Teaching Sustainable Energy in the School

Caribbean Energy Education and Awareness Programme

Organization of American States

SUSTAINABLE ENERGY FOR CARIBBEAN EDUCATORS IN THE BAHAMAS: Teaching Sustainable Energy in the Classroom

August 21st to 22nd 2013

Ministry of Education
Conference Center

SUSTAINABLE ENERGY FOR CARIBBEAN EDUCATORS IN THE BAHAMAS: Teaching Sustainable Energy in the Classroom

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What is KidWind?

The KidWind Project is a team of teachers, students, engineers and practitioners exploring the science behind wind energy in classrooms around the US. Our goal is to introduce as many people as possible to the elegance of wind power through hands-on science activities which are challenging, engaging and teach basic science principles.

SUSTAINABLE ENERGY FOR CARIBBEAN EDUCATORS IN THE BAHAMAS:
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DAY 1

8:00 AM	**Welcome Remarks** Representative Ministry of Education (TBC)	**Introduction to the Workshop** Yvette Trecco, OAS Bahamas (TBC)	**Agenda overview and Pre-Workshop evaluations** Keith Etheridge, Kidwind

UNDERSTANDING ENERGY, ELECTRICITY & EFFICIENCY

9:15 AM	**ACTIVITY**	Understanding Forms and Sources of Energy (WindWise Lessons 1) *Forms of energy, sources of energy, and energy transformations through activities, demonstrations and discussion.*
10:15 AM	**LECTURE**	*Energy Basics (WindWise Lesson 2)* Sources of energy, conservation & efficiency, phantom loads, etc.
10:45 AM	***COFFEE BREAK***	
11:00 AM	**ACTIVITY**	*How Does a Generator Work? (WindWise Lesson 9)* *Discussion on Faraday's law, building simple electric generators. How design variables affect electricity production and try to light a small light bulb?*
11:30 AM	**ACTIVITY**	*What is the Cost of Inefficiency? (WindWise Lesson 3)* Learn about work, energy, and power and explore how using electrical appliances and devices can have economic and environmental costs. A Kill-a-watt meters will be used to measure and compare various devices.
12:15 PM	***LUNCH***	

UNDERSTANDING & EXPERIMENTING WITH WIND POWER

1:00 PM	**ACTIVITY**	How Does a Windmill Work? This lesson helps teachers understand how a windmill captures the energy of the wind and transforms it into usable mechanical energy, which is the basis for understanding modern wind turbines. This activity covers standards related to the engineering design process and the scientific method to design, build, test, and improve their models.
2:00 PM	**ACTIVITY**	*Constructing Electrical & Weightlifting Wind Turbines* Teachers will construct simple classroom wind turbines. During this process we cover topics related to electromagnetism, energy transformations and kinetic and potential energy.
2:30 PM	**LECTURE**	*Wind Energy Basics – History, Technology, Impacts, and Classroom applications*
3:30 PM	***END DAY 1***	

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DAY 2

8:00 AM	**Review, Agenda, Questions** Keith Etheridge, Kidwind	
9:00 AM	**ACTIVITY**	Designing Wind Turbine Blades Using the turbines they have recently constructed teachers will explore the science of wind turbine blade design These activities use WindWise Lessons 8,10,11
10:30 AM	***COFFEE BREAK***	
	UNDERSTANDING & EXPERIMENTING WITH SOLAR THERMAL & PV	
10:45 AM	**LECTURE**	Solar Power Basics – Solar Thermal and Photovoltaics
11:30 AM	**ACTIVITY**	Solar Thermal Experiments Teachers will build solar collectors and measure temperature change in water
12:00 AM	***LUNCH***	
12:45 PM	**ACTIVITY**	*Photovoltaic Experiments* *Teachers will perform experiments with small solar panels, such as: Sun angle experiments, wiring different types of circuits (series vs. parallel), powering load devices (motors, lights, water pumps), and building solar powered cars.*
1:30 PM	**DISCUSSION**	*Can Renewable Energy Power Our Classroom?* *Teachers will conduct an energy audit of the classroom to find out how much power is used. This is an important bridge as the teacher move to their offsite tours in the afternoon.*
2:30 PM	***CLOSING: Questions and Post-Workshop Evaluations***	
2:00 PM		***OFFSITE TOUR/GUEST LECTURES (Tentative)***

Why teach energy?

