

Arlington Public Schools

VMDO

CONSULTING ENGINEERS cmta

ARLINGTON PUBLIC SCHOOLS

DISCOVERY ELEMENTARY EXPLORERS



SUSTAINABILITY

conservation

health + wellness

stewardship



Place

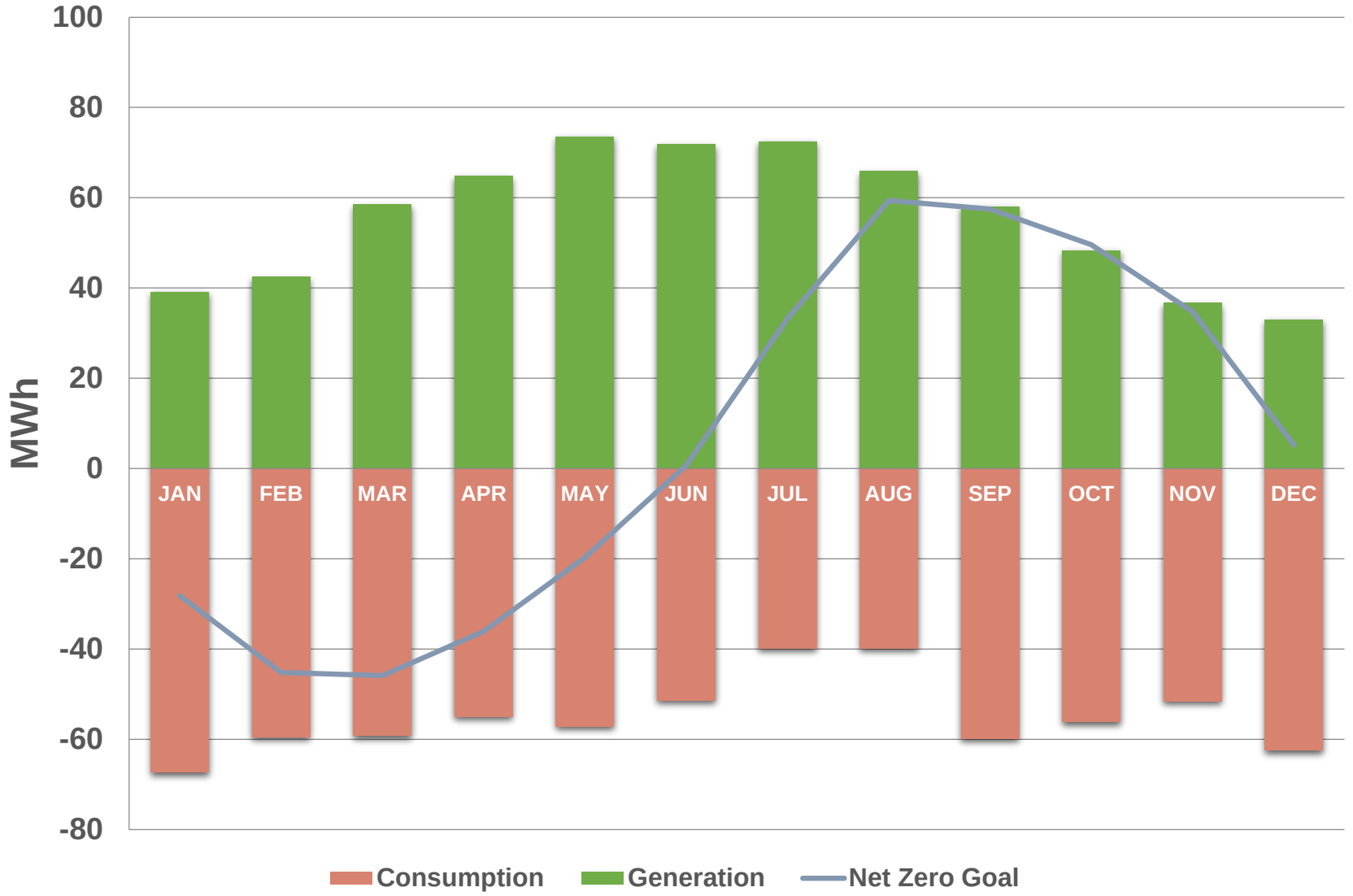
compelling

engaging

visceral




WEB



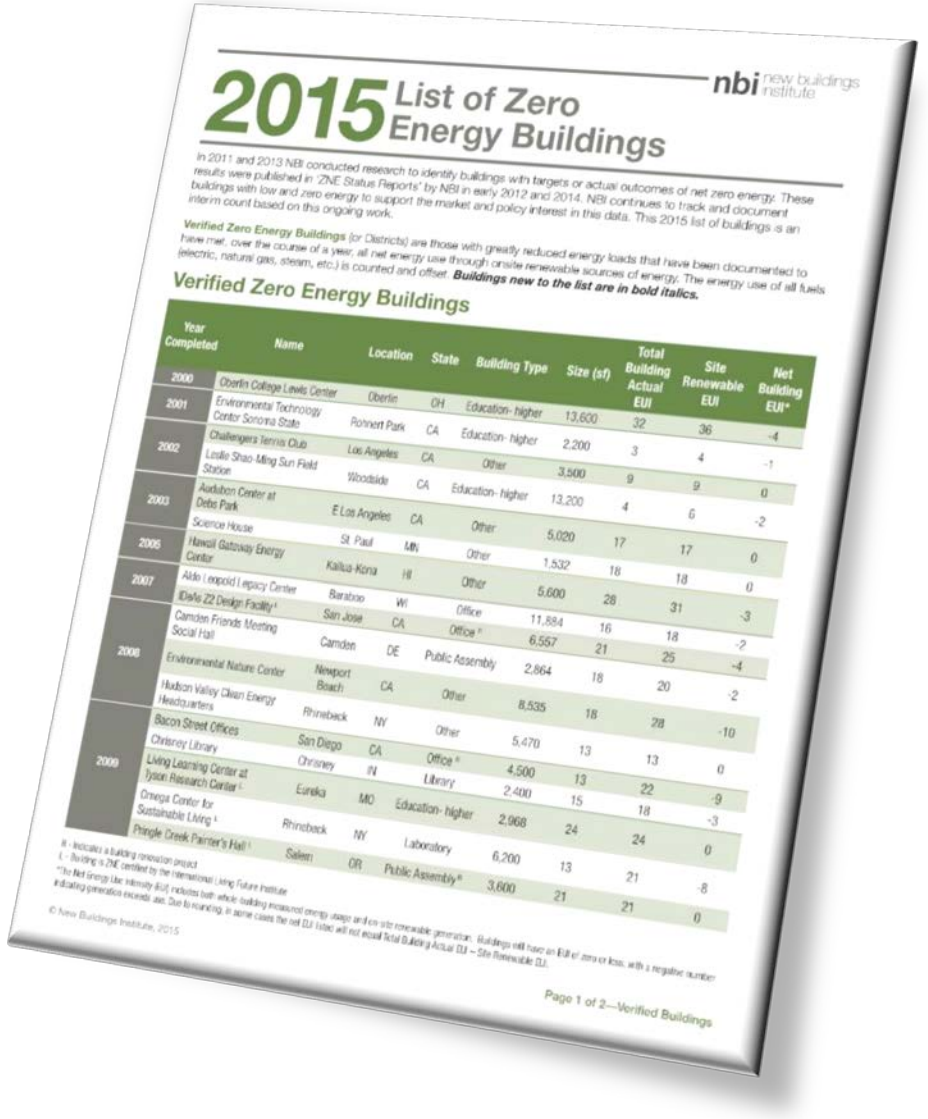
What is net-zero energy?

39 Total
Net Zero Buildings
in the United States

152+ in planning stages

7 K-12 School Projects

Lumber Bridge **NC**	74,000 sf
Lexington **KY**	70,000 sf
Bowling Green **KY**	72,285 sf
Hood River **OR**	5,331 sf
Kamuela **HI**	5,902 sf
Seattle **WA**	1,425 sf
Putney **VT**	16,800 sf



nbi new buildings institute

2015 List of Zero Energy Buildings

In 2011 and 2013 NBI conducted research to identify buildings with targets or actual outcomes of net zero energy. These results were published in "ZNE Status Reports" by NBI in early 2012 and 2014. NBI continues to track and document buildings with low and zero energy to support the market and policy interest in this data. This 2015 list of buildings is an interim count based on this ongoing work.

Verified Zero Energy Buildings (or Districts) are those with greatly reduced energy loads that have been documented to have met, over the course of a year, all net energy use through on-site renewable sources of energy. The energy use of all fuels (electric, natural gas, steam, etc.) is counted and offset. ***Buildings new to the list are in bold italics.***

Verified Zero Energy Buildings

Year Completed	Name	Location	State	Building Type	Size (sf)	Total Building Actual EUI	Site Renewable EUI	Net Building EUI*
2000	Oberlin College Lewis Center	Oberlin	OH	Education- higher	13,600	32	36	-4
2001	Environmental Technology Center Sonoma State	Rohnert Park	CA	Education- higher	2,200	3	4	-1
2002	Challengers Tennis Club	Los Angeles	CA	Other	3,500	9	9	0
	Leslie Shao-Ming Sun Field Station	Woodside	CA	Education- higher	13,200	4	6	-2
2003	Audubon Center at Debs Park	E Los Angeles	CA	Other	5,020	17	17	0
	Science House	St. Paul	MN	Other	1,532	18	18	0
2005	Hawaii Gateway Energy Center	Kailua-Kona	HI	Other	5,600	28	31	-3
2007	Aldo Leopold Legacy Center	Baraboo	WI	Office	11,884	16	18	-2
	iDeAs Z2 Design Facility †	San Jose	CA	Office *	6,557	21	25	-4
2008	Camden Friends Meeting Social Hall	Camden	DE	Public Assembly	2,864	18	20	-2
	Environmental Nature Center	Newport Beach	CA	Other	8,535	18	28	-10
	Hudson Valley Clean Energy Headquarters	Rhinebeck	NY	Other	5,470	13	13	0
2009	Bacon Street Offices	San Diego	CA	Office *	4,500	13	22	-9
	Chimney Library	Chimney	IN	Library	2,400	15	18	-3
	Living Learning Center at Tyson Research Center †	Eureka	MO	Education- higher	2,968	24	24	0
	Omega Center for Sustainable Living †	Rhinebeck	NY	Laboratory	6,200	13	21	-8
	Pringle Creek Painter's Hall †	Salem	OR	Public Assembly *	3,600	21	21	0

† - Indicates a building renovation project

‡ - Building is ZNE certified by the International Living Future Institute

*The Net Energy Use Intensity (EUI) indicates both whole-building measured energy usage and on-site renewable generation. Buildings will have an EUI of zero or less, with a negative number indicating generation exceeds use. Due to rounding, in some cases the net EUI listed will not equal Total Building Actual EUI – Site Renewable EUI.

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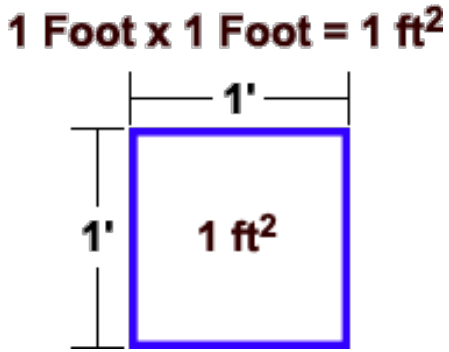
How many net-zero-energy buildings are there?

Energy Use Intensity (EUI) =

Energy use per square foot over one year

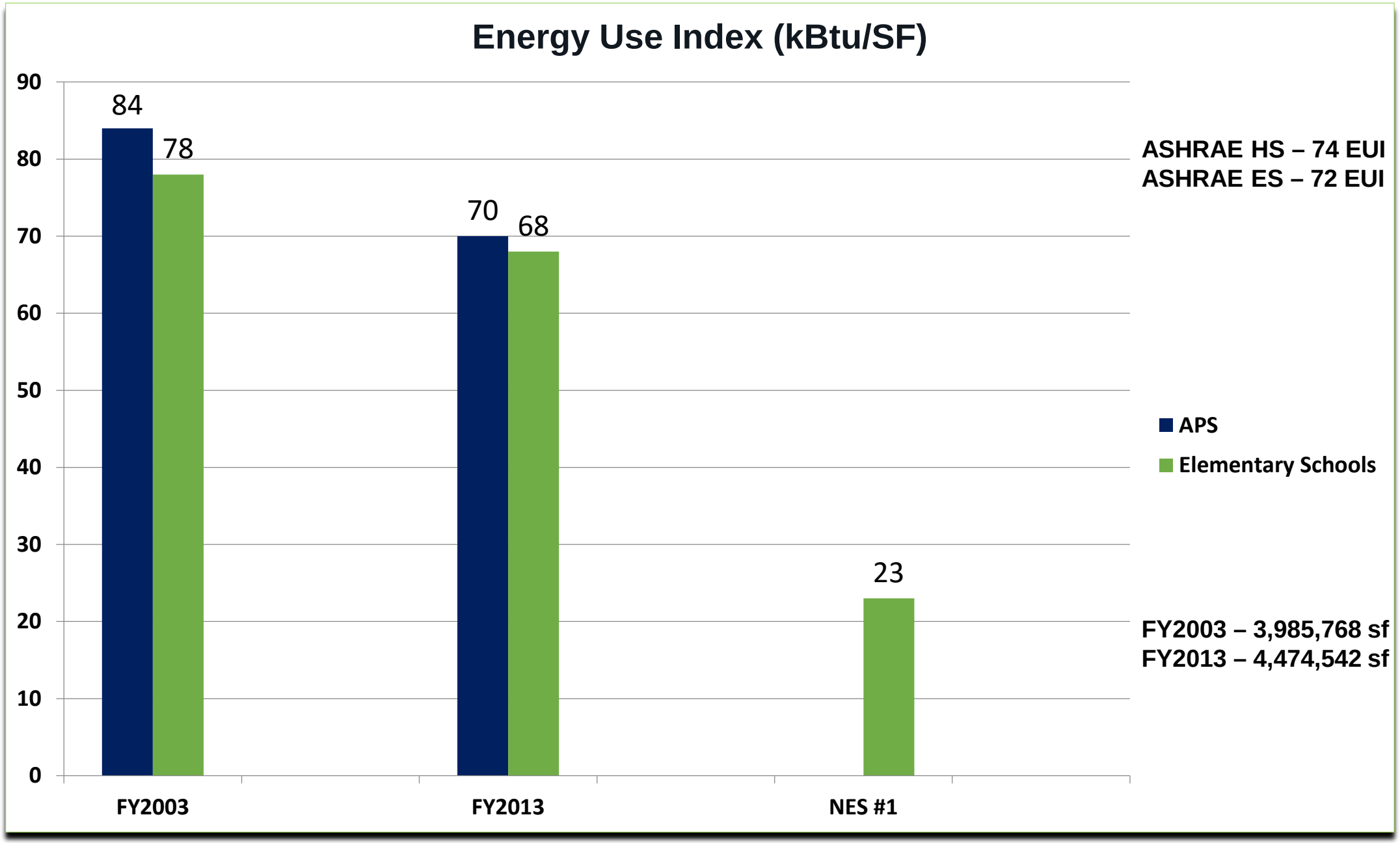






kBTU / s.f. / yr.

