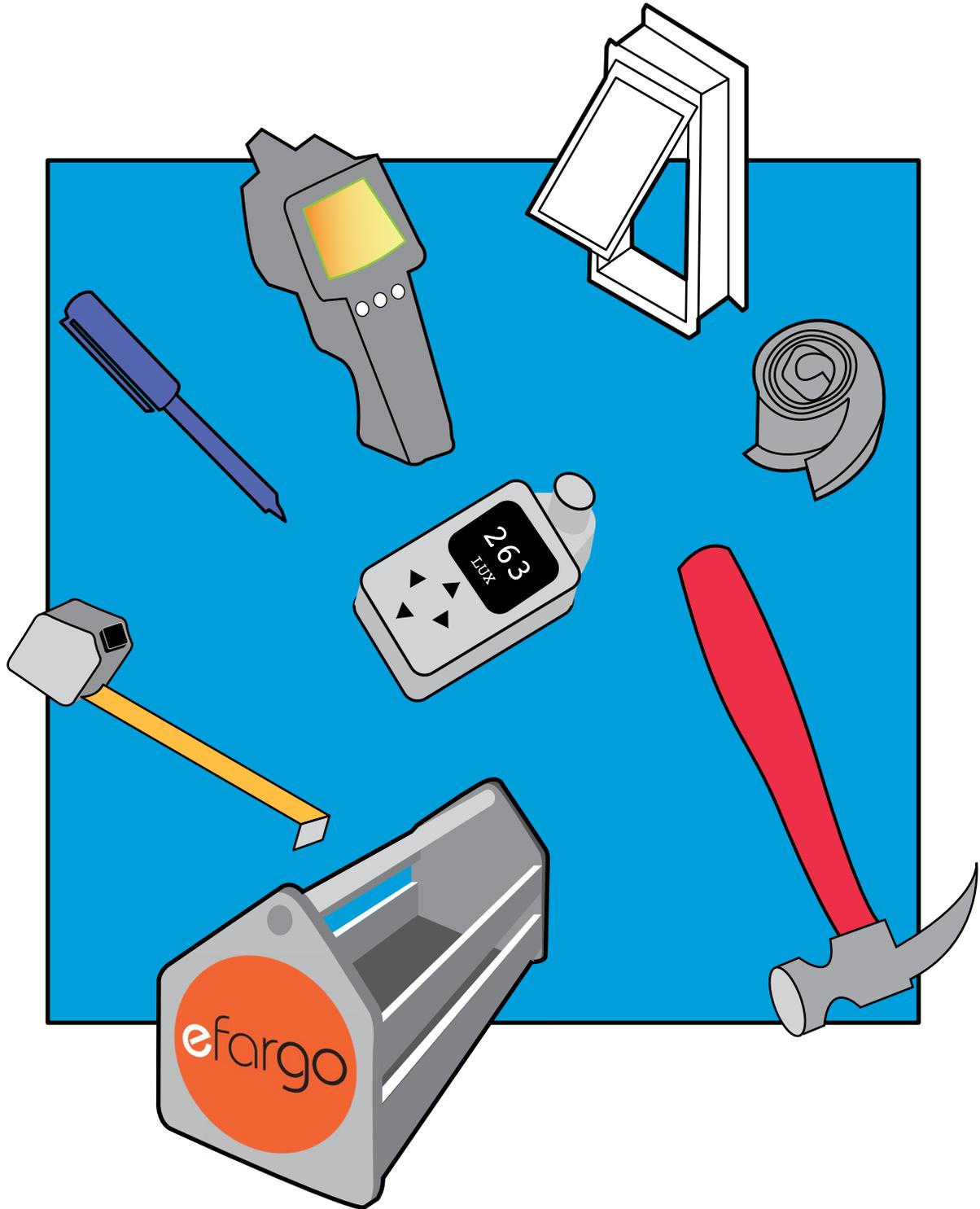


K - 1 2 ENERGY CHALLENGE



TOOLKIT

K-12 ENERGY
CHALLENGE



TOOLKIT

NOTE

efargo is a community-based, action-oriented, partnership between NDSU, the City of Fargo, Cass County Cooperative and Xcel Energy. This toolkit was developed to reduce energy use in municipal buildings. The K-12 Energy Challenge empowers the students, teachers, administrators and facility managers to reduce energy use in their school through educational projects and actions.

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.
© efargo 2015 www.efargo.org

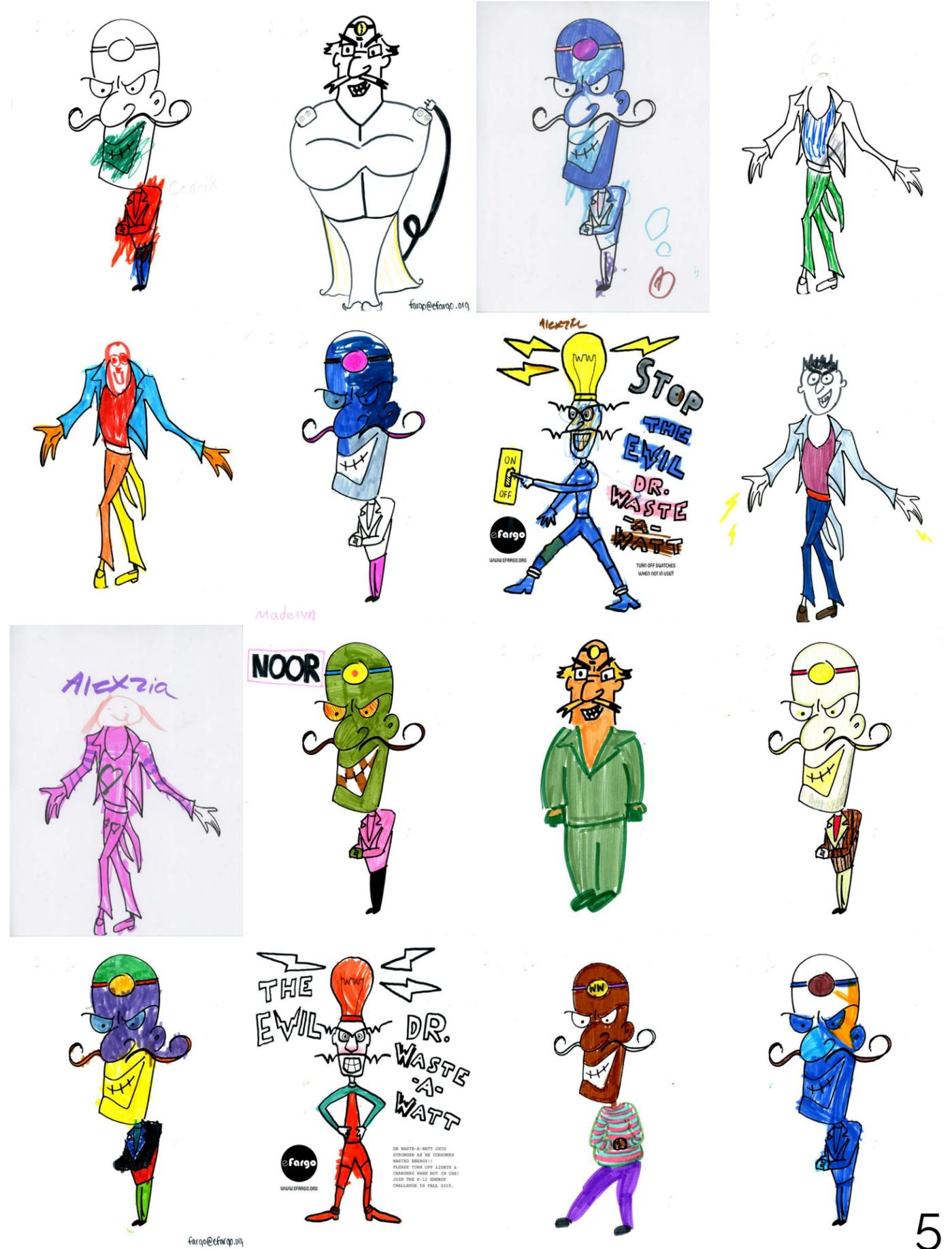


TABLE
OF
CONTENTS



Anusha

OVERVIEW

8 Introduction

10 Energy Use Summary

14 Waste-a-Watt

16 Proposed Timeline

NUTS &
BOLTS

18 Proposed Phases

24 School-Wide Events & Activities

27 Classroom/Club Events & Activities

32 Next Generation Standards

RESOURCES

35 Top Ten No-Cost Energy Saving Tips

39 Top Ten Long-term School Facilities Improvements

42 Similar Competitions

48 Local Learning Resources

INTRODUCTION

CHALLENGE All schools are invited to participate in a six-week energy-saving CHALLENGE organized by efargo to promote energy-efficiency and provide opportunities for the sustainability leaders of tomorrow. efargo challenges you to help defeat the evil Waste-a-Watt (see pg. 14) by reducing the amount of wasted energy in your school alongside your very own Energy Saving Superheroine/hero (see pg. 26).