Economy

National Security

Environment

Better consumer decision making

Because it's in your standards

Humanity's Top Ten Problems for next 50 years*

1. **ENERGY**
2. **WATER**
3. **FOOD**
4. **ENVIRONMENT**
5. **POVERTY**
6. **TERRORISM & WAR**
7. **DISEASE**
8. **EDUCATION**
9. **DEMOCRACY**
10. **POPULATION**

2003	**6.5**	**Billion People**
2050	**8-10**	**Billion People**

***Dr. Richard Smalley, Rice University**
1996 Nobel Prize

Why Renewable Energy & Efficiency In The Bahamas?

Set up our Children To Make Better Decisions

- The Nassau Guardian – March 20, 2012

For decades, we in The Bahamas have realized that, in a lot of cases, education can determine success.

For many of us, it has been a means to escape poverty, open up new opportunities and expand our world.

Investment in educating Bahamian students about energy efficiency, renewable energy and energy conservation can lead to a generation that better understands how to harness available resources and can transform us into a population that consumes energy in a responsible way and would lead to local innovations of processes and products that are best suited for our economy and for our environment.

Any effort to transform our economy into a greener one must engage these young persons and the earlier the better.

Teachers have the opportunity to equip them with the skills to make good decisions around the use of energy.

Such programs target all levels in our education in a language that they can understand.

It would not involve the addition of a new subject but would be integrated the existing curriculum and would reflect the realities of our island economy and climate.

Learning would take place through demonstrating how to harness the wind to provide useful work such as to turn wheels, for example, and explain how a see saw, while used for fun, is really a simple machine.

Children would learn that different types of light bulbs come in different shapes and learn which ones help save on energy use by producing more heat than light.

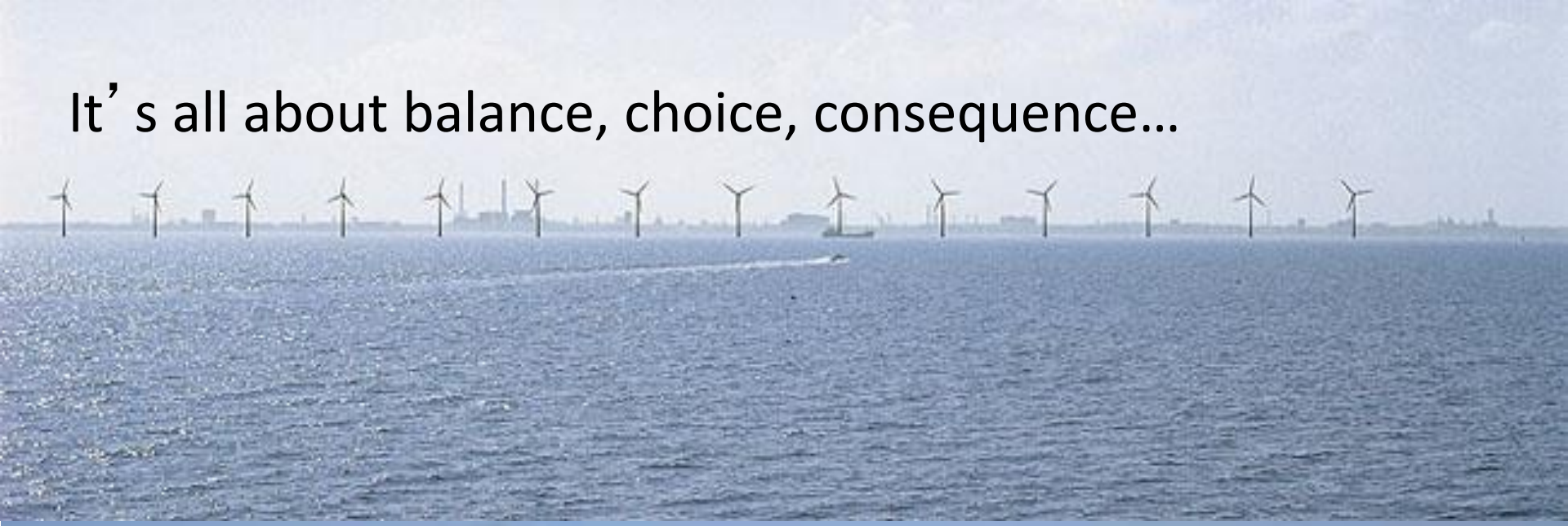
They would learn how simple acts like turning off lights and televisions are important in reducing consumption of electricity.