How is energy use measured?



APS Reduction + NES Energy Goal

Are you willing to question…

How your power is purchased?

How food is cooked in the cafeteria?

How you procure and use information technology?

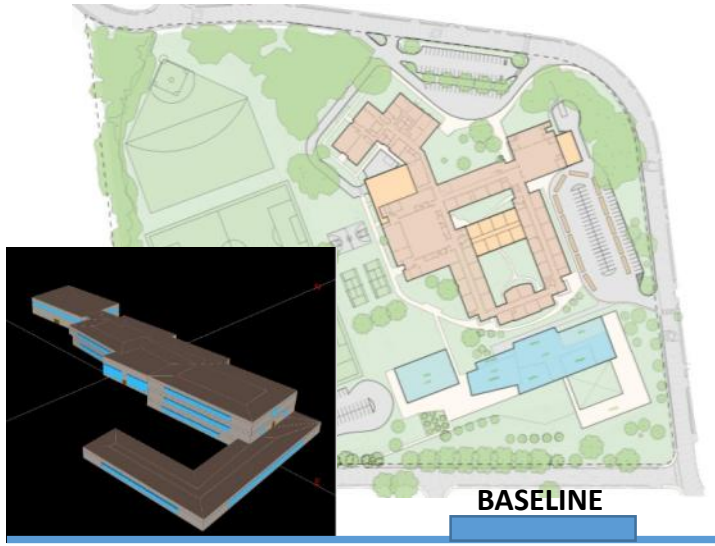
How testing is administered?

How you schedule your building systems?
(including IT and kitchen)

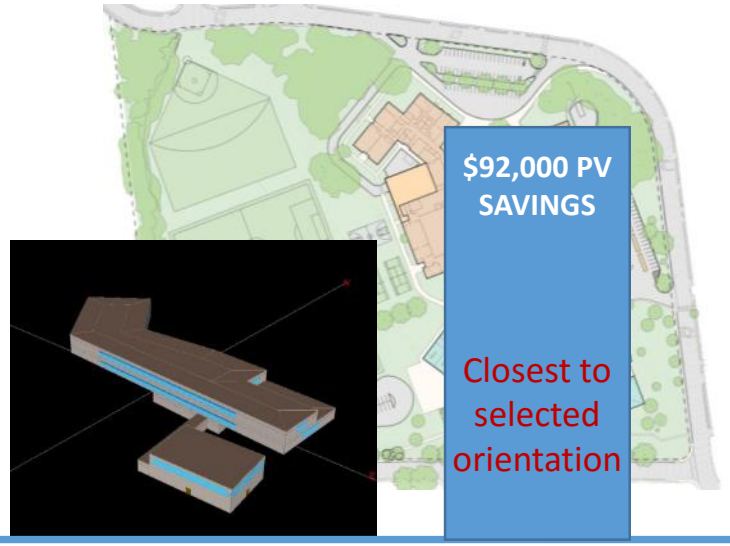
How you clean your buildings?



Can’t expect 21st century results from 20th century process

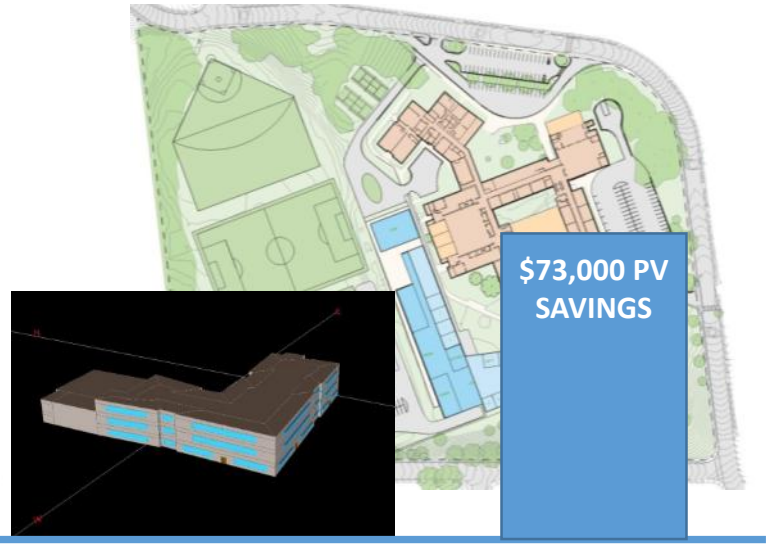


BASELINE

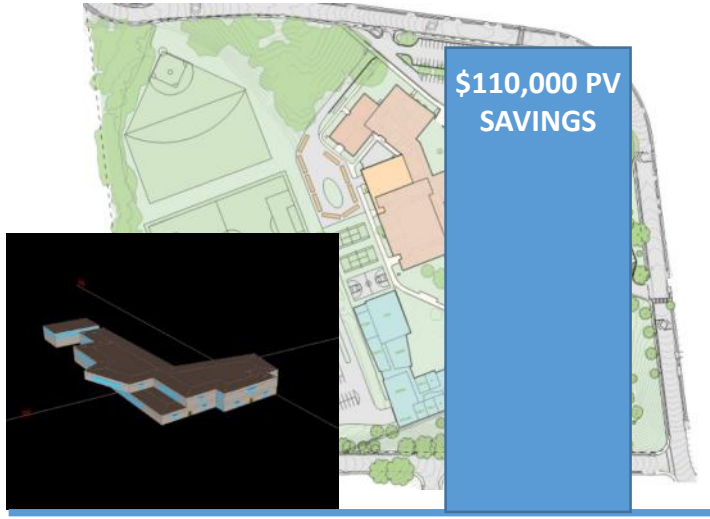


$92,000 PV SAVINGS

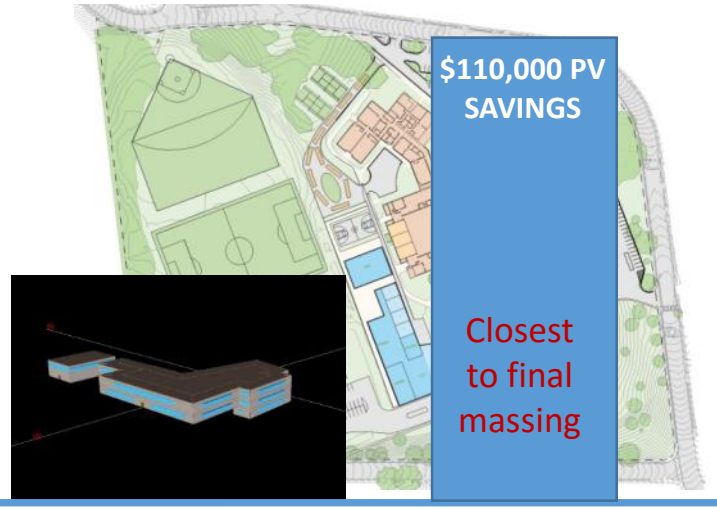
Closest to selected orientation



$73,000 PV SAVINGS

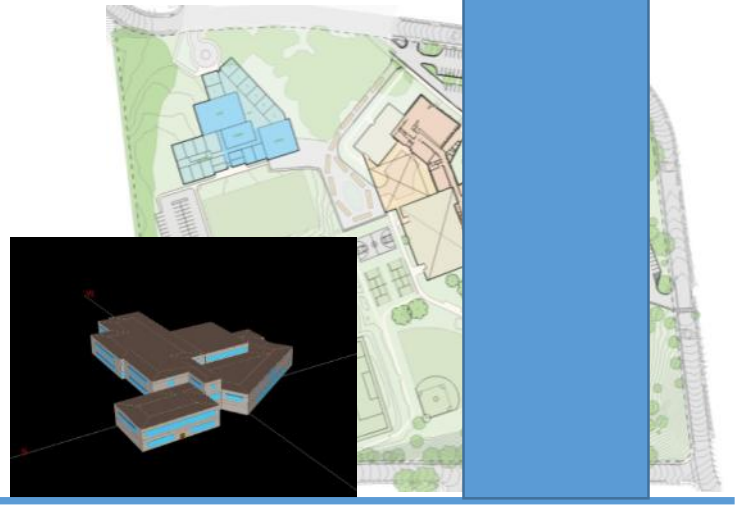


$110,000 PV SAVINGS



$110,000 PV SAVINGS

Closest to final massing



$202,000 PV SAVINGS

Energy Modeling + PV Offset Costs



Aerial view of existing conditions before project



School tied into south facing slope | preserved programmable space



No view of solar panels by neighbors



Good energy design + good neighborhood design



496 kW array, 1706 panels | Harvesting & celebrating light



Proper shading techniques + covered outdoor play space



Use of glass for impact | Cost shifting & energy modeling



Discovery Energy Reduction Strategies

Performance to Date

Bid $4 Million under budget and completed under budget (with array and 2 turf fields)

$331/sf (typical range inside the Beltway)

2015-2016 School Year (actual)

APS Elementary School Energy cost average: $1.10/sf

Discovery: $0.32/sf (with PV array not online until Jan)

2016-2017 School Year (anticipated)

Discovery: $0.14/sf

$94,000 annual savings in operating costs





DISCOVERY ELEMENTARY SCHOOL

NET ZERO ENERGY

WHAT

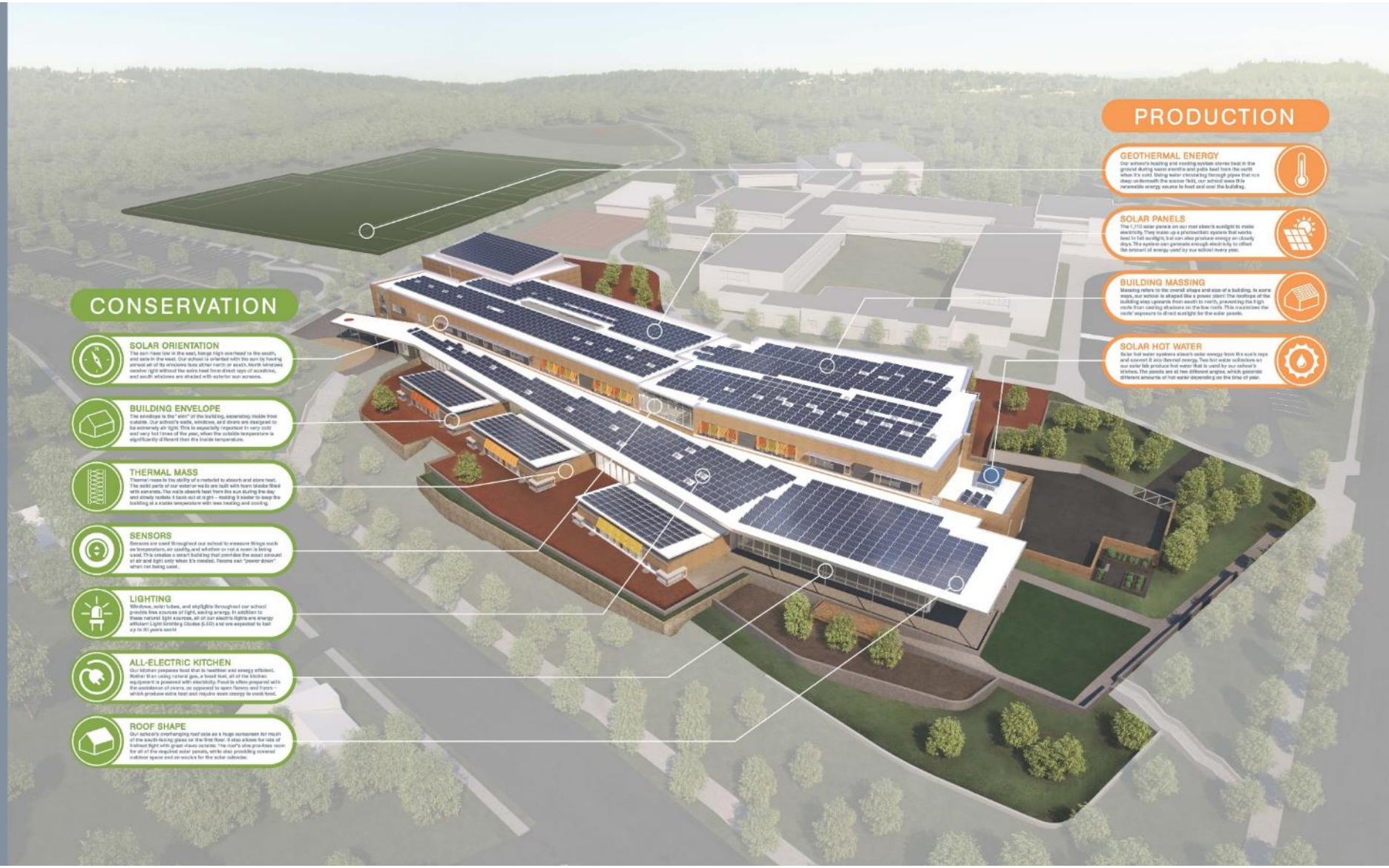
IS A NET ZERO ENERGY BUILDING?