EFARGO efargo is a City of Fargo and NDSU partnership created to enter the [Georgetown University Energy Prize Competition](#) to make cities more energy-efficient. Our goal is to reduce energy use throughout Fargo and a major piece of this is educating and empowering our children to contribute their creativity, knowledge, enthusiasm and actions to create a better future for our community.

- GOALS**
1. Educate K-12 students about the science of energy production, transmission and consumption and resulting impacts.
 2. Empower K-12 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 and work toward winning the Energy Prize.

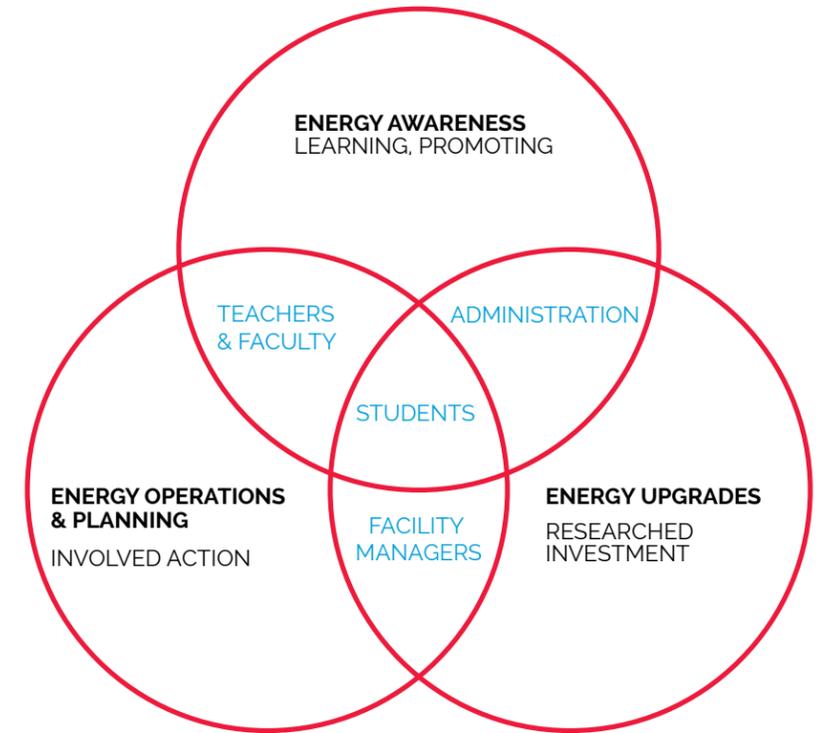
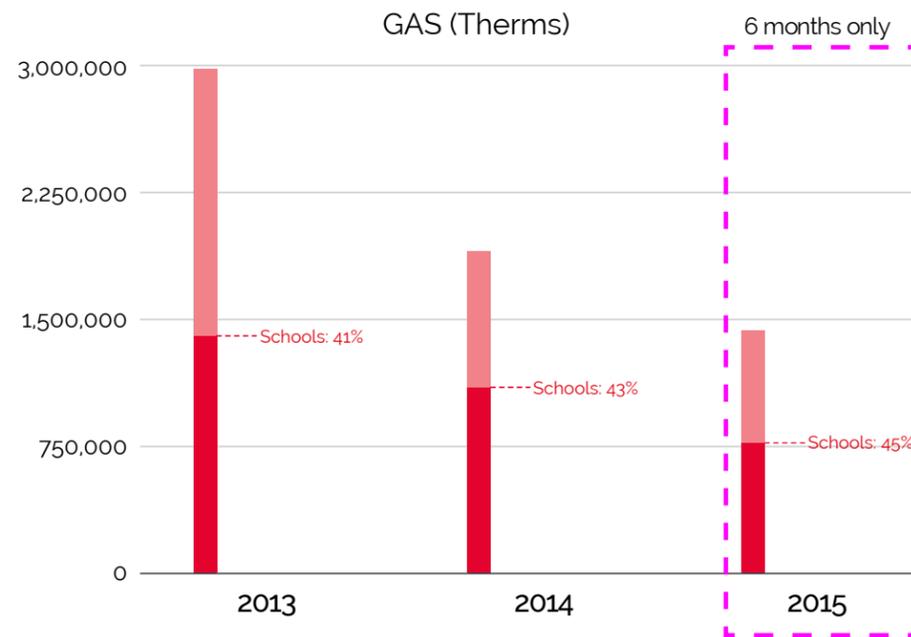
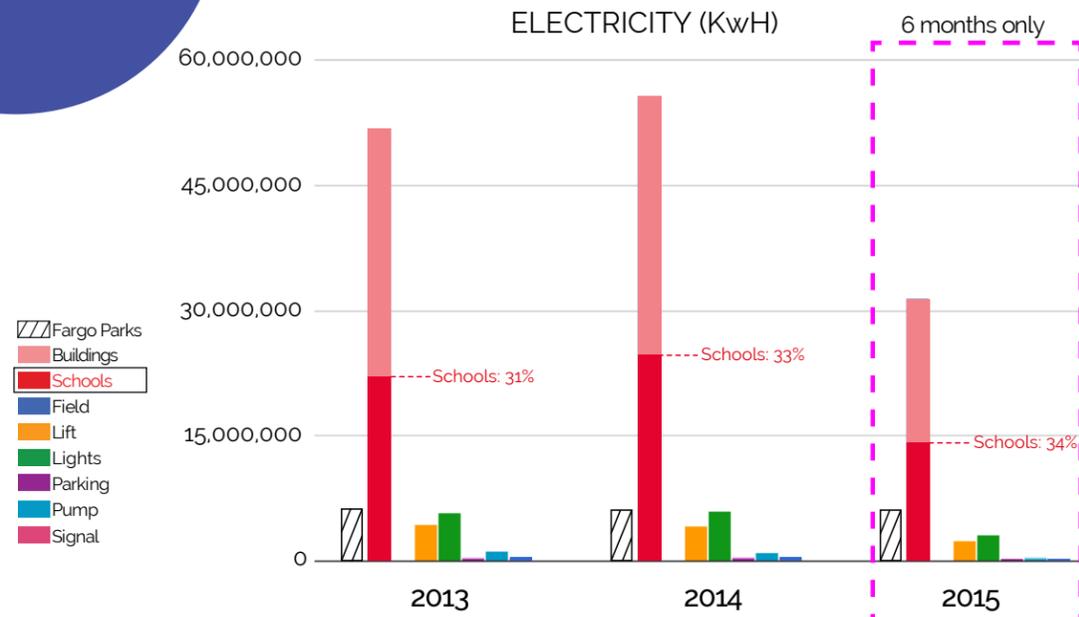


Diagram: According to the USGBC Powering Down Guide, successfully reducing energy in schools requires "three complementary avenues." Listed, they are 1. Awareness, 2. Operations and Planning and 3. Upgrades. Drawing on successful National K12 competitions, when students lead efforts and are partnered with teachers, faculty, facility managers and administration, impact and result can be lasting.

- TEAM**
1. School-based team (students, teachers, facilities managers and staff, principals, administrators)
 2. CHALLENGE events can be incorporated into a classroom activity or club activity. The important thing is for each school to have at least one [project champion](#) that is either a teacher, facility manager or administrator. We strongly encourage each school also having a [student champion](#).

- RECOGNITION** All participating schools shall receive recognition for their achievements at the end of the 6 week challenge.
1. Certificate to each school will show the amount of energy they saved over the competition period.
 2. Special recognition for student/staff/teachers showing exemplary leadership, nominated by the school.

CITY OF FARGO MUNICIPAL ENERGY USE



ELECTRIC & GAS USE IN SCHOOLS Fargo Schools constitute a major portion of Municipal energy use, consistently consuming more than 30% of electricity used by the City of Fargo. Out of the City of Fargo gas energy use, schools consistently account for more than 40 percent of expenditures. This high percentage of energy use gives us the opportunity to impact a large portion of energy used.