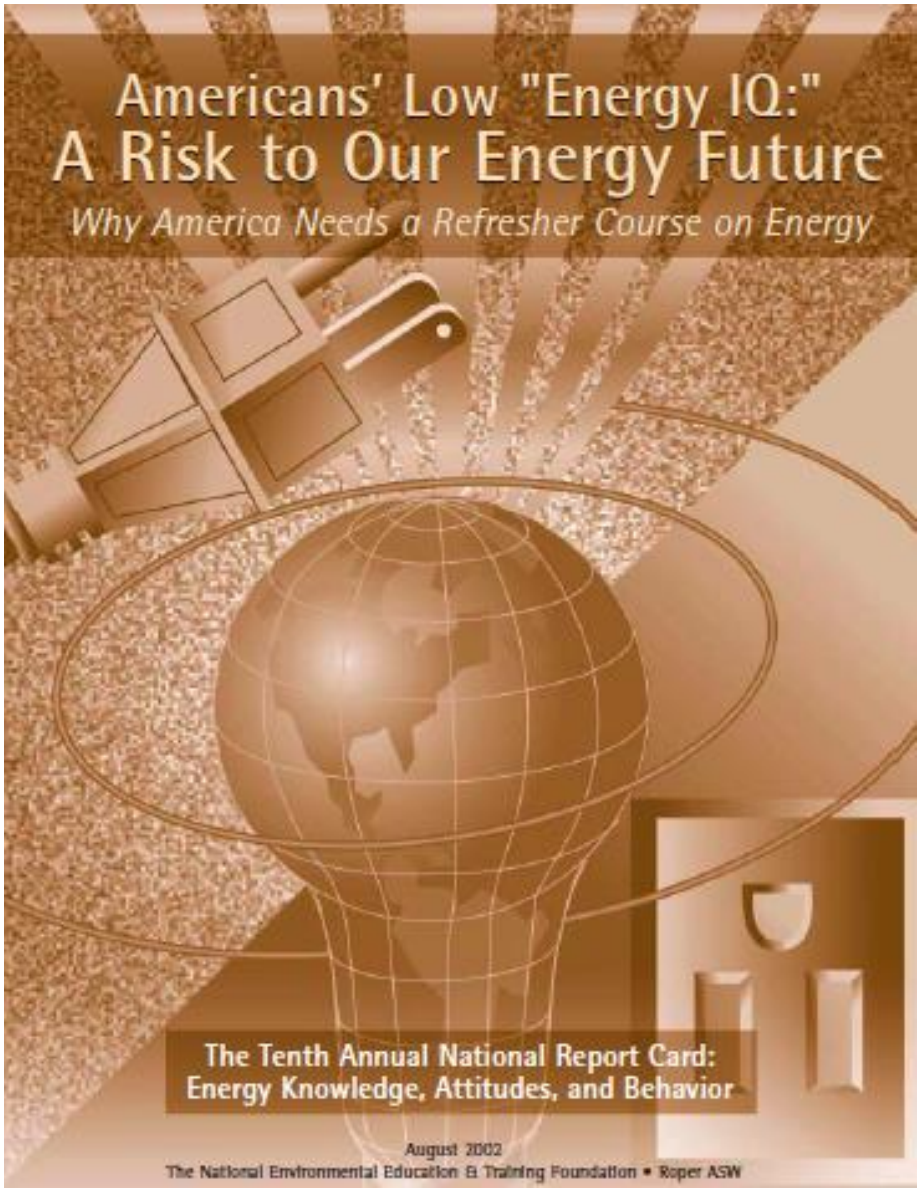
The importance of demystifying energy and science for our children cannot be understated. Indeed these children will be the ones to deliver a green tourism product, sustainable water production, production of algae to produce oil and other innovations that have yet to be considered.