A net zero energy building generates more energy in a year than it uses. Our school still uses energy from the local electric power grid, but also sells the clean, renewable energy produced by our solar panels back to the same power grid. Our school will be "net zero" because, over the course of 12 months, it will have cleanly produced as much energy as consumed, if not more!

WHY

HAVE A NET ZERO ENERGY BUILDING?

Using design strategies that **CONSERVE** energy, our school consumes less energy than most buildings its size. However, our school can also **PRODUCE** clean, renewable energy and provide it back to the local electric power grid. This energy is then used by local neighborhood buildings during peak electricity usage times throughout the year. Our school is a model of how clean, renewable energy can be produced to meet our local energy needs and also reduce the carbon impact a building can have on the natural environment.



CONSERVATION

SOLAR ORIENTATION
The sun rises low in the east, hangs high overhead to the south, and sets low in the west. Our school is oriented with this sun by having almost all of its windows face either north or south. North windows receive light without the extra heat from direct rays of sunshine, and south windows are shaded with exterior sun screens.

BUILDING ENVELOPE
The envelope is the "skin" of the building, separating inside from outside. Our school's walls, windows, and doors are designed to be extremely air tight. This is especially important in very cold and very hot times of the year, when the outside temperature is significantly different than the inside temperature.

THERMAL MASS
Thermal mass is the ability of a material to absorb and store heat. The solid parts of our exterior walls are built with foam blocks filled with concrete. This walls absorb heat from the sun during the day and slowly radiate it back out at night – making it easier to keep the building at a stable temperature with less heating and cooling.

SENSORS
Sensors are used throughout our school to measure things such as temperature, air quality, and whether or not a room is being used. This creates a smart building that provides the exact amount of air and light only when it's needed. Rooms can "power down" when not being used.

LIGHTING
Windows, solar tubes, and skylights throughout our school provide free sources of light, saving energy. In addition to these natural light sources, all of our electric lights are energy efficient Light Emitting Diodes (LED) s ot are expected to last up to 20 years each!

ALL-ELECTRIC KITCHEN
Our kitchen prepares food that is healthier and energy efficient. Rather than using natural gas, a fossil fuel, all of the kitchen equipment is powered with electricity. Food is often prepared with the assistance of ovens, as opposed to open flames and fryers – which produce extra heat and require more energy to cook food.

ROOF SHAPE
Our school's overhanging roof acts as a huge sunscreen for much of the south-facing glass on the first floor. It also allows for lots of brilliant light with great views outside. The roof's slope provides room for all of the required solar panels, while also providing covered outdoor space and an acoustic for the solar collector.

PRODUCTION

GEOTHERMAL ENERGY
Our school's heating and cooling system stores heat in the ground during warm months and pulls heat from the earth when it's cold. Using water circulating through pipes that run deep underneath the soccer field, our school uses this renewable energy source to heat and cool the building.

SOLAR PANELS
The 1,710 solar panels on our roof absorb sunlight to make electricity. They make up a photovoltaic system that works best in full sunlight, but can also produce energy on cloudy days. The system can generate enough electricity to offset the amount of energy used by our school every year.

BUILDING MASSING
Massing refers to the overall shape and size of a building. In some ways, our school is shaped like a power plant! The rooftops of the building step upwards from south to north, preventing the high roofs from casting shadows on the low roofs. This maximizes the roofs' exposure to direct sunlight for the solar panels.

SOLAR HOT WATER
Solar hot water systems absorb solar energy from the sun's rays and convert it into thermal energy. Two hot water collectors on our solar lab produce hot water that is used by our school's kitchen. The panels are at two different angles, which generate different amounts of hot water depending on the time of year.