Energy Star Median	Fargo Schools Median	EUI (Usage per ft ²), Comparison to Energy Star Median	
58.2	64	Davies High School	31.84 (54%)
		Bennett Elementary	40.61 (70%)
		Horace Mann Roosevelt Elementary	42.56 (73%)
		Clara Barton Hawthorne Elementary	45.17 (77%)
		Discovery Middle School	46.09 (79%)
		Washington Elementary	51.43 (88%)
		Carl Ben Eielson Middle School	59.07 (101%)
		Lincoln Elementary	59.69 (102%)
		Kennedy Elementary	60.10 (103%)
		Jefferson Elementary	64.00 (110%)
		Longfellow Elementary	65.19 (112%)
		Woodrow Wilson High School	65.34 (112%)
		Ben Franklin Middle School	70.20 (120%)
		Centennial Elementary	72.10 (124%)
		Lewis and Clark Elementary	72.18 (124%)
South High School	76.79 (132%)		
McKinley Elementary	88.94 (153%)		
Madison Elementary	113.74 (195%)		
North High School	127.15 (218%)		

*As a new school, Ed Clapp was excluded from EUI calculations due to lack of baseline use.

ENERGY USE COMPARISON Energy Use Index is a way to look at how much energy is used in relation to a buildings square footage. The Energy Star Median figure represents School Buildings throughout the United States. Comparing the National Median with that of Fargo School reveals that overall Fargo schools compare favorably to the national median. Some of the schools (shown in green) are considerably below national median while some are significantly above (shown in red). The Fargo schools facilities administration has created a strategic approach by completing a comprehensive assessment which has resulted in a 10-year plan to make improvements to structures and systems in all schools to create significant improvements in efficiency.

Now it is up to the occupants of each to take on the challenge and do their part to lower energy use in each school by preventing energy waste.

Every school presents a unique opportunity to learn about energy production, consumption, and waste. Being able to compare participating schools efforts and results will help all of us learn and take action!

ADDITIONAL DATA: Visit www.efargo.org/k12challenge for West Fargo Schools and Updates.

NOOR



ALEXIA



WWW.EFARGO.ORG

TURN OFF SWITCHES WHEN NOT IN USE!!

WASTE-A-WATT

PLOT 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 this madness!

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 stop Waste-A-Watt dead in his tracks before he conquers Fargo. As we waste less, he becomes weak. Right now he may be powerful from our past wasted energy, but we can be even stronger when we work together!

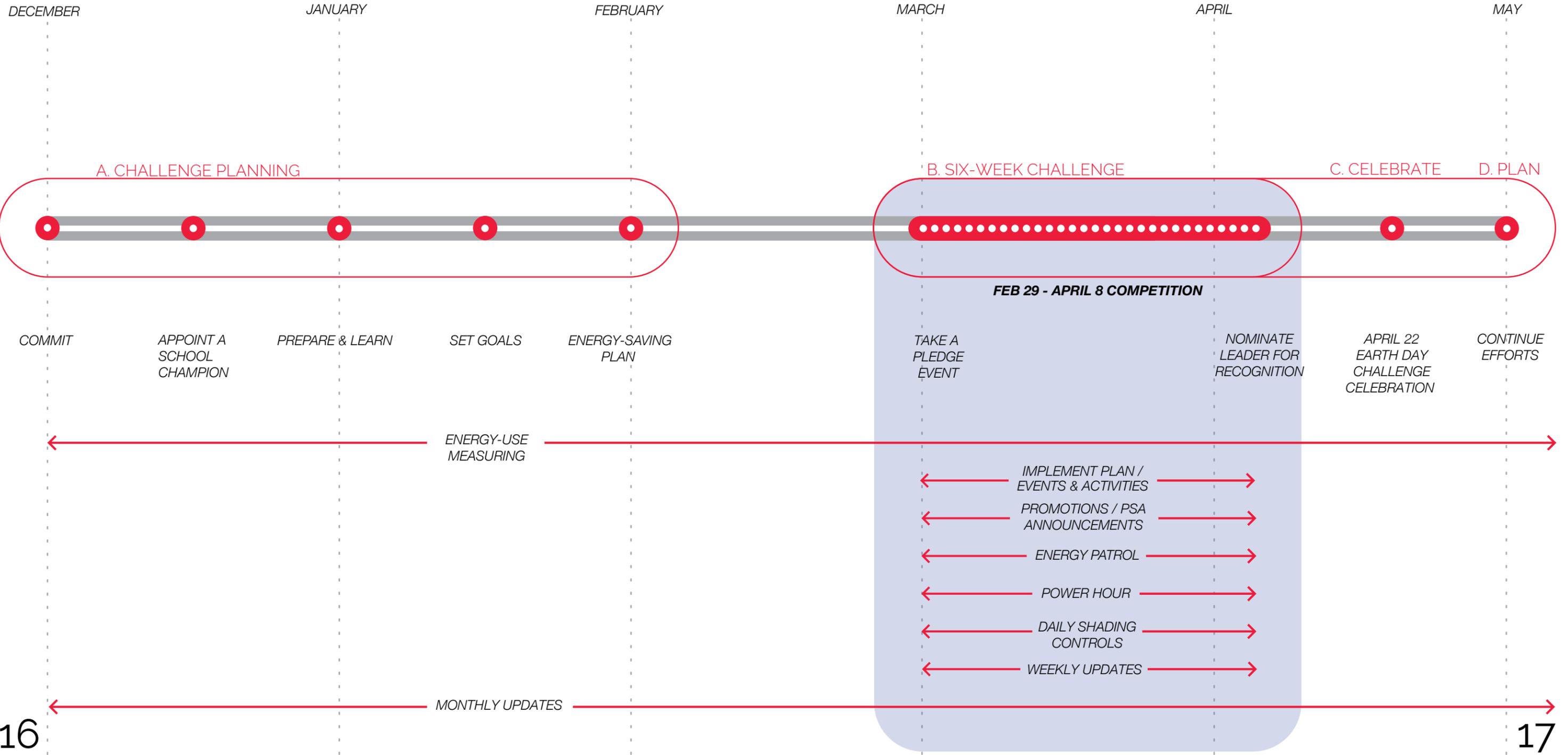
All we need to do is make sure that we are not wasting energy. It can be as simple as turning the lights off when leaving a room or unplugging unused electronics.

efargo is inviting all schools to help defend the City of Fargo and surrounding community and defeat the evil Waste-a-Watt. Create and join forces with your school's very own Energy Superheroine/hero to become an energy-saving school and prevent Waste-a-Watt from conquering our city! We have the power to make a big change!

Opposite: DrawingWaste-A-Watt which is a combination of drawings by participants of Party for the Planet hosted by the Red River Zoo April 24, 2015.



CHALLENGE PHASES & MILESTONES



INTRO

Participants will challenge their schools and others to reach the greatest possible reduction in energy-use. To that end, students and designated energy champions shall plan and design their own activity package to prevent energy waste. Suggested events and activities are provided by efargo. Teams will keep efargo updated on a weekly basis by letting us know what activities you did via email, along with meter readings. Please email us a short description and photos and videos of your events at k12challenge@efargo.org.

WINTER 2015-2016

1. Orientation for teachers, administrators and teams.
2. Presentation based on Burnsville Public School "Battle of the Buildings" competition which reduced overall energy-use in the school district by 9%, and in Sioux Trail Elementary by 29%!
3. Participating schools may take advantage of local and online learning resources (see pg. 50) about specific energy monitoring methods and actions. These will further the team's knowledge about aspects of sustainability and demonstrate strategies for conservation. Based upon demand, efargo may be able to arrange workshops by local professionals or NDSU students. Please contact us if you are interested in such a workshop being offered.
4. Open Q&A advisory workshops with efargo to brainstorm strategies for conservation.

A. CHALLENGE PLANNING

DECEMBER 2015 1. MAKE A COMMITMENT

Form a planning committee comprised of students, teachers and staff all dedicated to the goal of energy conservation. Collaborate with your team to determine a meeting schedule and location that can be consistent throughout the school year. Make sure that everybody agrees upon and understands the roles and responsibilities of each team member. In-school teams should be diverse and include at least one student, teacher, staff member and facility manager. Supplementary team partnerships

may be implemented between students and parents or sponsors for events and other student-led initiatives.

DECEMBER 2015 2. APPOINT A SCHOOL CHAMPION

Every school should have a designated student, teacher, facility manager, or administrator that can help to promote, organize, and lead their schools efforts in the CHALLENGE and act as a liaison between the school and efargo. Champion will be responsible for providing regular weekly updates to efargo team during competition period.

