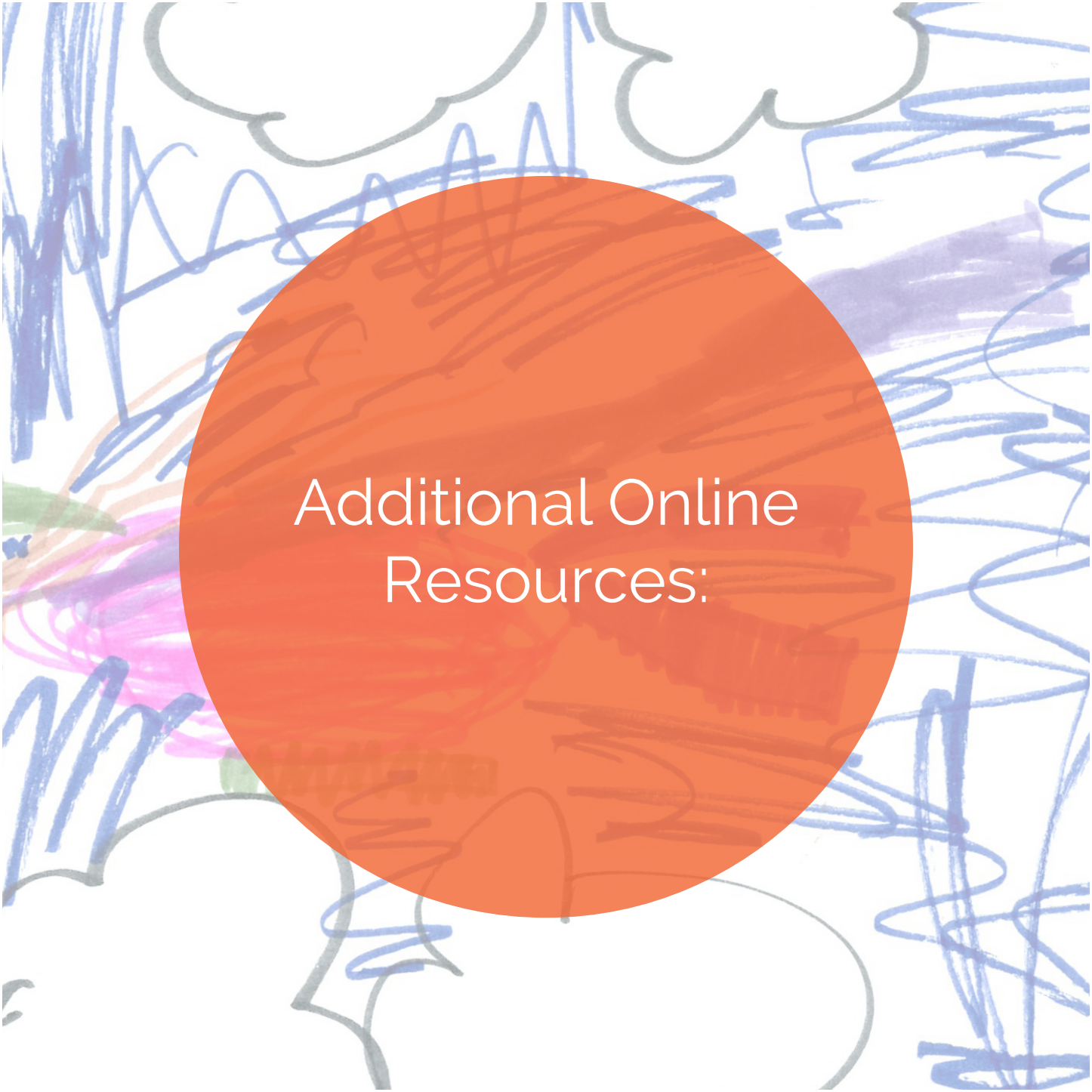
The efargo Energy Challenge integrates science learning standards to create a project-based learning experience for the schools.

included

closely related

Standards are arranged by disciplinary core ideas:

Fourth Grade	4-PS3	Energy
	4-PS4	Waves and Their Application in Technologies for Information Transfer
	4-LS1	From Molecules to Organisms: Structures and Processes
	4-ESS1	Earth's Place in the Universe
	4-ESS2	Earth's Systems
	4-ESS3	Earth and Human Activity
Fifth Grade	5-PS1	Matter and its Interactions
	5-PS2	Motion and Stability: Forces and Interactions
	5-PS3	Energy
	5-LS1	From Molecules to Organisms: Structures and Processes
	5-LS2	Ecosystems: Interactions, Energy, and Dynamics
	5-ESS1	Earth's Place in the Universe
	5-ESS2	Earth's Systems
	5-ESS3	Earth and Human Activity
	3-5-ETS1	Engineering Design



Additional Online Resources:

CITY OF FARGO MUNICIPAL ENERGY USE

Fargo Schools consume more than 30% of electricity used by the City of Fargo.

LOCAL LEARNING RESOURCES

Local actions and projects implementing energy reduction and energy conservation measures.

OTHER COMPETITIONS

References to regional and global competitions engaging the community in energy + resource reduction.

ENERGY-USE BREAKDOWN IN K12 SCHOOLS BY SOURCE

A break-down of energy-use in schools by energy sources, including heating, cooling, lighting, and office equipment. This helps direct efforts in order to maximize potential reduction impact.

TOP TEN NO-COST SCHOOL ENERGY SAVING TIPS

10 simple ways energy can be saved without incurring additional operating costs or investments. These actions are primarily focused on energy-awareness and energy-use planning.

TOP TEN LONG-TERM SCHOOL FACILITIES IMPROVEMENTS

10 ways that encourage thinking about different ways that energy is used in schools and on school-grounds. Their costs may vary but are relatively inexpensive and bring return on investment over time.

Check out the efargo page: *http://efargo.org/k12challenge4-0*