DISCOVERY ELEMENTARY SCHOOL
NET ZERO ENERGY
CONSERVATION
PRODUCTION



Backyard



Forest



Ocean



Atmosphere



Solar System



Galaxy



1st Floor: Earth



2nd Floor: Sky

Using Wayfinding to Teach about **“ Your Expanding World”**



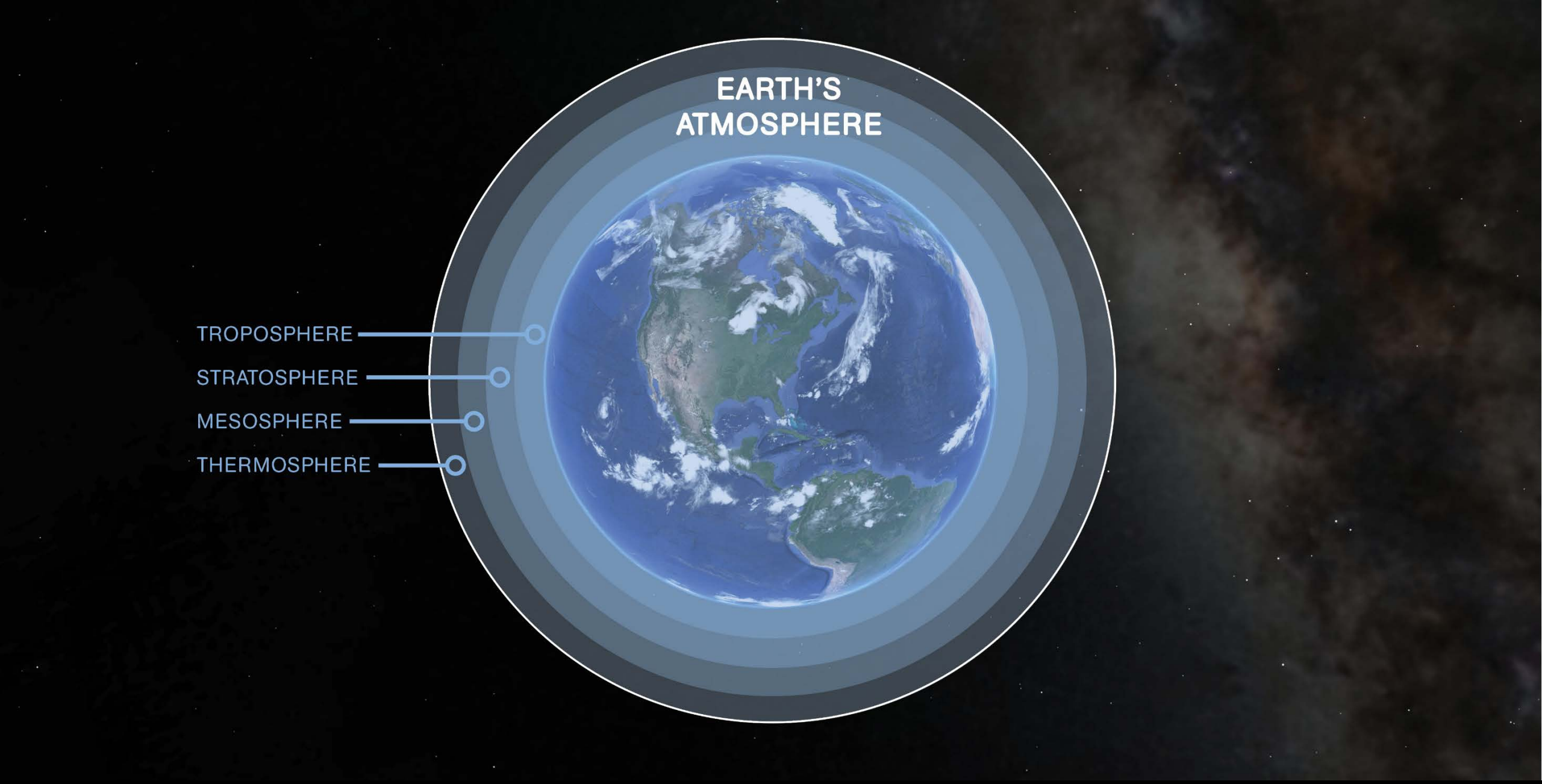
The Backyard



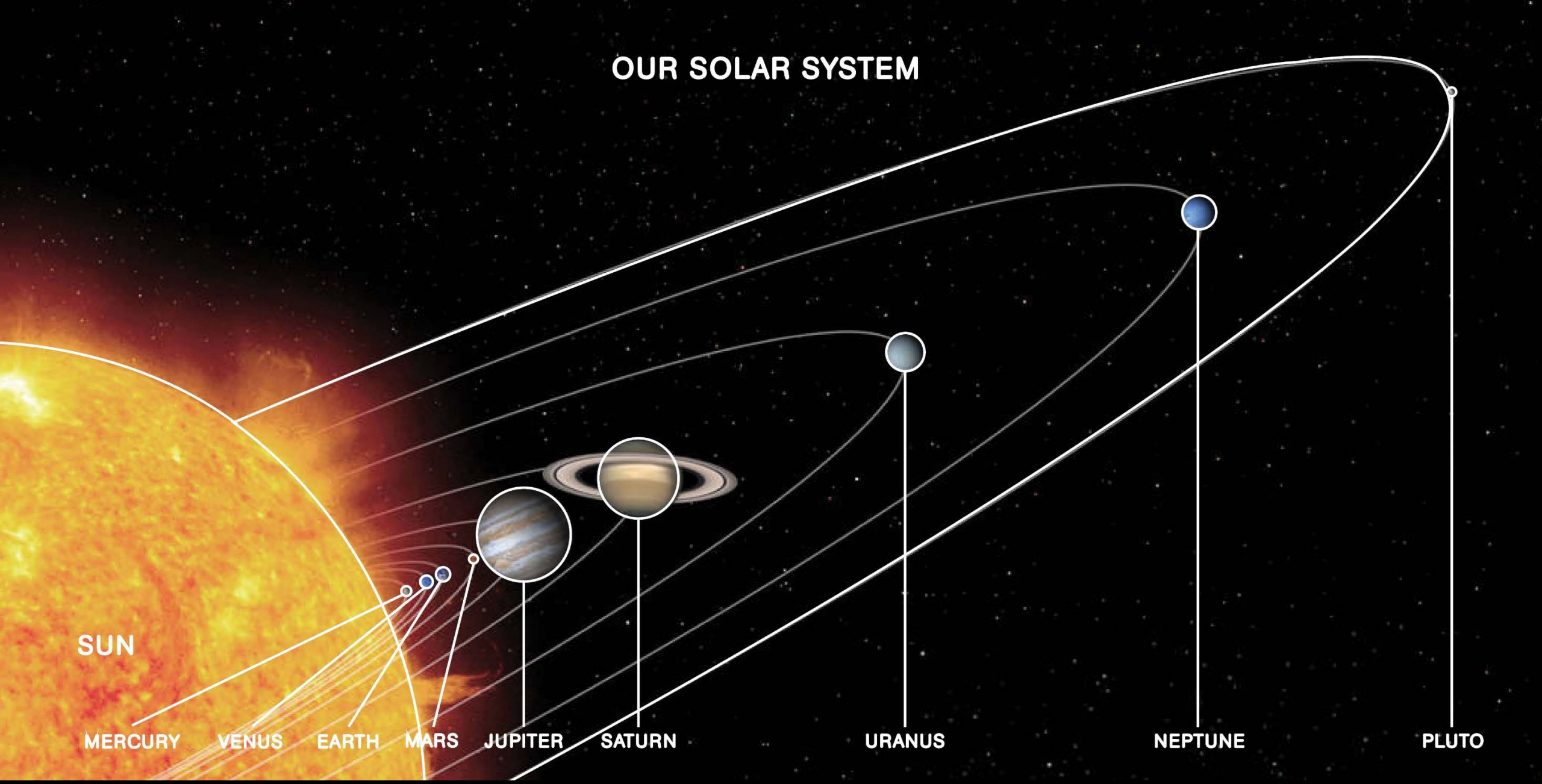
The Forest



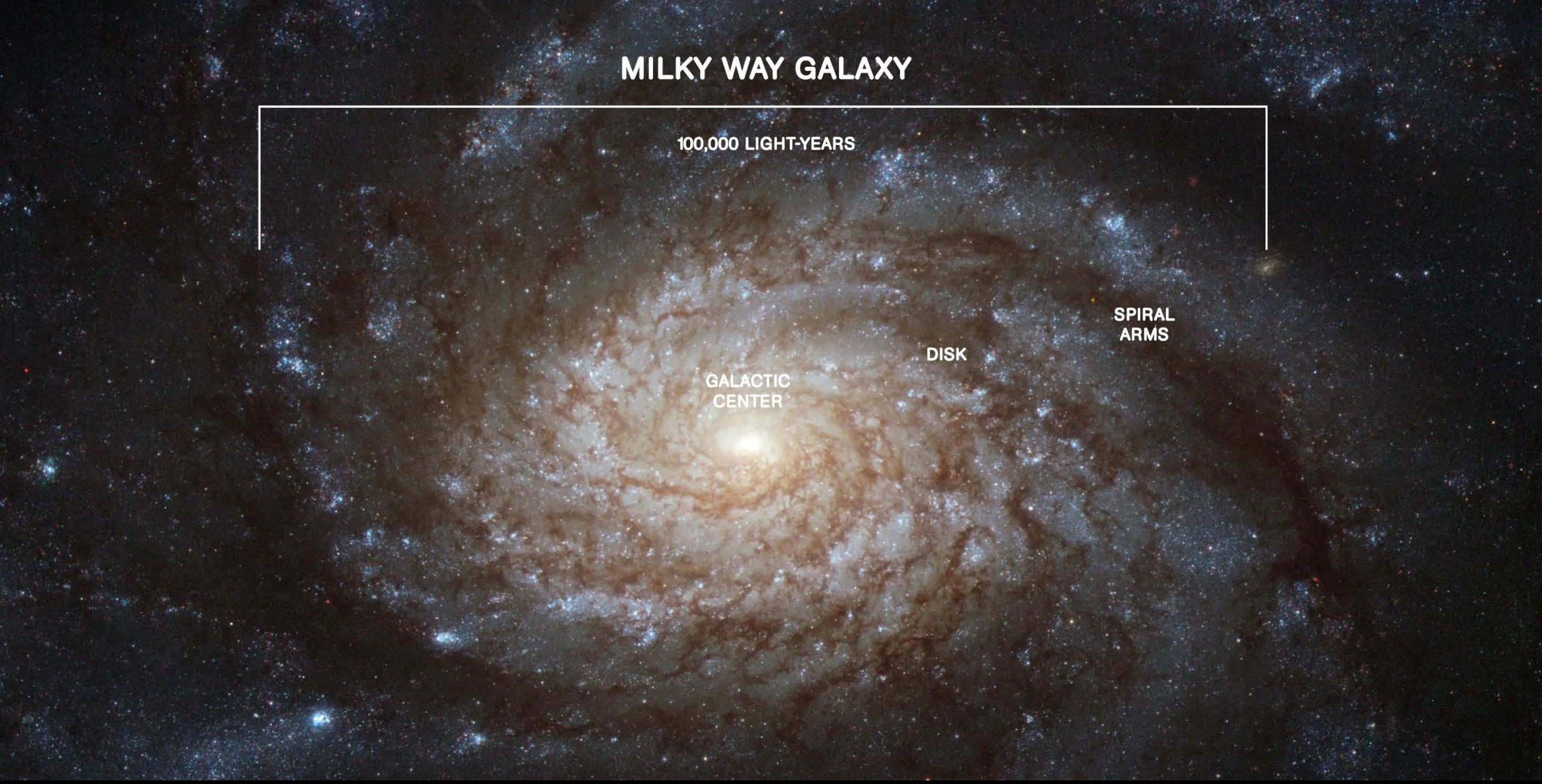
The Ocean



The Atmosphere



The Solar System


MILKY WAY GALAXY
100,000 LIGHT-YEARS
SPIRAL ARMS
DISK
GALACTIC CENTER

The Galaxy







Backyard
Pre-K & K

Forest
1st Grade

Ocean
2nd Grade

Your Expanding World

Local fauna & their habitats

SOL: colors, shapes, sizes, weights, water phases, magnets, plant/animal growth, shadows, recycling, water/energy use at home

Sustainable materials

SOL: motion, interactions with water, plants/animals basic life needs, sun as energy/light/position, weather/seasons natural resources

Water conservation

SOL: magnets/poles, phases/measurement of matter, life cycles, habitats, types/effects of weather, plants as source oxygen

The Journey of Discovery: Earth



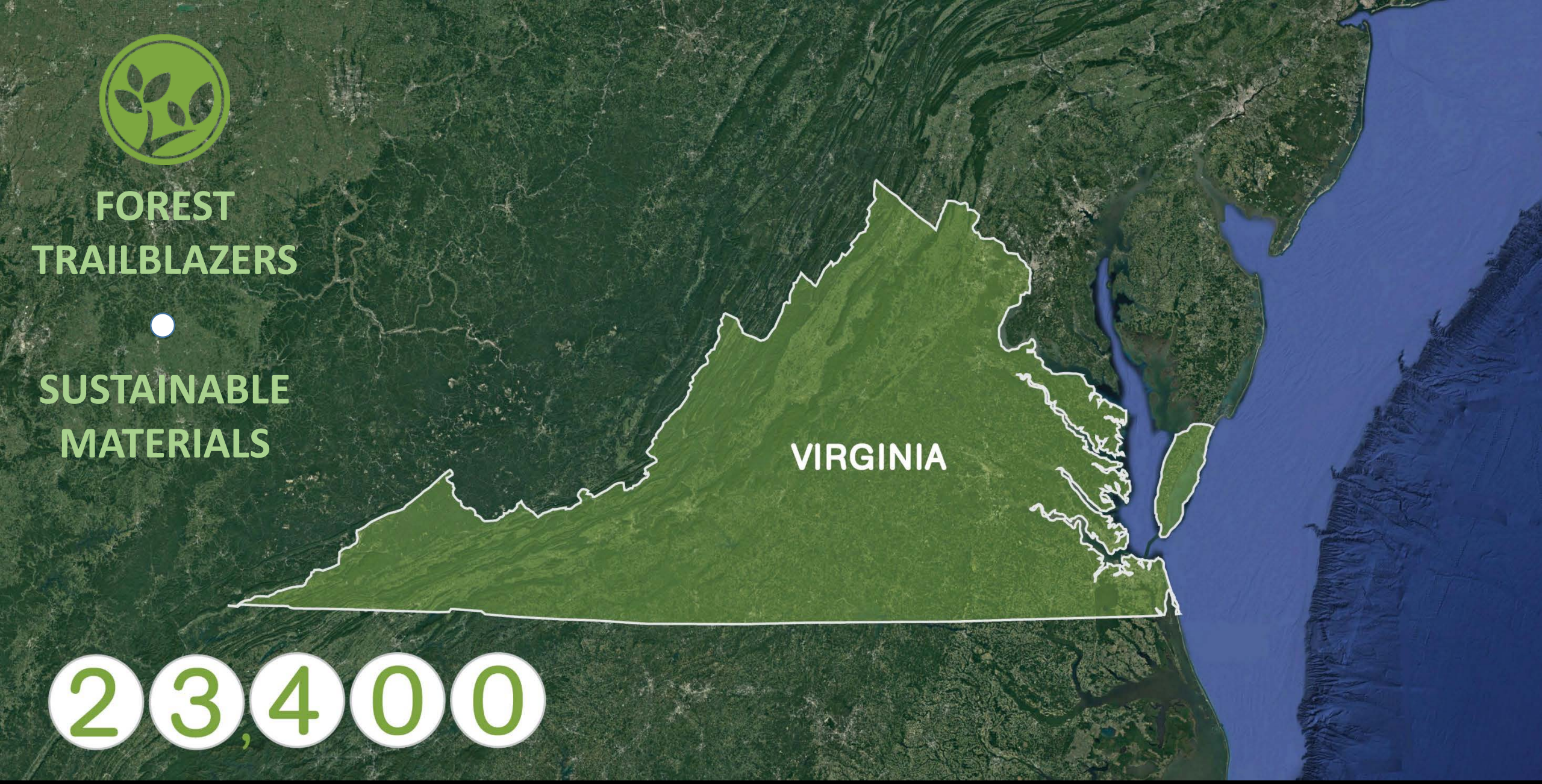
There are 26 square miles that make up our backyard of Arlington




3 Ways to READ a Book
Read the pictures
Read the words
Read by retelling
First
Then
Next
Lastly
Read to Self
Independent Reading
Looks like...
Sounds like...
eyes on books
shhh! very quiet
hands on books
bodies still
We do Read to Self to get better at reading!
carefully turning the pages
Our Class Schedule
Morning Meeting
Guest Speaker
Reading Workshop
Recess
Lunch
Calendar
Math Workshop
Art
Snack/Wellness
Social Studies Science
Pack-up/Dismissal
Atlantic


FOREST TRAILBLAZERS
LIBRARY


M PIONEERS
GALAXY VOYAGERS
EAGLE EYRIE
BAT CAVE
GROUNDHOG BURROW



There are 23,400 square miles that make up our Virginia Forests


FOREST
MUSIC

White Tailed Deer

Odocoileus virginianus



Only the males, or bucks, grow antlers. They shed and regrow these antlers every year. Baby fawns have white spots on their fur to help them blend in with the forest. The spots disappear as they get older!

Yellow Warbler

Setophaga petechia



The Yellow Warbler is one of 50 different species of North American songbirds. While other birds are known to lay eggs in their nests, the Yellow Warbler builds new nests directly on top of old ones, resulting in nests up to six tiers high!

Northern Mockingbird

Mimus polyglottos



The Mockingbird gets its name from its ability to "mock" other noises. They can imitate other birds, animals, and mechanical sounds such as car alarms, and can remember up to 200 songs!

Spotted Salamander

Ambystoma maculatum



Spotted Salamanders spend most of their lives hiding under rocks, or in abandoned forest burrows, emerging only at night to feed. For being spotted, they sure are hard to spot!

Coyote

Canis latrans



A member of the dog family, Coyotes form strong family groups as well as packs for hunting. They have a very distinctive call, which is often heard at night!

Five Lined Skink

Plestiodon fasciatus



Five-lined skinks can use their bright blue tails as defense. They can disconnect part of their tail which continues to twitch and distract predators as they escape to safety!

Woodland Deer Mouse

Peromyscus maniculatus



Woodland Deer Mice can be found just about anywhere. They are good climbers and can even tunnel through snow. They communicate by grooming one another, producing scent, and making a variety of squeaky noises.

Praying Mantis

Mantis religiosa



The Praying Mantis is named for its unique front legs, that appear to be folded as if in prayer. They can turn their heads 180 degrees and see up to 60 feet away to spot prey!

The Forest Trailblazer Classrooms: Virginia Forest Species

DISCOVER VIRGINIA'S FRIENDLY FORESTS



62% of Virginia is made up of forests! These forests provide homes to a range of different species including over 70 amphibian and reptile species, 200 bird species, and 55 mammal species. 27 of the plant and animal species found in Virginia forests are threatened or endangered and need their habitat protected!

How many different animals can you spot living in the trees in your neighborhood?

WHAT MATERIALS DO FORESTS PROVIDE US?



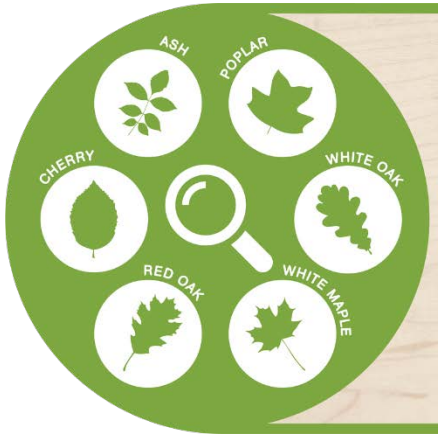
Trees are among the largest and oldest organisms on earth! Over 5,000 different products come from trees including hundreds of food items such as fruit, coffee, and nuts. They also help produce the oxygen that we breathe every day. One tree produces nearly 260 pounds of oxygen each year.

How many different products around your home and our school come from trees?

HOW 'CAN' YOU HELP?

There are over 80 billion aluminium cans used each year around the world. Recycling a single aluminum can saves enough energy to power a TV for three hours. Make sure you always recycle aluminum here and at home!

A WALK THROUGH OUR OWN FOREST AT DISCOVERY



The wood found in our school is certified by the FSC (Forest Stewardship Council), which means it was grown and harvested sustainably. The interior wood is white maple and the exterior wood is western red cedar. Can you identify the 6 local wood species that line this hallway by the shapes of their leaves?

To learn more about the FSC and forest stewardship, visit: https://us.fsc.org/

HOW OUR SCHOOL USED SUSTAINABLE MATERIALS



22% of the materials used to build our school were harvested and manufactured within 500 miles of here. During construction, our school recycled 95% of all waste produced during the project! Recycling reduces the need to use new raw materials from the earth.

Can you find all of these different products around our school?

RECYCLE TO SAVE TREES

The average American uses up to 680 pounds of paper each year! If you recycle all of that paper, you could save up to 6 trees each year. Use the recycling bins around our school to recycle your unwanted paper.

The Forest Trailblazer Factoids: Forest, Materials, & Conservation



JOHN MUIR

John Muir was a Scottish-American naturalist, author, environmental philosopher, and advocate of preserving and protecting nature. As a wilderness explorer, he is known for his exciting adventures in search of nature's beauty. As a preservationist, he taught people the importance of experiencing and caring for our natural heritage. He has been called "The Father of our National Parks" and helped form the Sierra Club.



SACAGAWEA

Sacagawea was a bilingual Lemhi Shoshone woman who accompanied Lewis and Clark's Corps of Discovery in exploring the Louisiana Purchase in 1805. She traveled thousands of miles with the expedition from the northern plains through the Rocky Mountains to the Pacific Ocean and back. Besides serving as the group's translator, Sacagawea established cultural contacts with Native American populations and researched natural history.



DANIEL BOONE

Daniel Boone was a pioneer, explorer, woodsman, and one of the most widely known American frontiersmen. Boone was born near Reading, Pennsylvania but later blazed a trail to the west through the Cumberland Gap, thereby providing access to the frontier. Boone played a key role in the exploration and settlement of Kentucky, including carving out the Wilderness Road and building the settlement station of Boonesboro.