JANUARY 2016 3. PREPARE AND LEARN

Get involved in the efargo preparation events to prepare and plan for the CHALLENGE period. Please contact efargo team to discuss your idea and let us know how we may help you prepare.

JANUARY 2016 4. SET GOALS

Understand how energy is currently being used within your facility and set reasonable goals for the CHALLENGE period. We recommend to start with an early reduction goal of 5% with a longer term goal of reducing energy use by 20%.

FEBRUARY 2016 5. CREATE AN ENERGY-SAVING PLAN

Begin planning events for saving energy. Remember that some events work best as whole-school initiatives and others work best when incorporated into the classroom (refer to the Example Events and Activities section p. 28). It's important to have a steady flow of events or classroom activities planned throughout the Challenge period to keep students motivated and interested.

B. SIX-WEEK CHALLENGE

FEB 29-MAR 4 **1. TAKE A PLEDGE EVENT**

Hold a "Take the Pledge" event to get the whole school involved in your energy savings plan. Ask each person to write on a whiteboard one way in which they intend to reduce their energy consumption to help defeat Dr. Waste-a-Watt. This may be a great opportunity to introduce your school's Energy Conservation Superheroine/hero (see pg. 26). Have somebody dress up as your Superheroine/hero and have students take pictures with them, bringing attention to energy while having fun!

FEB 29-APRIL 8 **2. IMPLEMENT SAVINGS PLAN WITH EVENTS & ACTIVITIES**

Throughout the competition period, implement a variety of events or activities to achieve energy savings. Ideas for grade appropriate events/activities can be found in the Events and Activities section (see pgs. 24 and 28).

3. ENERGY-USE MEASURING

During the CHALLENGE energy will be measured and compared against a baseline of prior use. Energy-use must be tracked by the Champion by working with your facility manager to record the weekly energy use, and submitting it to efargo (k12challenge@efargo.org) On our K12 Challenge portal of the website there will be a dashboard displaying how your school ranks in comparison to other Fargo schools in the race to reduce! Outside of the competition, energy-use summaries will be conducted monthly.

4. PROMOTE YOUR EVENTS /PSA ANNOUNCEMENTS

Begin to promote CHALLENGE in whatever way possible as a way to increase student involvement. We suggest using your Superheroine/hero as a way to capture student's attention. Make announcements and use your videos, posters, etc. to get the word out about how students can become involved.

5. ENERGY PATROL THROUGHOUT SCHOOL

Set-up a patrolling schedule where students or student groups will randomly double-check energy-use in classrooms or other areas within the school. If used as a gentle reminder, they can be a pleasant way to inform while reducing energy-use.

6. POWER HOUR

Have a "Power Hour" where the entire school turns off all lights and electronics for an hour of the day. Try to do this at a time when natural daylight will provide sufficient lighting levels. Teachers may continue with their normal lesson plan or arrange a special activity during this time. This could be a one-time or recurring

event that the school does every Friday during the CHALLENGE period.

7. DAILY SHADING CONTROLS

Properly using the shades at night to retain heat, and opening them during the day to allow warm sunshine can have a large affect on energy use. Develop a plan for operating the schools shading systems, and follow-up throughout the competition.

8. WEEKLY UPDATES

Have weekly announcements that inform students of their progress and help keep the school engaged in energy conservation. These may be posters, announcements over the intercom or on your school's weekly TV production. Take advantage of any resources you may have access to. Schools will be invited to post pictures and share stories about their events and energy conservation strategies on efargo portals and social media. Please email them weekly to the efargo team during the six-week CHALLENGE at k12challenge@efargo.org.

APRIL 4-8 **9. NOMINATE LEADER FOR RECOGNITION**

Each school may nominate a teacher, staff and/or students who have shown great leadership throughout the competition for special recognition.

C. CHALLENGE CELEBRATION

CELEBRATE & RECOGNIZE YOUR ACHIEVEMENTS

APRIL 22, 2016 EARTH DAY Host a celebration for the entire school that celebrates your accomplishments and encourages students and staff to continue their efforts. A member of the efargo team will present your school with a certificate of achievement. Nominated individuals who were especially influential in your school's energy conservation mission may also be recognized.

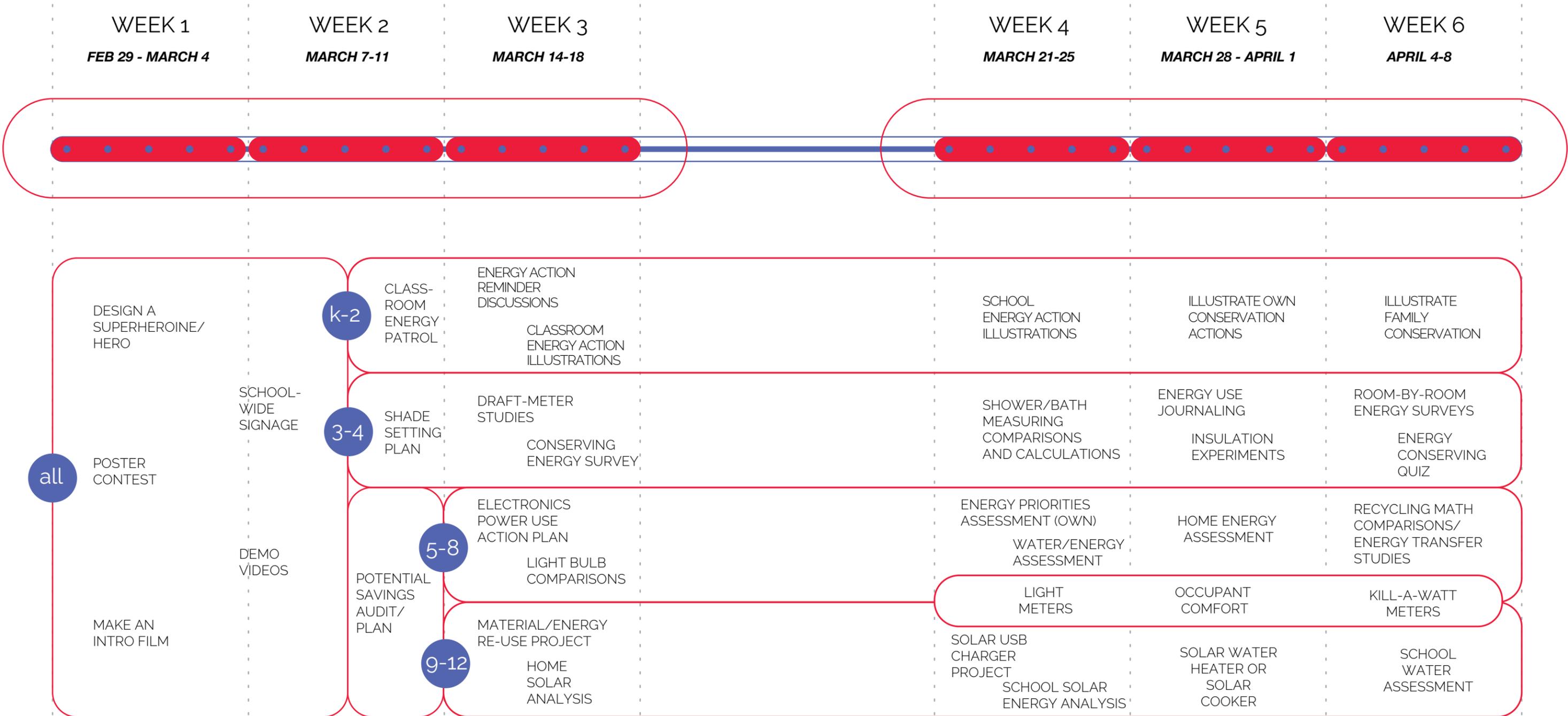
D. PLAN TO CONTINUE EFFORTS

MEASURE SUCCESS & PLAN FOR NEXT YEAR

MAY Ask students to create ideas for continuing the momentum. How will efforts continue pick up the following year? What was most successful? What should be done differently next year? Who will be returning and what responsibilities should be passed on?



EXAMPLE
EVENTS
& ACTIVITIES
TIMELINE



SCHOOL-WIDE AND INDIVIDUAL EVENTS & ACTIVITIES

SCHOOL-WIDE EVENTS & ACTIVITIES

DESIGN A SUPERHEROINE/HERO

Have a "Design our Energy Conservation Superheroine/hero" contest to help design your school's Superheroine/hero. Come up with a catchy name and drawing of what this character may look like. Either have your planning committee organize an event or have each class design their own superheroines/heros. She/he may be assigned superpowers to battle the evil Waste-a-Watt! Have fun and use this to spark student interest in the CHALLENGE! Choose a winner and make a video showing how your school and Superheroine/hero plan to stop the evil Waste-a-Watt from taking over Fargo.