Science Literacy

- In the U.S., climate change is still a "debate"
- Recent studies have shown that 50% of Americans cannot name an example of *renewable energy*.
- Understanding basics of energy and electricity
  - What is a watt / kilowatt / kilowatt-hour?
- How can we "conserve" energy if we don't understand basic energy concepts?

It’s all about balance, choice, consequence…





NEED
National Energy Education Development

Why is teaching energy important?

75% of Americans rate themselves as having "a lot" or "a fair amount" of knowledge about energy

A Roper Report in 2001 put Americans to the test…

Reality Check

Only one in eight adult American's (12%) has a passing understanding of basic energy information.

U.S. Energy Consumption by Source, 2009

BIOMASS 4.1%
renewable
Heating, electricity, transportation

HYDROPOWER 2.8%
renewable
Electricity

GEOTHERMAL 0.4%
renewable
Heating, electricity

WIND 0.7%
renewable
Electricity

SOLAR & OTHER 0.1%
renewable
Light, heating, electricity

PETROLEUM 37.3%
nonrenewable
Transportation, manufacturing

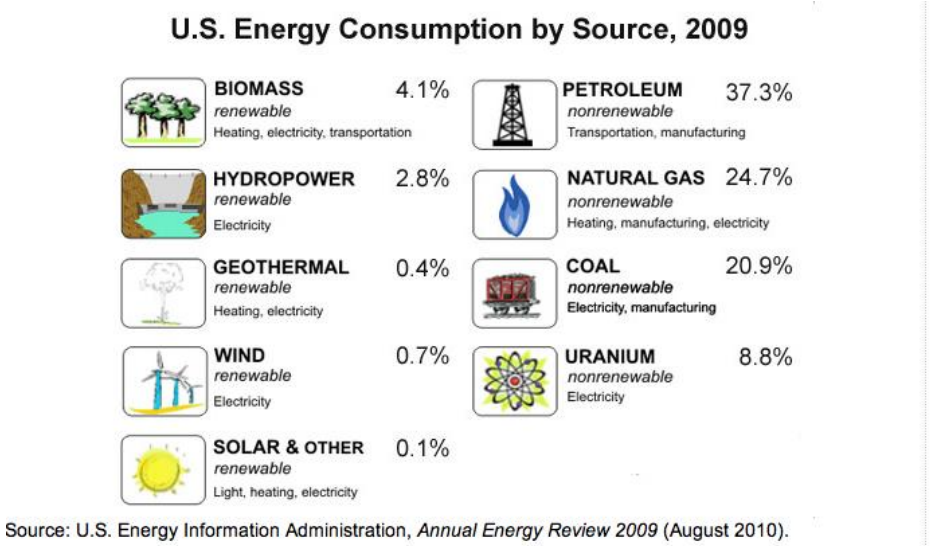
NATURAL GAS 24.7%
nonrenewable
Heating, manufacturing, electricity

COAL 20.9%
nonrenewable
Electricity, manufacturing

URANIUM 8.8%
nonrenewable
Electricity

Source: U.S. Energy Information Administration, *Annual Energy Review 2009* (August 2010).

WHY IS ELECTRICITY NOT LISTED IN THE TABLE?



Source: U.S. Energy Information Administration, *Annual Energy Review 2009* (August 2010).

Generators and How We Get Electricity

What is Electricity?

Electricity is energy transported by the motion of electrons

We do not make electricity, we CONVERT other energy sources into electrical energy

Conversion is the name of the game

Electric Generator

Mechanical Energy → G → Electrical Energy

Electric Generator

Mechanical Energy → G → Electrical Energy

One simple way to think about a generator is to imagine it acting like a pump pushing water through a pipe. Only instead of pushing water, a generator uses through a pipe. Only instead of pushing water, a generator uses a magnet to push electrons along. This is a slight oversimplification, but it paints a helpful picture of the properties at work in a generator. A water pump moves a certain number of water molecules and applies a certain amount of pressure to them. In the same way, the magnet in a generator pushes a certain number of electrons along and applies a certain amount of "pressure" to the electron.