THEODORE ROOSEVELT

Theodore Roosevelt was an American statesman, author, explorer, soldier, and naturalist who served as the 26th President of the United States. While President, he set aside hundreds of millions of acres of wilderness, actively pursued soil and water conservation, and created over 200 national forests, parks, monuments, and wildlife refuges.

The Forest Trailblazer Explorers

OCEAN NAVIGATORS

WATER QUALITY & CONSERVATION

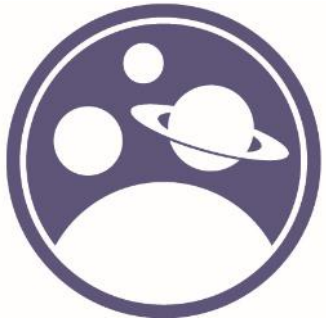


85,100,000

There are 85,100,000 cubic miles of water in our Atlantic Ocean


EXIT
OCEAN







Atmosphere
3rd Grade

Solar System
4th Grade

Galaxy
5th Grade

Your Expanding World

Air Quality + Greenhouse Gas

SOL: simple machines, material properties, adaptations, land/water ecosystems, soil, moon phases, water cycles, natural events, energy sources

Light

SOL: motion/force/mass, electricity, plant anatomy, ecosystem connections, weather phenomena, solar system, sun/earth/moon relationships

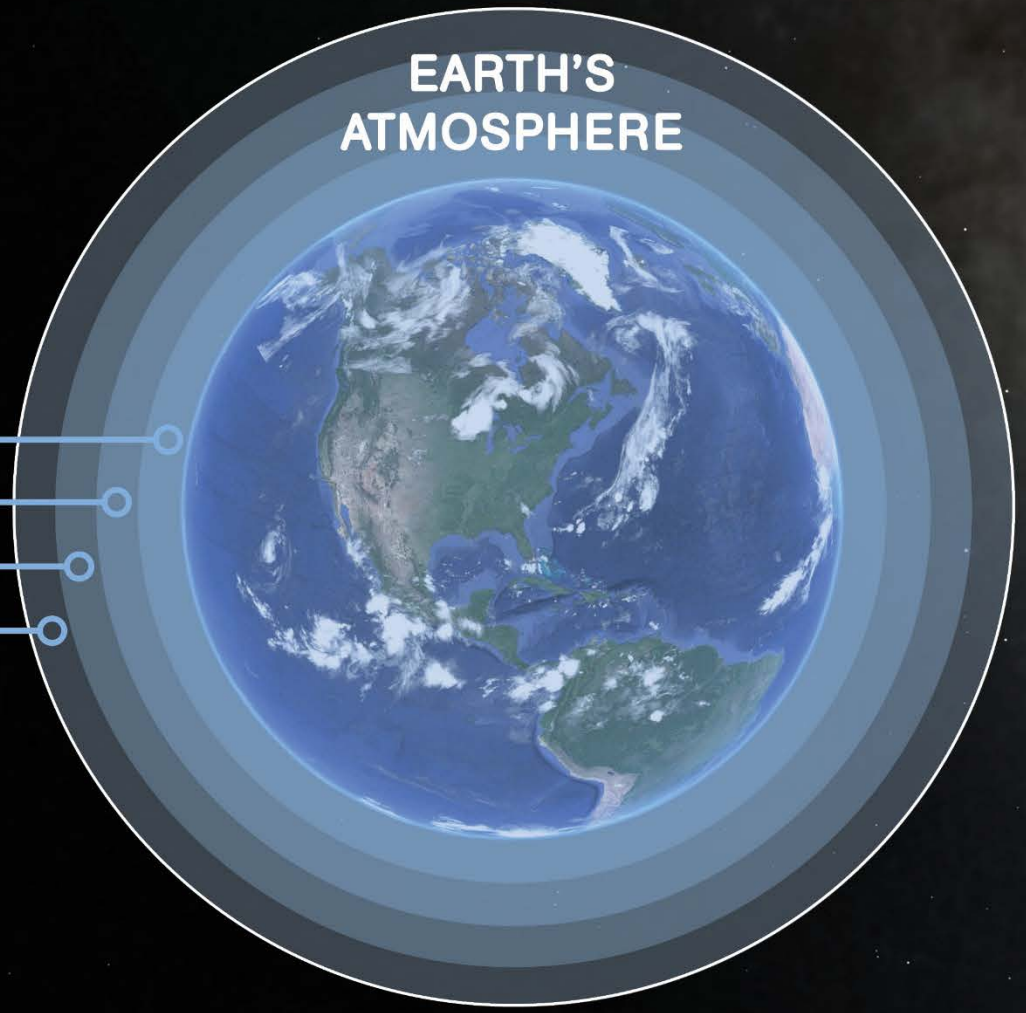
Energy

SOL: sound, visible light, phases/atoms of matter, cells, organisms, ocean environment, earth's surface

The Journey of Discovery: Sky

ATMOSPHERE AVIATORS

AIR QUALITY & GREENHOUSE GASSES



196,900,000

There are 196,900,000 square miles of Earth's surface that our Atmosphere surrounds

Rain



An important part of the water cycle, rain falls from clouds in the sky in the form of water droplets. One droplet of rain stays in the earth's atmosphere for about 10 days.

Northern Lights



Also referred to as aurora borealis, the northern lights are a natural display of light that occurs when charged particles from the sun's solar wind interact with Earth's magnetic field. They can be seen from many places but are visible nearly every night nearer to the North Pole.

Lightning



Lightning is a sudden electrostatic discharge between a cloud and the ground, or within a cloud during an electrical storm. Lightning is extremely hot and can heat the air around it to temperatures five times hotter than the sun's surface!

Tornado



Tornadoes are formed from large thunderstorms called super cells. Tornadoes are strong, turbulent columns of fast moving air that stay in contact with the earth's surface. Tornado wind speeds can reach up to 300 mph!

Thunder



Thunder is caused by the rapid expansion of air surrounding the path of a lightning bolt. To judge how close the lightning bolt is, count the seconds between the flash and the thunderclap. Each second represents about 300 meters.

Mist



Mist is made up of tiny water droplets suspended in the air. When warmer water in the air is rapidly cooled, it changes from invisible gas to tiny visible water droplets. The only difference between mist and fog is that mist is less dense.

Wind



Wind is the movement of gases or air, usually from a place of high pressure to low pressure. Depending on their strength, winds can be classified as a breeze, gale, storm or hurricane. Wind can provide energy through the use of wind turbines.

Hurricane



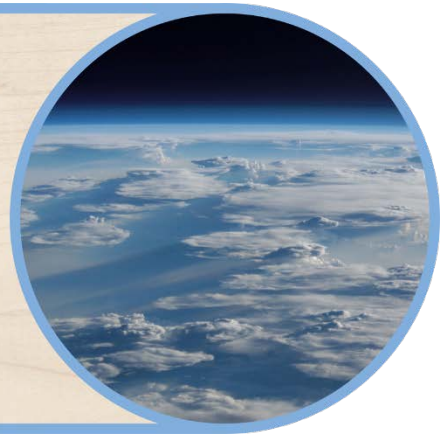
A hurricane is a tropical cyclone storm with wind speeds ranging from 74 mph to over 160 mph. Hurricanes are extremely large and can have a diameter up to 500 miles across!

The Atmosphere Aviator Classrooms: Atmosphere Elements

WHAT DOES OUR ATMOSPHERE DO?

Earth's five-layered atmosphere provides more than just the air we breathe. It also serves as a buffer that keeps us safe from meteorites and harmful radiation. The lowest layer is the troposphere and although it only extends 11 miles high, it provides most of our weather and contains four-fifths of the earth's air.

The atmosphere is 78% nitrogen, 21% oxygen, and a 1% mix of argon, carbon dioxide, helium, and neon.



WHAT IS THE GREENHOUSE EFFECT?

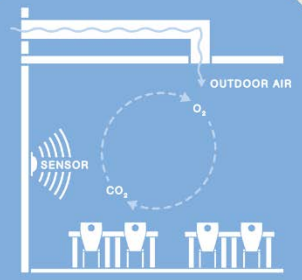
Greenhouse gases in the atmosphere absorb heat radiated by the earth. This prevents heat from disappearing into space and keeps the earth warm enough to sustain life. Greenhouse gases include carbon dioxide, methane, and nitrous oxide. Too much of these gases can intensify the warming effect on the planet.

Earth is sometimes called the Goldilocks Planet because its climate is "just right."



KEEP THE AIR CLEAN

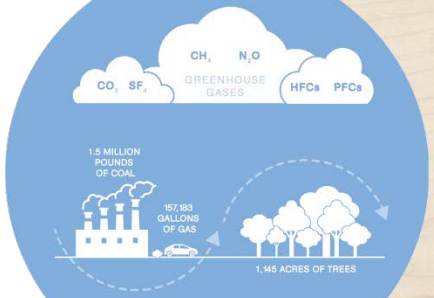
You breathe about 2 gallons of air every minute or 3,400 gallons of air each day! Taking the bus, carpooling, walking, or riding a bike to school can reduce air pollution from cars and help keep the air clean!



HOW DOES OUR SCHOOL GET CLEAN, FRESH AIR?

There are 58 sensors in our school that measure carbon dioxide, a gas released by breathing. When too much carbon dioxide builds up in any one room, the sensors call for outdoor air to be provided. This air is first filtered and de-humidified. A classroom of 20 people can exhale enough carbon dioxide to require fresh air after 30 minutes.

197 solar panels are needed to offset the total energy usage of our school's outdoor air system.



OUR SCHOOL'S CARBON FOOTPRINT

Compared to a typical elementary school of the same size, Discovery prevents 1,397 metric tons of carbon from being released into the atmosphere annually. That's the same amount of carbon that is released by burning 1.5 million pounds of coal or 157,183 gallons of gas. It would require 1,145 acres of trees to absorb

"Carbon Footprint" is the amount of carbon emissions by a country, organization, or individual person.

EATING LOCAL HELPS

It is estimated that 13% of U.S. greenhouse gas emissions result from the production and transport of food. You can help reduce carbon emissions by choosing to eat locally grown foods.

The Atmosphere Aviators: Atmosphere, Air, & Conservation



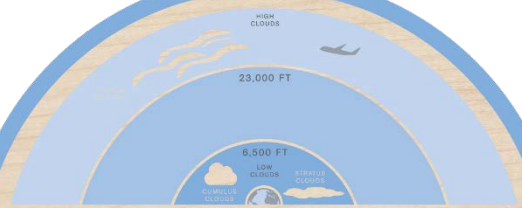
AMELIA EARHART

Amelia Earhart was an American aviation pioneer and author. Earhart's public career lasted less than a decade, from 1928 to 1937, but she used her fame to promote two causes important to her: the advancement of commercial aviation and the advancement of women. She became the first woman to fly solo across the Atlantic Ocean in 1932 and set many other records throughout her career.



CHUCK YEAGER

Chuck Yeager is a retired brigadier general in the United States Air Force and record-setting test pilot. Yeager was a World War II fighter pilot ace and later commanded fighter squadrons. His flying career spans more than 60 years and has taken him to every corner of the globe. On October 14, 1947, he became the first human to officially break the sound barrier when he flew the experimental Bell X-1 rocket 670 mph.



LUKE HOWARD

Luke Howard was a British manufacturing chemist and meteorologist. Howard was a pharmacist by profession, but meteorology was his hobby. His fascination with the weather led him to devise the classification of clouds that still remains in international use today. In December 1802, he proposed that every cloud belonged to one of three principal families, to which he gave the Latin names: cirrus, cumulus, and stratus.



WILBUR & ORVILLE WRIGHT

Wilbur and Orville Wright were American inventors and pioneers of flight. Considered the fathers of modern aviation, they developed innovative technology that changed the way we view our world. In 1903, the Wright brothers piloted the first powered airplane flight. Two years later, they built and flew the first fully practical airplane in Kitty Hawk, North Carolina. The same types of controls they devised then are still used today.