POSTER CONTEST

Hold an Energy Conservation Poster Contest to create signs for the school. Ask students to make a poster or signs that remind fellow students and staff to turn off the lights when leaving a room or unplug electronics that aren't being used. Once all posters have been collected, choose a winning design that will be hung up throughout the school. For elementary schools, you may instead decide to not make it a competition and hang up all of the posters. Students could also make posters to bring home and post them around their homes.

MAKE AN INTRO FILM

Media Debut or Film Festival: Each school will be invited to share a short film that introduces their school and Superheroine/hero in response to an eFargo Waste-a-Watt character sketch. Alternatively, a special school news edition could be created, or maybe even a comic book. The goal is to use current resources to introduce, raise awareness, and initiate the challenge. During kick-off week, videos shall be compiled and shared with all participating area schools.

SCHOOL-WIDE SIGNAGE

Have students create reminder signs which can be hung up throughout the classroom to remind students about ways in which they can be conserving energy.

DEMONSTRATION VIDEOS

Have students create videos demonstrating ways in which energy can be saved within your school. Share these videos with other students so that everybody can become more aware of ways in which they can conserve energy. These could take the form of a promotion, a Public Service Announcement, or another creative approach related to demonstration.

EXAMPLE CLASSROOM EVENTS & ACTIVITIES

CLASSROOM EVENTS & ACTIVITIES

CLASSROOM ENERGY PATROL

Create an Energy Patrol group that ensures that lights and monitors are turned off when not in use.

SHADE SETTING PLAN

Properly using the shades at night to retain heat, and opening them during the day to allow warm sunshine can have a large affect on energy use. Develop a plan for operating the schools shading systems, and follow-up throughout the competition. The Classroom Energy Patrol could potentially perform the shade setting actions.

POTENTIAL SAVINGS AUDIT, PLAN

Ask students to perform a potential savings audit on different pieces of equipment throughout the building (lights, computers, faucets, HVAC, vending machine, etc.). Start by calculating current energy usage of this equipment, and then identify energy efficient alternatives and calculate their energy use. Students can also look into the payback period and total savings over the lifespan of the new equipment. Each student can prepare a short presentation about their findings to present to your school's administration. It has potential to influence future equipment purchase decisions.

ENERGY ACTION REMINDERS

Discuss with students the different energy action items as a way to reinforce weekly CHALLENGE plans.

ENERGY ACTION ILLUSTRATIONS

What does energy reduction look like? Encourage student creativity in thinking this through in the act of illustrating a part of their daily life or another aspect of energy use.

DRAFT-METERS

Have students determine the areas where air is being supplied to the building and also where air is escaping the building (door, windows, etc.). "Draft-meters" can be made by attaching string or ribbon to the top of a pencil. This activity will show students where energy is being wasted in the building due to heat loss. Have students brainstorm solutions for these problem areas within the school.

CONSERVING ENERGY SURVEY

Conduct surveys that ask students to consider their own energy use. Gather data and report findings in a visually compelling and engaging way.

ELECTRONICS-USE ACTION PLAN Plug load from devices and electronics can account for twenty percent of electricity use in schools. What electronics are used in the school? How can they be monitored and used most efficiently? Take advantage of computers sleep options, and shut them down after a certain time period. Figure out a way to consistently power-down for nights and weekends.

LIGHT BULB COMPARISONS Compare incandescent, CFL, and LED bulbs along with their respective lighting values, heat output, energy use, costs, longevity and carbon emissions. What light bulbs are used in different areas of the school? This activity would pair great with one measuring light levels in rooms, while learning about optimum lighting for different activities and how to maximize natural day-lighting.

MATERIAL/ENERGY RE-USE PROJECT Conduct a project to measure embodied energy of different materials. Find creative ways to re-use existing materials, and create a report explaining how waste-energy was prevented through material sourcing/choices.

RECYCLING COMPARISONS What happens to energy when a material is recycled into a different use or form?

HOME SOLAR ANALYSIS What potential does your home have for using solar energy? Conduct a thorough investigation that proposes a robust photovoltaic system for powering your homes energy.

SCHOOL ENERGY ACTION ILLUSTRATIONS What does energy use look like at a larger scale? How do others and the school itself interact with energy? What systems are in place that use energy?

SHOWER/BATH COMPARISONS Determine how to measure the difference in water usage in both an average shower and bath. This can involve real-life measurements or calculations. How much energy can be saved with the more efficient option? What else can be done to reduce energy used with water in school and at home?

ENERGY PRIORITIES ASSESSMENT What are your own energy priorities? What challenges are associated with this assessment? Opportunities?

WATER/ENERGY ASSESSMENT Assess your own home water use or that of the schools. What are the associated systems? In what ways is energy used? How does water compare with the overall of home/school energy usage? What measures could be taken to reduce water energy use? How might a water energy use plan look?

LIGHT METERS Use light-meters from your local library to measure lighting levels; consider optimal lighting levels, and determine a plan for adjusting the light to match optimal functional use. Plan energy-use reductions with lighting. Another exercise could be to design a classroom to be lit naturally.

SOLAR USB CHARGER PROJECT Design and build a solar-powered USB charger. Alternate may be designing a system to capture energy from a bicycle. How would regular use affect plug-load?

SCHOOL SOLAR-ENERGY ANALYSIS Research solar energy and systems and conduct a study on your school detailing how much solar energy would be required to reduce non-renewable energy use by 5, 10, 20 and 50 percent. Provide cost/benefit analysis and report findings.

ILLUSTRATE OWN CONSERVATION ACTIONS Imagine the ways in which you can conserve energy-use in your daily life. Create a series of sketches showing what this looks like.

ENERGY-USE JOURNALING Keep a journal recording when you use energy, for how long, and how often. This will provide the basis for finding ways to eliminate energy waste.

INSULATION EXPERIMENTS Create an experiment by which materials can be investigated for their insulating properties. Either use ice or hot water in a container wrapped by the different materials. By measuring change of temperature over time, what can be revealed about a materials inherent properties? How does this relate to our climate region?

HOME ENERGY ASSESSMENT

Conduct a thorough investigation of how your home uses energy. What systems are in place? What are the seasonal and yearly use trends? What appliances use the most energy?

OCCUPANT COMFORT

Have students conduct an experiment to measure occupant comfort at different lighting levels. Start by having all of the lights in the room on, and ask student to complete a series of tasks including reading, writing, drawing etc. Slowly begin to turn off different banks of lights and ask students to complete the same tasks at each level. After students have completed the tasks with all lights off, ask them which lighting level was easiest and most difficult to work in. Pair this activity with the use of light meters, which measure the amount of light in lumens. De-lamping is a significant, immediate action that could result from this activity.

KILL-A-WATT METERS

Rent Kill-a-Watt Meters from your local library or contact us for information on obtaining them (k12Challenge@efargo.org). Measure the amount of electricity is being used by electronics when turned on and off. You may be surprised by the amount of energy being used even when in standby mode. Students can use this information to determine where vampire loads exist (energy being used when in the off position) and where power-strips should be used.

SOLAR COOKERS

Have student create solar cookers to learn about the power of solar energy. Students will create a dome shaped with cardboard that is covered in a reflective surface, and then attach a stick at the very center. When faced towards the sun, solar rays will bounce off of the reflective surface and hit the stick at the center providing a significant amount of heat. On a nice day, take students outside to test out their solar cookers for a cookout!

ILLUSTRATE FAMILY CONSERVATION

Encourage students to think about energy in relation to their own home. What does family energy conservation look like?