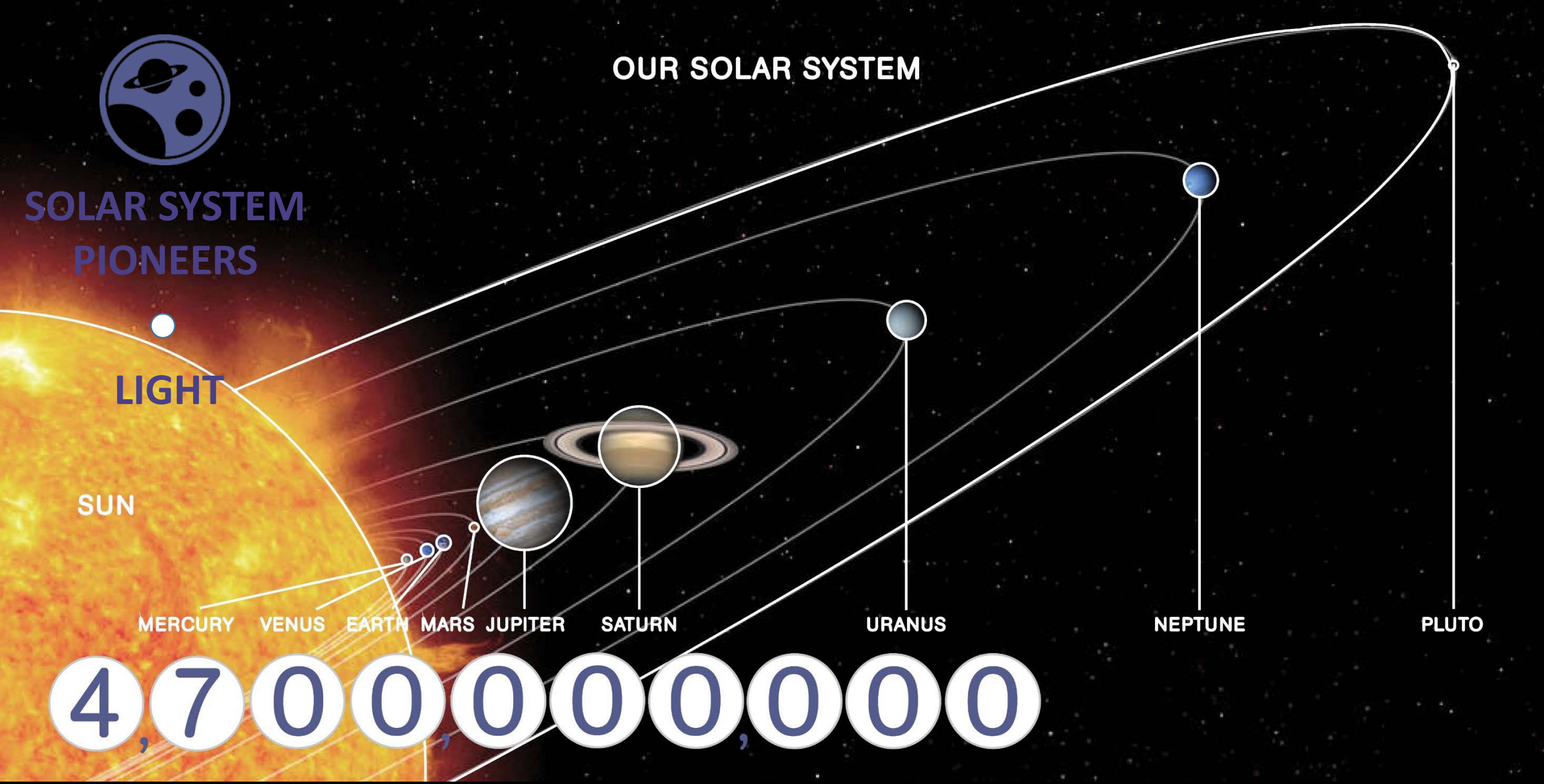
The Atmosphere Aviator Explorers



THE WOOD IN YOUR SCHOOL

There are Virginia species of trees used all throughout your school! This wood came from sustainably maintained forests because we need to protect our trees.

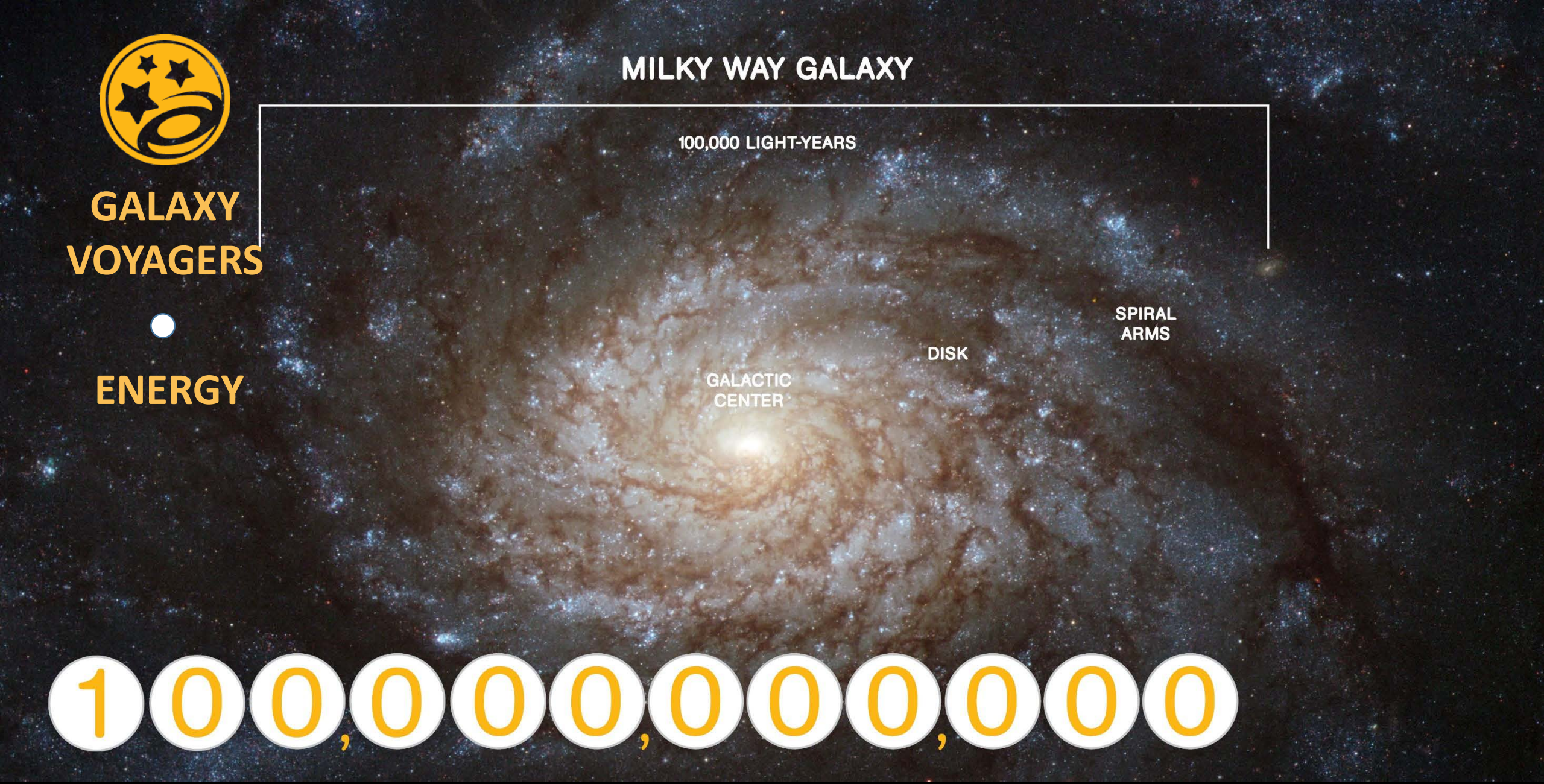
Can you identify the different wood patterns and the shapes of their leaves?



There are 4,700,000,000 miles from Earth to the edge of our Solar System - Pluto


SOLAR SYSTEM
VMDO


VMDO



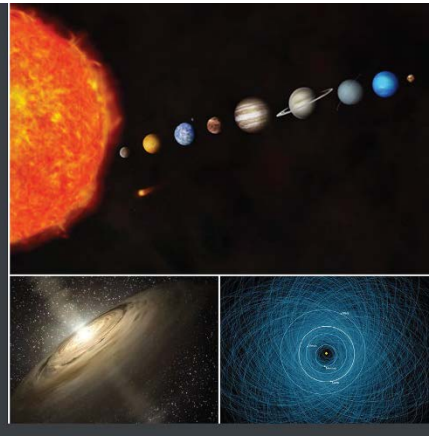
There are over 100,000,000,000 stars in our Milky Way Galaxy

Star



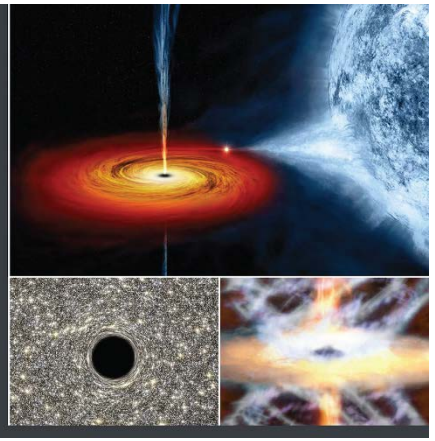
A star is a big ball of gas which gives off both heat and light created from nuclear fusion. The Sun is the only star in our Solar System, but there are approximately 200 billion stars in the Milky Way Galaxy!

Solar System



A solar system refers to a star and all the objects that travel in orbit around it. So far, astronomers have found more than 500 solar systems and are discovering new ones every year. With the estimated 200 billion stars in our galaxy, each of those stars could have its own planetary system!

Black Hole



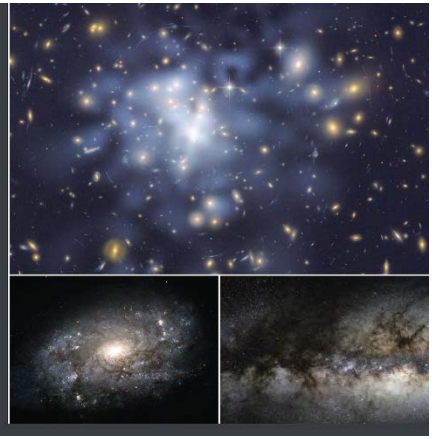
A black hole is a large amount of matter packed into a very small area resulting in a gravitational field so strong that nothing, not even light, can escape. Because a black hole is indeed "black," it is impossible for us to see. In order to locate one, we have to look for its effects on the nearby environment.

Nebula



A nebula is an enormous cloud of dust and gas. Considered the basic building blocks of the universe, nebulae contain the elements that make up stars and solar systems. They are also among the most beautiful objects in the universe, glowing with rich colors and swirls of light.

Dark Matter



Dark matter is an unknown kind of matter that cannot be seen with a telescope but accounts for most of the matter in the universe. Scientists believe that 90% of our galaxy's mass consists of dark matter, which gives it a mysterious halo.

The Galaxy Voyager Classrooms: Milky Way Galaxy Elements

WHAT IS SOLAR POWER?

Solar power is energy from the sun that is converted into thermal or electrical energy. Solar energy is the cleanest and most abundant renewable energy source available. Enough sunlight reaches the earth's surface each hour to satisfy the world's energy demands for an entire year!

Plants use solar energy to create chemical food in the form of photosynthesis!



EARTH'S NATURAL ENERGY SOURCE

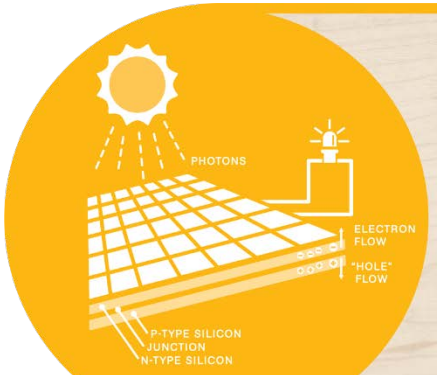
"Geo" means "from the earth" and "thermal" means "heat." Geothermal refers to a type of energy found in the earth that can be captured to provide clean and renewable energy. Geothermal energy is very energy-efficient. Almost none of the energy used is wasted, so it helps keep energy bills very low!

Have you ever seen a volcano or a geyser? If so, then you've seen geothermal energy in action!



FLICK THE SWITCH

About 30% of energy used in buildings and homes is used inefficiently or unnecessarily! Make sure you turn off lights when you leave the room and unplug powered off electronics to save energy at home and school.



OUR SCHOOL USES SOLAR PANELS TO PRODUCE ENERGY

There are 1,710 solar panels on our roof, which produce 618,000 kilowatt-hours of electricity annually. As sunlight moves through a photovoltaic cell, the photons in light are absorbed by the bottom of the panel and push electrons to the topside. This movement of particles creates an electrical current similar to a battery.

In full summer sunshine, the solar panels produce enough energy to power 62,000 LED light bulbs!



OUR SCHOOL EXCHANGES HEAT WITH THE EARTH

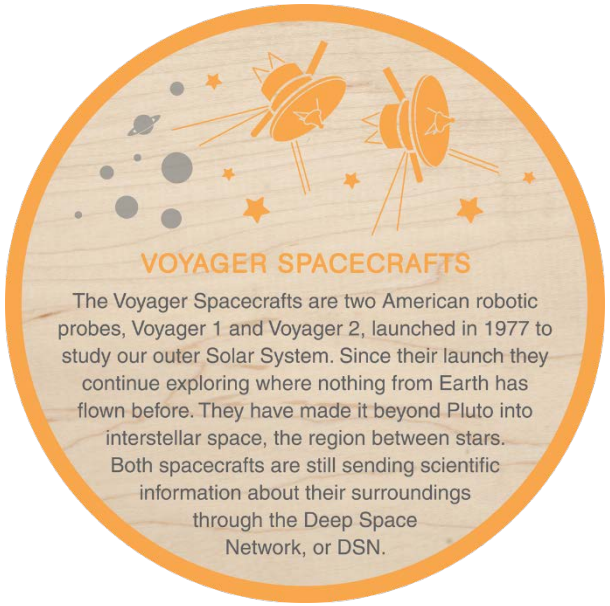
A large system of 70 geothermal pipes circulates 12,500 gallons of water between our school and 500' deep underground wells. Heat pumps move heat back and forth between this water and our school's air. When cool air is needed, heat is taken from the air and transferred to the water. The heat pumps work in reverse when warm air is needed.

787 solar panels are needed to offset the total energy used to provide conditioned air to our school.

SAVING ENERGY IS 'COOL'

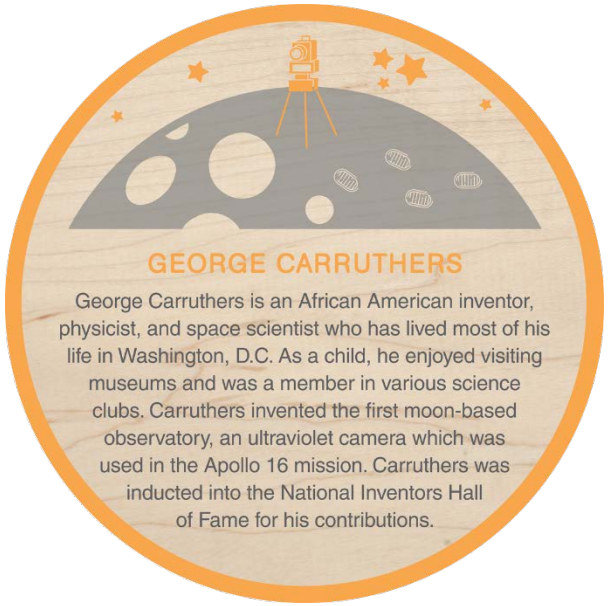
Cooling and heating costs make up about 50% of an average U.S. home's total energy bill. Lower the temperature on your thermostat in the winter and raise it in the summer when no one is home to save energy and money!

The Galaxy Voyager Factoids: Galaxy, Energy, & Conservation



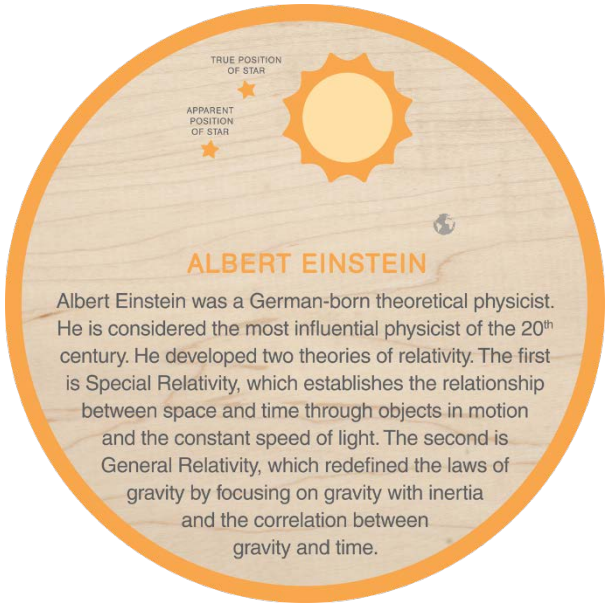
VOYAGER SPACECRAFTS

The Voyager Spacecrafts are two American robotic probes, Voyager 1 and Voyager 2, launched in 1977 to study our outer Solar System. Since their launch they continue exploring where nothing from Earth has flown before. They have made it beyond Pluto into interstellar space, the region between stars. Both spacecrafts are still sending scientific information about their surroundings through the Deep Space Network, or DSN.



GEORGE CARRUTHERS

George Carruthers is an African American inventor, physicist, and space scientist who has lived most of his life in Washington, D.C. As a child, he enjoyed visiting museums and was a member in various science clubs. Carruthers invented the first moon-based observatory, an ultraviolet camera which was used in the Apollo 16 mission. Carruthers was inducted into the National Inventors Hall of Fame for his contributions.



ALBERT EINSTEIN

Albert Einstein was a German-born theoretical physicist. He is considered the most influential physicist of the 20th century. He developed two theories of relativity. The first is Special Relativity, which establishes the relationship between space and time through objects in motion and the constant speed of light. The second is General Relativity, which redefined the laws of gravity by focusing on gravity with inertia and the correlation between gravity and time.



GALILEO GALILEI

Galileo Galilei was an Italian Renaissance astronomer, physicist, engineer, philosopher, and mathematician. Galileo has been called the “father of observational astronomy,” the “father of modern physics,” and the “father of science.” He constructed a telescope which allowed him to confirm the phases of Venus, discover the four largest moons of Jupiter (named the Galilean moons), and observe sun spots.

The Galaxy Voyager Explorers





Solar Lab outside the Galaxy corridor

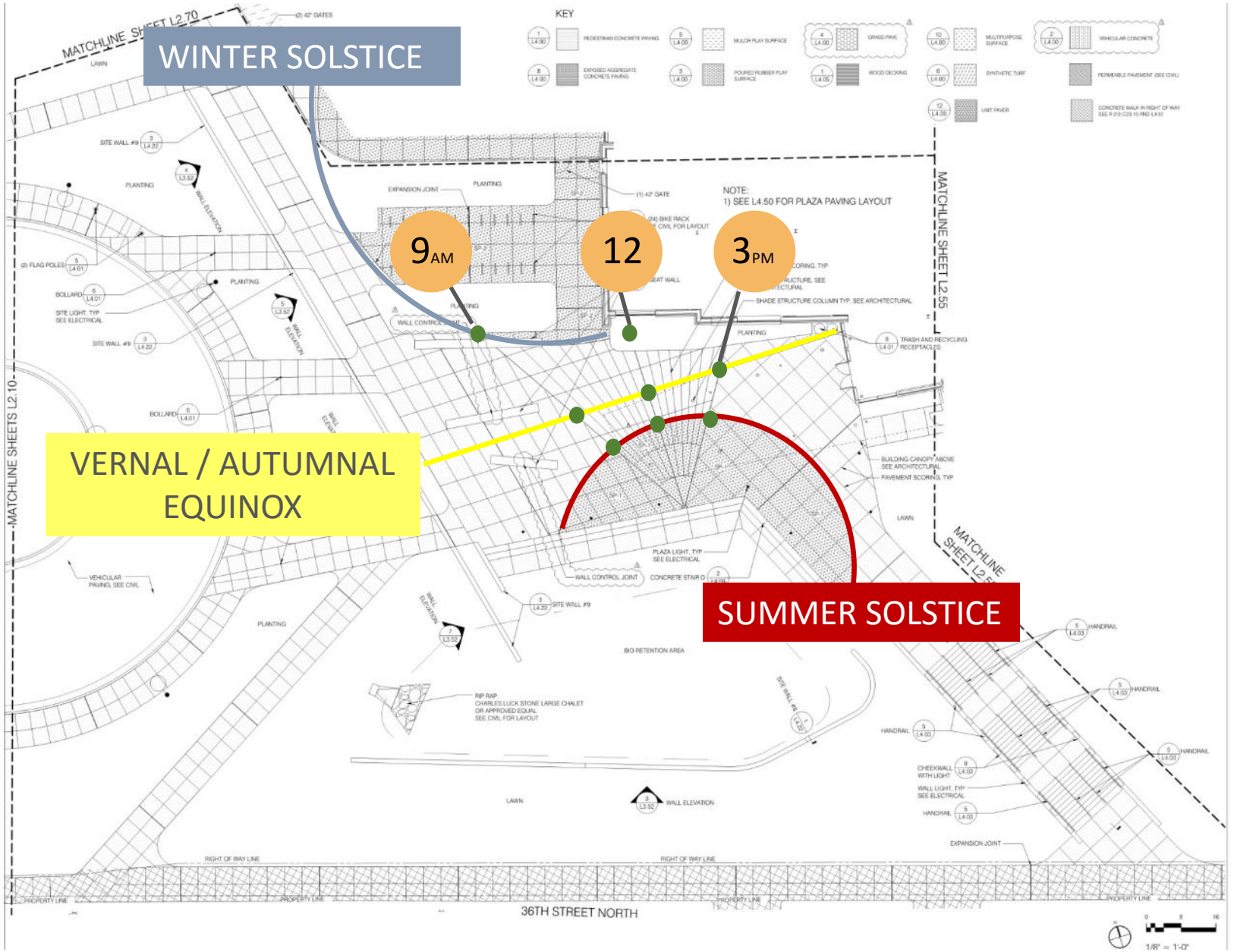

DISCOVERY EXPLORERS
EXPLORING YOUR EXPANDING WORLD
2
2ND FLOOR SKY
200000000000
4,700,000,000
1969000000
1
1ST FLOOR EARTH
85100000
23400
28


DISCOVERY EXPLORERS
EXPLORING YOUR EXPANDING WORLD
2
1
DEN


GALAXY VOYAGERS







Solar Calendar = Time of Day + Time of Year







HOME

10:35 AM | TUESDAY, JUNE 21 2016

89°/67°



TODAY'S HIGH 112 kW

TODAY'S LOW 80 kW

LIVE POWER CONSUMPTION



TODAY'S HIGH 112 kW

TODAY'S LOW 80 kW

LIVE POWER PRODUCTION



TODAY'S HIGH +10 kW

TODAY'S LOW -15 kW

LIVE NET POWER

DISCOVER DISCOVERY

EVALUATE THE **LIVE BUILDING DATA**

TRAVEL THE **VIRTUAL TOUR**

CHECK OUT **DISCOVERY'S WEBSITE**

LEARN MORE ABOUT YOUR **ECO ACTION**

EXPLORE YOUR **EXPANDING WORLD**

HOME

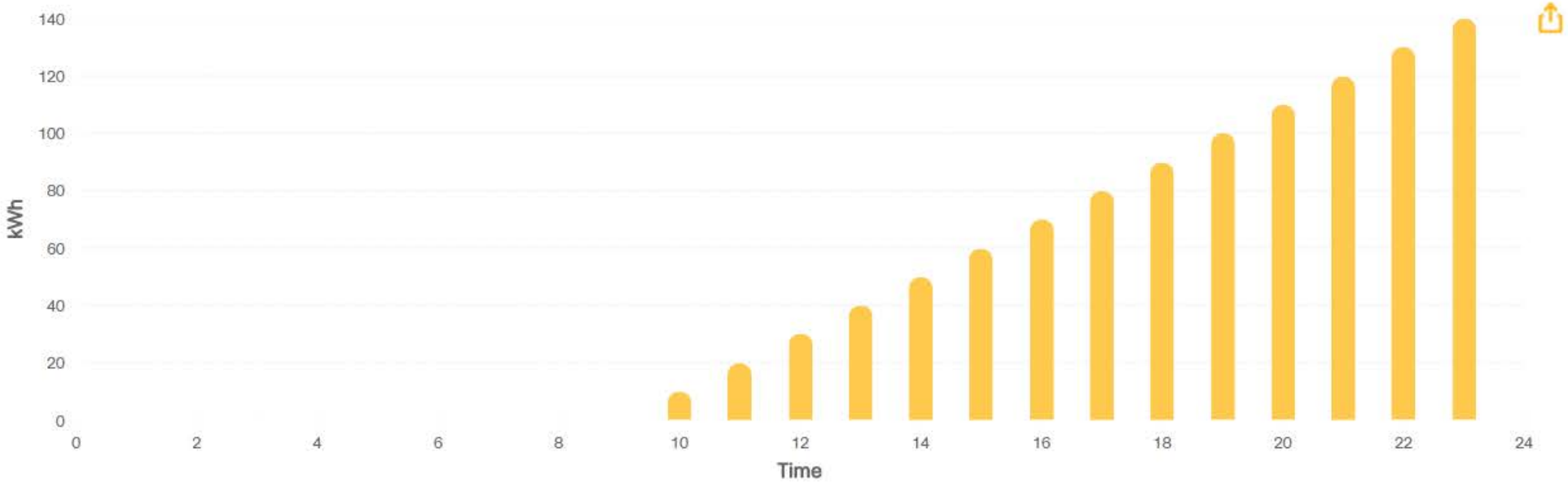
ENERGY CONSUMPTION

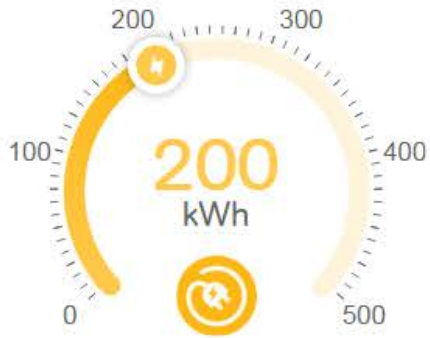
9:57 AM | SATURDAY, OCTOBER 1 2016

54°/66°

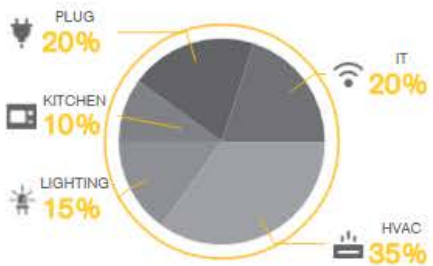
ALL HVAC LIGHTING KITCHEN PLUG IT

DAY WEEK MONTH YEAR SCHOOL YEAR





TOTAL ENERGY CONSUMPTION



ENERGY CONSUMPTION BREAKDOWN

WHAT DOES THIS DATA MEAN?

This shows the total amount of energy used to operate Discovery Elementary today. This means all energy required to heat, cool and light the building, store and prepare food, operate technology, and power everything plugged into outlets.