ROOM-BY-ROOM ENERGY SURVEYS

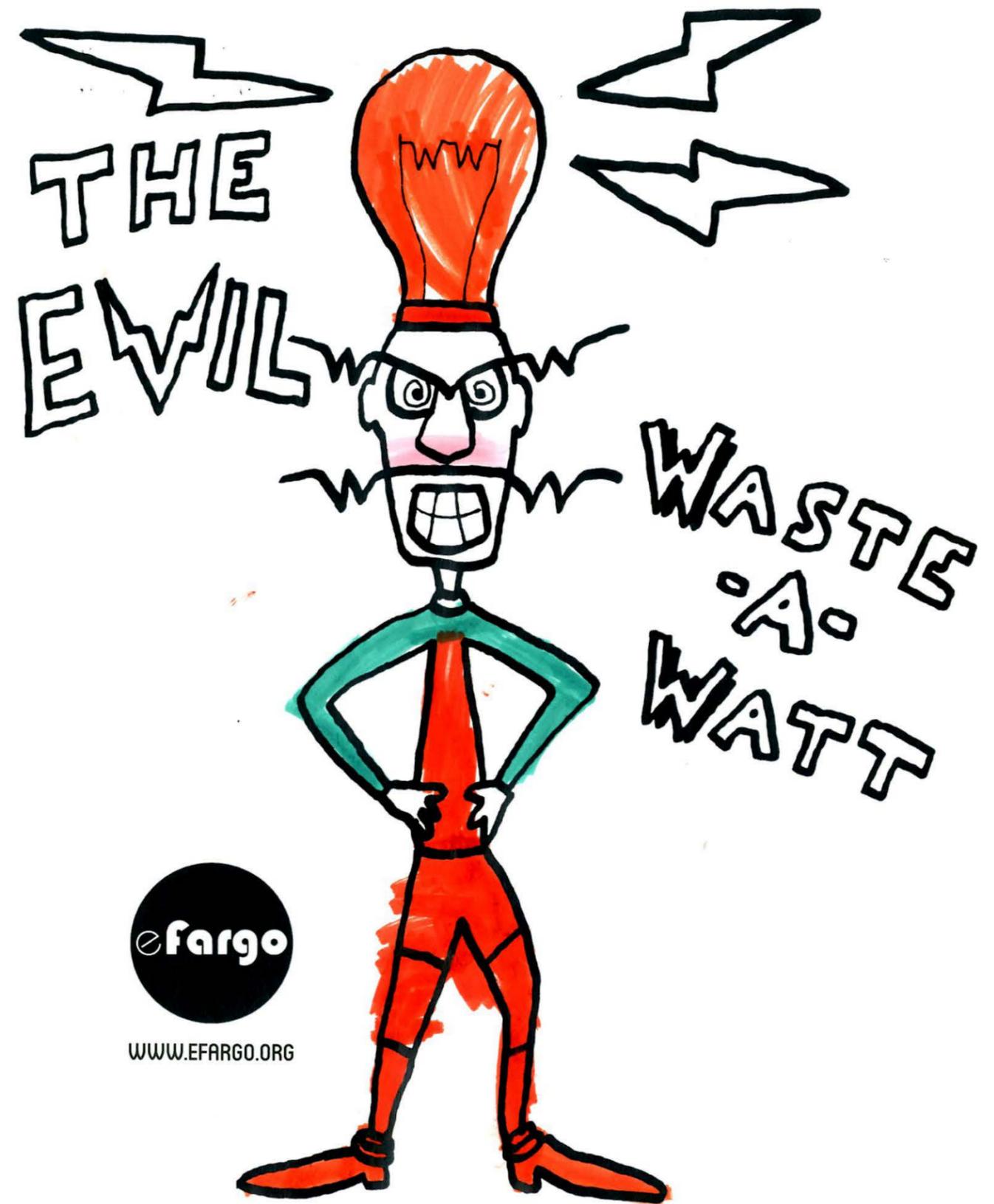
Take an inventory of a series of rooms either at school or at home, considering how energy is used and how the elements within the room affect different properties and behaviors of energy.

ENERGY CONSERVATION QUIZ

Test knowledge on energy conservation with a quiz.

UPDATED LIST ONLINE:

Visit www.efargo.org/k12challenge/activities for most recent list and additional details.





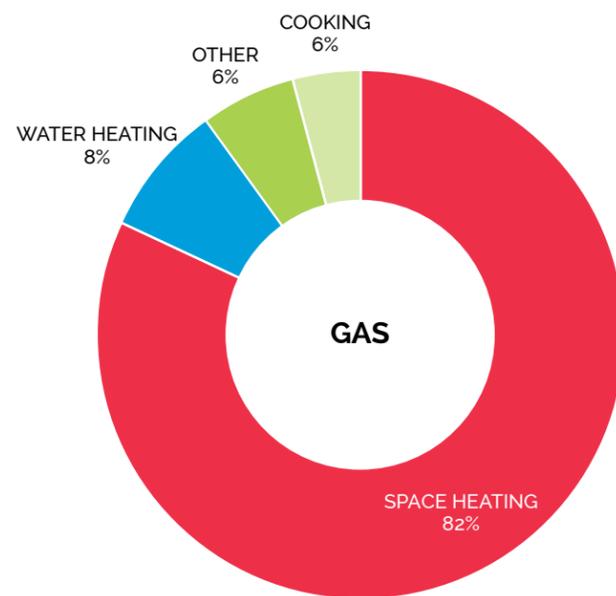
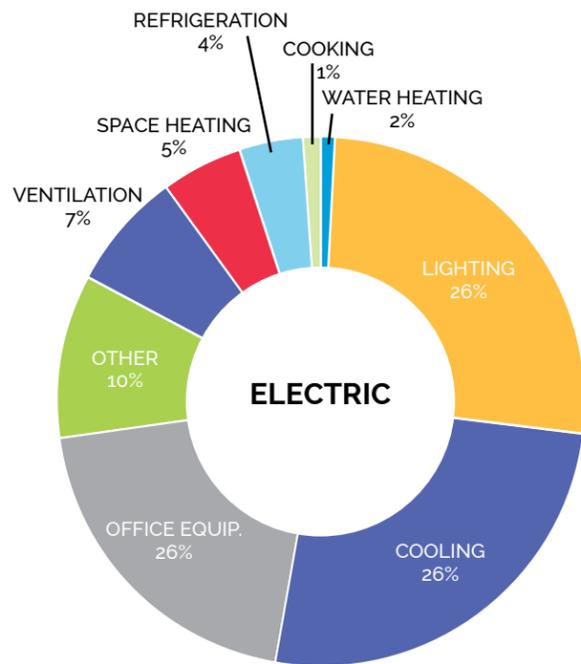
NEXT GENERATION SCIENCE INTEGRATION

- included
- closely relates to overall

Kindergarten	K-PS2	Motion and Stability: Forces and Interactions
	K-PS3	Energy
	K-LS1	
	K-ESS2	Earth's Systems
First Grade	K-ESS3	Earth and Human Activity
	1-PS4	Waves and their Applications in Technologies for Information Transfer
	1-LS1	From Molecules to Organisms: Structures and Processes
	1-LS3	Heredity: Inheritance and the Variation of Traits
Second Grade	1-ESS1	Earth's Place in the Universe
	2-PS1	Matter and its Interactions
	2-LS2	Ecosystems: Interactions, Energy, and Dynamics
	2-LS4	Biological Evolution: Unity and Diversity
	2-ESS1	Earth's Place in the Universe
	2-ESS2	Earth's Systems
Third Grade	K-2-ETS1	Engineering Design
	3-PS2	Motion and Stability: Forces and Interactions
	3-LS1	From Molecules to Organisms: Structures and Processes
	3-LS2	Ecosystems: Interactions, Energy and Dynamics
	3-LS3	Heredity: Inheritance and Variation of Traits
	3-LS4	Biological Evolution: Unity and Diversity
	3-ESS2	Earth's Systems
	3-ESS3	Earth and Human Activity
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
Physical Sciences	5-ESS2	Earth's Systems
	5-ESS3	Earth and Human Activity
	3-5-ETS1	Engineering Design
	MS-PS1	Matter and its Interactions
	MS-PS2	Motion and Stability: Forces and Interactions
	MS-PS3	Energy
	MS-PS4	Waves and Their Applications in Technologies for Information Transfer
	HS-PS1	Matter and its Interactions
	HS-PS2	Motion and Stability: Forces and Interactions
	HS-PS3	Energy
Life Sciences	HS-PS4	Waves and Their Applications in Technologies for Information Transfer
	MS-LS1	From Molecules to Organisms: Structure and Processes
	MS-LS2	Ecosystems: Interactions, Energy, and Dynamics
	MS-LS3	Heredity: Inheritance and Variation of Traits
	MS-LS4	Biological Evolution: Unity and Diversity
	HS-LS1	From Molecules to Organisms: Structures and Processes
	HS-LS2	Ecosystems: Interactions, Energy, and Dynamics
	HS-LS3	Heredity: Inheritance and Variation of Traits
Earth and Space Sciences	HS-LS4	Biological Evolution: Unity and Diversity
	MS-ESS1	Earth's Place in the Universe
	MS-ESS2	Earth's Systems
	MS-ESS3	Earth and Human Activity
	HS-ESS1	Earth's Place in the Universe
	HS-ESS2	Earth's Systems
	HS-ESS3	Earth and Human Activity
Engineering, Technology and Applications of Science	MS-ETS1	Engineering Design
	HS-ETS1	Engineering Design

ENERGY-USE BREAKDOWN IN K12 SCHOOLS BY SOURCE



Heating, Cooling, Lighting and Office Equipment accounts for most of the energy used in K12 schools. Understanding this may help direct efforts in order to maximize potential reduction impact.