PERCENT CHANGE

(from previous period)

2.8%

EQUIVALENTS

Typical Houses	2.3
Typical 60 watt LED Bulbs	22
Typical Smartphones charged	112

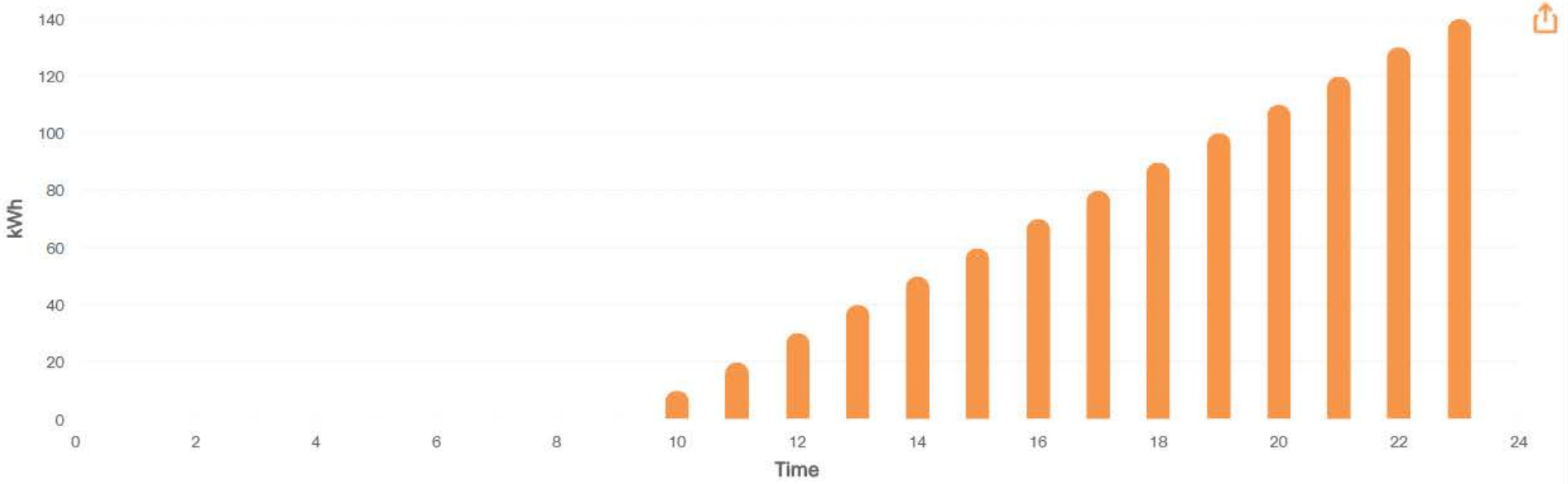
HOME

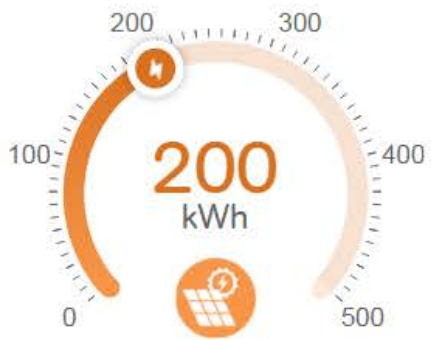
ENERGY CONSUMPTION

9:57 AM | SATURDAY, OCTOBER 1 2016

54°/66°

DAY WEEK MONTH YEAR SCHOOL YEAR





TOTAL ENERGY PRODUCTION

WHAT DOES THIS DATA MEAN?

For business professionals caught between high OEM price and mediocre print and graphic output, there's a solution: Business Express's Eclipse line of compatible laser toner cartridges that meet or exceed OEM quality for 20% less than typical OEM price.

PERCENT CHANGE

(from previous period)

0.5%

EQUIVALENTS

Typical Houses	1.3
Typical 60 watt LED Bulbs	8
Typical Smartphones charged	2

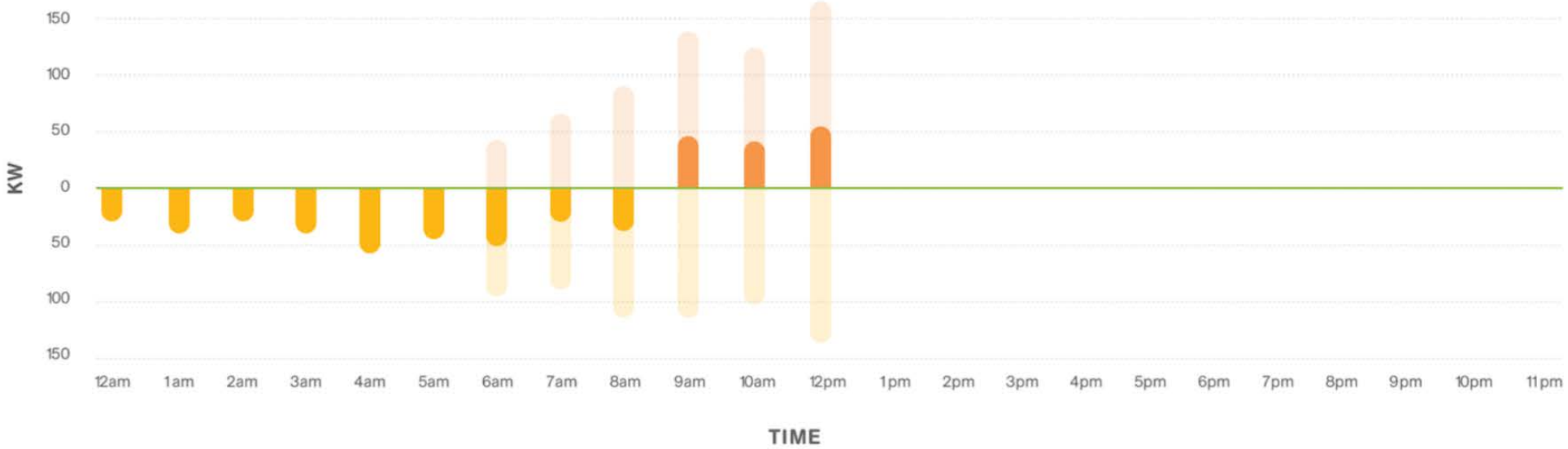
HOME

ENERGY CONSUMPTION

9:57 AM | SATURDAY, OCTOBER 1 2016

54°/66°

DAY WEEK MONTH YEAR **SCHOOL YEAR**





TOTAL ENERGY PRODUCTION

WHAT DOES THIS DATA MEAN?

This data represents all the energy than goes into powering Discovery! Everything from bringing fresh air to making sure the lights come on.

PERCENT CHANGE

(from previous period)

2.8%

EQUIVALENTS

Typical Houses	2.3
Typical 60 watt LED Bulbs	22
Typical Smartphones charged	112



You feel the energy when you walk in, but what does it mean for learning?



When Collaboration Becomes The Norm



Expanding The Notion of Team



A walk down the hallway breaks down the idea of “my isolated room"



Not 5 third grade classrooms, but 5 third grade teachers teaching all



Collaboration becomes the norm because design has stripped us of isolation


COLLABORATION COMMONS
Introduction
What is a bioretention garden?



What is a classroom?




SOLAR SYSTEM PIONEERS



John Re
@HeyJReDiscovery

Following

human graph on bike walk to school day - Ms Cs 2nd grade @DiscoveryESPTA @DiscoveryAPS @ATPcommutes @MissCoulouris





Sylvia
@SylviaKinder

Following

Natural light,atrium windows are Awesome to 👀 students @RussoErin @vmdoarchitects @PhilipDonovan





Authentic learning

DISCOVERY ELEMENTARY
ECO-ACTION

WE WILL DO OUR BEST TO MAKE OUR EARTH HEALTHIER & TO MAKE OUR SCHOOL A BETTER PLACE

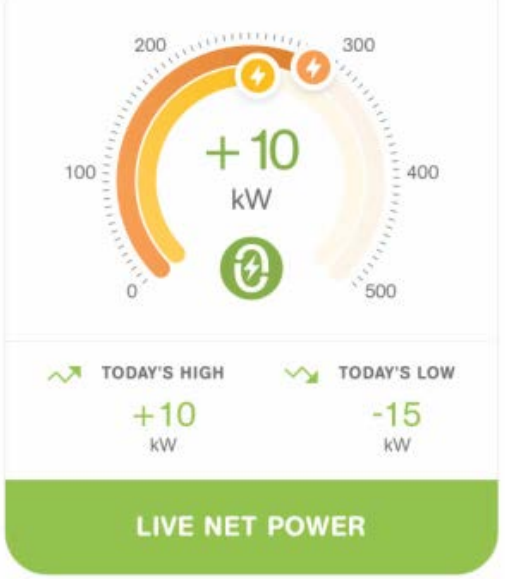


Authentic learning



Weighing trash | Food donations | Cardboard challenge | Tour guides







Powerful, purposeful learning



Axis, orbit, equator, math, science, history… and the Pantheon!



This is their school | Student ownership of their learning


GALAXY VOYAGERS
Mrs. Zarkowsky
Levi.A
Peter Matthews
Brady Ulery
Nathan Reiser
Annemarie Clark



The Place To Be at 3:41



Limitless Possibilities



Discovery



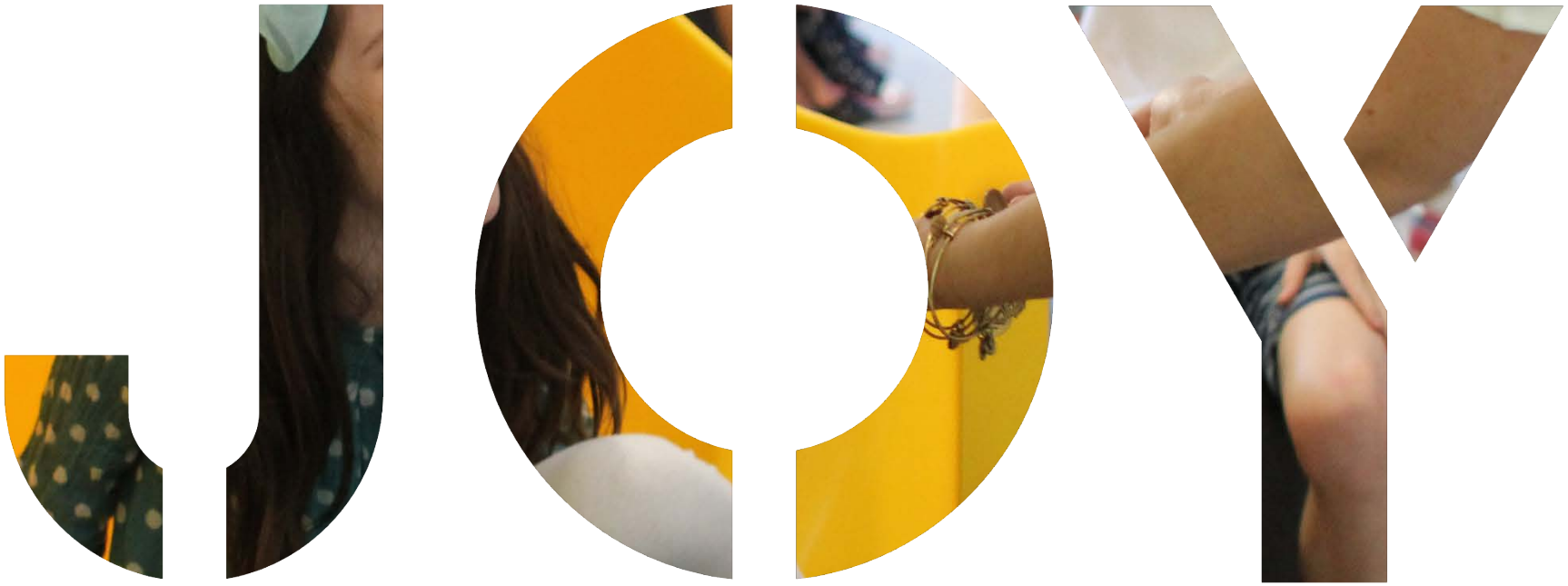
By Anna M on 2 May 2016

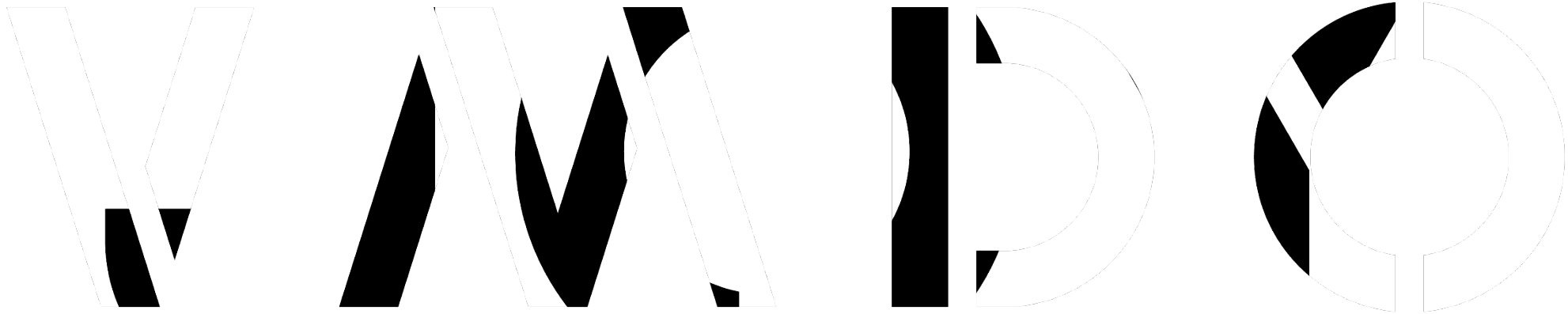
I am a bird
Who flew out of a wooden house
Who flew through the whispering leaves of the forest
Who soared over the depths of the ocean
Then I went into the atmosphere
Spinning through sparkling snow
And flew into the solar system
Dancing through twinkling stars
And flew into the galaxy
where I thought
I came from a backyard




JOHN MUIR
John Muir was a Scottish-American naturalist, author, environmental philosopher, and advocate of preserving and protecting nature. As a wilderness explorer, he is known for his exciting adventures in search of nature's beauty. As a preservationist, he taught people the importance of experiencing and caring for our natural heritage. He has been called "The Father of our National Parks" and helped form the Sierra Club.


GROUNDHOG BURROW


JOY




Arlington
Public
Schools


CONSULTING
cmta
ENGINEERS

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