Shown above is a break-down of energy-use in schools by energy source, based on National averages. Within categories powered by electricity, it is apparent that reducing energy use of computers will have an affect on 26 percent of electric usage. Similarly, reducing energy used in space heating will affect 82 percent of all natural gas usage. We recommend acting on areas that use the most energy first.

www.energystar.gov/sites/default/files/buildings/tools/EPA_BUM_CH10_Schools.pdf

TOP TEN NO-COST SCHOOL ENERGY SAVING TIPS

	ACTION	CURRENT USE
1	shading devices	
2	close openings	
3	special-use rooms	34% gas 5% elec.
4	clear vented areas	
5	HVAC settings	
6	sleep mode on	26% elec.
7	off for holidays	
8	turn off lights	26% elec.
9	use natural daylight	
10	reduce water-heater temp on wknds	8% gas 2% elec.

Primarily focused on energy-awareness and energy-use planning, the strategies above describe simple ways energy can be saved without incurring additional operating costs or investments. The ten tips are listed along with the percentage of energy use they affect. For example, turning off unused lights affects electricity use, which for lighting averages 26 percent. These actions involve raising awareness and creating and following-up with an energy plan.

TOP TEN NO-COST ENERGY SAVING TIPS

1. SHADING DEVICES Use shading devices to help control heat loss and gain through building windows. Open blinds at the beginning of the school day to allow the sun to help heat the building. After the school day is over, close blinds to avoid heat loss through the windows.

http://www.nrel.gov/tech_deployment/pdfs/commercial_building_checklists.pdf

2. CLOSE OPENINGS Make sure that all windows and doors remain closed when the HVAC system is running. By allowing conditioned air to escape the building, energy and money are being lost. For some systems, this can also negatively impact the temperature of other spaces.

<http://www.coolcalifornia.org/article/save-energy-schools>

3. SPECIAL USE ROOMS Some spaces of school buildings are only used during specific hours of the day; such as the cafeteria, auditorium and gymnasium. Ensure that your HVAC system is programmed around this schedule so that it is not heating or cooling an unused space.

<http://www.ase.org/resources/energy-saving-tips-schools>

4. CLEAR VENTED AREAS Ensure that all airflow is left unblocked. Keep bulky furniture as well as personal items away from the vents so that spaces can be properly heated or cooled.

<http://www.ase.org/resources/energy-saving-tips-schools>

5. HVAC SETTINGS Have building maintenance personnel adjust HVAC temperature settings outside of regular school hours to save energy on space heating and cooling. The high percentage of energy used for heating and cooling can be greatly impacted by making this small change.

<http://www.eere.energy.gov/buildings/info/schools/index.html>

www.cacx.org/resources/documents/CA_Commissioning_Guide_Existing.pdf

6. SLEEP MODE ON Computers are left untouched for several hours a day in K-12 schools, so it is important to make sure they aren't drawing energy when unused. Make sure that computers are set to enter sleep mode when not in use. Screens should be set to power down after 10 minutes of use, and another goal is to maximize power down time especially during evenings and weekends.

<http://www.usgbc.org/articles/how-much-could-your-school-save>

7. OFF FOR THE HOLIDAYS Make sure that all electronic devices are turned off and unplugged over the weekends and holidays so that unused energy isn't being wasted. Many electronics still use energy when they are turned off – this energy use is called a vampire load.

<http://www.ase.org/resources/energy-saving-tips-schools>

8. TURN OFF LIGHTS This may seem simple, but for every 1,000 kWh of unused electricity you save nearly \$85 on your electricity bill. Lighting accounts for an average 26% of a schools electricity use, so by turning off unused or unnecessary lights you can save large amounts of energy.

<http://www.eere.energy.gov/buildings/info/schools/index.html>
www.centerforgreenschools.org/sites/default/files/resource-files/Behavior-based-Efficiency.pdf

9. USE NATURAL DAYLIGHT Utilize natural day-lighting when and where it is sufficient for the activity. Not only will you save energy on lighting, but you can also help to improve student performance. According to a study conducted by the California Board of Energy Efficiency, students were found to test 15-26% better in classrooms with natural day-lighting. Optimal light levels for classrooms vary based on activity, and can be found on page 7 here: https://www.energystar.gov/ia/business/EPA_BUM_CH10_Schools.pdf

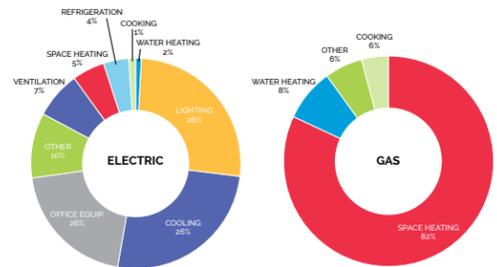
<https://www.xcelenergy.com/staticfiles/xcel/Marketing/Managing-Energy-Costs-Schools.pdf>

10. REDUCE WEEKEND WATER HEATER TEMPERATURE Heating water requires a tremendous amount of energy. If possible, turning down the water heater temperature over the weekend can lead to savings.

www.nationalgridus.com/non_html/shared_energyeff_schools.pdf



**TOP TEN
LONG-TERM
SCHOOL FACILITIES
IMPROVEMENTS**



Key: Impact Categories
(See pg.36 for details)

ACTION	CURRENT USE
1 south facade	
2 seal leaks	34% gas 5% elec.
3 deter winds	
4 replace filters	
5 power strips	26% elec.

ACTION	CURRENT USE
6 lighting retrofits	
7 motion sensors	26% elec.
8 bulb dimmers	
9 aerators	8% gas 2% elec.
10 xeriscaping	10% elec.

Students, teachers, faculty, administration, and facility managers may participate in these efforts. The costs vary but are relatively inexpensive and bring return on investment with savings over time. The ten presented are intended to encourage thinking about different ways that energy is used in schools and on school-grounds.

TOP TEN LONG-TERM SCHOOL FACILITIES IMPROVEMENTS

1. SOUTH FACADE There are a variety of ways to reduce the amount of heat gain received on the South façade of your building. Deciduous trees can provide shade in the warmer months, and allow the sun to heat the building during winter months. Installing shades in southern windows can also be very helpful in avoiding unwanted heat gain.

http://www.nrel.gov/tech_deployment/pdfs/commercial_building_checklists.pdf

2. SEAL LEAKS Use a thermal imaging camera to identify areas of your building where heat may be escaping. Use caulk or weather-stripping to seal these leaks and avoid heat transfer. This will lessen the work that your HVAC system needs to do to reach optimal thermal comfort.

http://www.nrel.gov/tech_deployment/pdfs/commercial_building_checklists.pdf

3. DETER WINDS Coniferous trees and shrubs can be planted along the north, west and east sides of the site to deter winds away from your building. According to the Department of Energy, this can reduce your buildings heating bills by up to 33%.

<http://energy.gov/energysaver/articles/landscaping-shade>

4. REPLACE FILTERS Air Handling Unit filters should be replaced every 1-3 months so that the equipment can work efficiently. Dirty filters will force your HVAC system to work much harder which in turn uses a lot more energy. In a climate where schools need to be heated for the majority of the year, this can make a huge impact upon your utility bill.

http://www.nrel.gov/tech_deployment/pdfs/commercial_building_checklists.pdf

5. POWER STRIPS Power strips should be used to reduce the impact of plug loads. Even when electronics are turned off, they can still be consuming energy. Power strips will allow you to completely cut off power to equipment when it's not in use. Occupancy sensors can ensure power strips are turned off whenever the room is unoccupied.

http://www.nrel.gov/tech_deployment/pdfs/commercial_building_checklists.pdf

6. LIGHTING RETROFITS Replace incandescent bulbs with energy efficient lighting options. We recommend either LED or CFL bulbs. By upgrading your lighting system, you can see significant reductions in your electricity bill. According to the USGBC, lighting in schools can account for up to 50% of the school's total energy use.

http://www.epa.gov/statelocalclimate/documents/pdf/k-12_guide.pdf

<http://www.eere.energy.gov/buildings/info/schools/index.html>
www.centerforgreenschools.org/sites/default/files/resource-files/Behavior-based-Efficiency.pdf

7. MOTION SENSORS Although it's best to have occupants turn off lights when they aren't in use, it can be hard to remember to do so. Install lighting controls into your lighting system so that energy isn't being wasted on unoccupied spaces. Sensors that measure motion and lighting can help curb excess lighting use.

<http://energy.gov/energysaver/articles/lighting-controls>

8. BULB DIMMERS By installing dimmable lights into your school, you can more easily control lighting levels and reduce energy use. Our lighting needs change throughout the day, so by using dimmable lights we can better address our lighting level needs. When lights are dimmed, it also reduces their wattage, adding to energy savings.

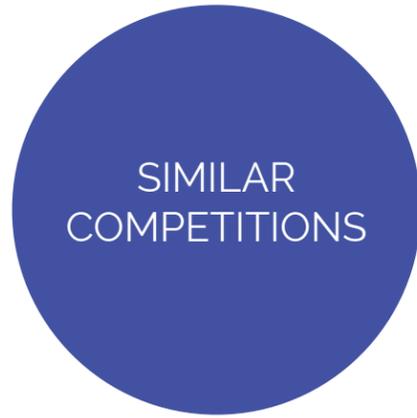
<http://energy.gov/energysaver/articles/lighting-controls>

9. AERATORS It takes a lot of energy to heat water; by adding aerators to your faucets, you can decrease the amount of warm water used each time. User's will still be able to efficiently wash their hands while additionally saving energy used by the water heater and reducing water consumption.

http://www.nrel.gov/tech_deployment/pdfs/commercial_building_checklists.pdf

10. XERISCAPING To reduce the amount of water needed to maintain your school's landscaping, use native plants that thrive in your climate. You should also try to reduce the amount of turf areas to what is necessary, because they often require not only a lot of summer watering but additional energy with regular maintenance work.

<http://energy.gov/energysaver/articles/landscaping-water-conservation>



SIMILAR
COMPETITIONS

**CAMPUS
CONSERVATION
NATIONALS**

WHAT?

The world's largest electricity and water reduction competition for universities and colleges.

WHERE?

Colleges and universities all throughout North America.

HOW?

Each school holds a 3-week competition to see how much they can conserve energy and water-use compared to a baseline reading. Schools have the option of hosting an individual competition between buildings on their campus or participating in a group competition to compete against other schools. Each school has an organizing team that is responsible for planning all events and recording energy or water use throughout the competition period. Most efforts are geared towards behavior change solutions.

<http://www.competetoreduce.org/>

**SAN DIEGO SCHOOL
ENERGY CONSERVATION
COMPETITION**

WHAT?

Energy conservation competition to save money and reduce impact on the environment.

WHERE?

San Diego School Districts - 35 schools in total

HOW?

Schools compete against each other to see who can save the most energy over a 3 week competition period. Some strategies employed include turning everything off over weekends, setting thermostats at 78 degrees, removing extraneous light bulbs or hosting a school-wide blackout.

<http://www.energizeschools-sd.org/energy-competition.html>

**IGNITING CREATIVE
ENERGY CHALLENGE**

WHAT?

Contest for students to share their ideas about energy and the environment

WHERE?

Students all throughout North America are welcome to participate

HOW?

Students share their ideas about how individuals, families or communities can help to conserve energy and promote environmental stewardship. They may do so through any means they see appropriate. In the past students have prepared artwork, science projects, essays, music, videos, service projects, website, etc.

<http://www.ignitingcreativeenergy.org/>

**BATTLE OF THE
BUILDINGS 2014**

WHAT?

Annual competition related to buildings and their impact on the environment.

WHERE?

District 191 Schools in Burnsville, Eagan and Savage, MN.

HOW?

In 2014, schools were challenged to see who could reduce their energy use by the greatest percentage. The winning school was able to reduce their energy use by 29.1% in just 5 short weeks. Some of the strategies used include turning off lights, unplugging unused appliances, and setting building temperature a little lower.

<http://www.isd191.org/news-calendars/go-green-sustainability-isd-191#.VUrQMvVhBc>

THE SPRINT TO SAVINGS**WHAT?**

Energy conservation competition to catalyze energy savings and provide educational experiences for students.

WHERE?

All DC public schools are welcome to participate.

HOW?

Schools assemble "Green Teams" to plan and implement energy saving efforts. A series of "energy monsters" are created to help teach younger students about how energy is wasted. Older students can complete an energy audit to understand where energy can be saved within their school. Throughout the competition, Green Teams are encouraged to issue tickets to energy wasters, so they can understand their impact on the school.

<http://www.dcgreenschoolschallenge.com/#dgsc>

**GLOBAL GREEN CUP
ENERGY CHALLENGE****WHAT?**

Challenge to raise awareness about climate change and resource conservation.

WHERE?

Schools all across the country are invited to participate to help save energy

HOW?

Schools are invited to join the challenge to save energy and bring positive change to the world. In 2013, 300 schools participated to help save over 1.5 gigawatts of electricity within 4 weeks.

<http://www.greenschoolsalliance.org/energy-challenge>

**U.S. ARMY'S
ECYBERMISSION****WHAT?**

A state, regional and national Science, Technology, Engineering and Mathematics (STEM) competition for 6th-9th grade teams that propose a solution to a real problem in their community.

WHERE?

Web-based competition for students throughout the United States

HOW?

Three to four students and one advisor in the same state form a team and register with a mission challenge using science, technology, engineering or mathematics to solve a problem in their community. The team will conduct research and experiments to find a solution in 8-weeks and submit a mission folder answering all questions, attach photographs, survey questions and any additional documents from the teams competition.

<http://www.ecybermission.com>





LOCAL
LEARNING
RESOURCES

**METHANE ENERGY
CAPTURE
& WIND AND SOLAR
ENERGY PRODUCTION**

City action helped turn the smelly gas emitted from the landfill into a viable energy source, saving the city millions of dollars. Additionally, the Landfill uses wind and solar energy to supplement its energy supply.

<http://apps.cityoffargo.com/solidwaste/energyproduction/>

LED RETROFIT

All 5,400 incandescent traffic lights have been replaced with LED's, and 85% of the city's 2,400 pedestrian lights have been replaced. This saves the city \$30,000 annually.

**MATBUS GENERATOR
AND BIODIESEL**

MATBUS uses 20% blended biodiesel fuel during the summer, and the Metro Transit Garage utilizes a power generator during peak energy-use times to reduce costs and power-grid loads.

**WASTEWATER
RECYCLING**

Up to two million gallons of wastewater are sold daily to a nearby ethanol plant, producing an effect that is equivalent of taking 28,000 vehicles off the road each year. The city earns \$800,000 while eliminating the need for using natural river and ground water sources.

<http://www.cityoffargo.com/CityInfo/Mayor/FargoEnergyUse/>

**BICYCLES AND
TRANSPORTATION
ENERGY**

Great Rides Bike Share program was initiated by NDSU students and has quickly grown to be a successful alternate transportation option. Solar-powered bike stations populate downtown and the NDSU campus where students and the public may use the bicycles free-of-charge for short trips.

**CCEC'S ENERGY
PRODUCING BIKE**

Cass County Electric Coop has an energy bike that provides an opportunity to demonstrate an energy concept in a visual way. It allows riders energy to be transformed into light. The bike promotes energy conservation and teaches lighting technology as it compares to LED (light emitting diode) and CFL (compact fluorescent) light bulbs to incandescent light bulbs. It takes more pedal power to run the incandescent light bulbs than it takes to run one of the bulbs that uses less energy. Hands-on demonstration and presentations available that last 30-60 minutes.

**BLOWER-DOOR
DEMONSTRATION**

An effective way to test a buildings energy performance is to use a blower door to measure how well the building retains warm or cool air. Workshops may be arranged to demonstrate an energy performance test.

**NDSU STUDENT
GROUPS**

efargo is has partnered with with various NDSU Student Organizations including USGBC-NDSU and the Society of Women Engineers who have prepared lessons and workshops to share with students in schools. Other student organizations such as Tau Beta Pi and NDSU Lions will assist by volunteering time where needed n schools.

CONTACT & SIGNUP

Contact us at k12challenge@efargo.org or visit www.efargo.org/k12challenge to learn more and sign-up for workshops. You may also email Troy at troy.raisanen@ndsu.edu for more information. Workshops will be updated online as they become available, and availability may be limited.

