

White Nail

Radio Transmitter: Billion Dollar Savings Through Energy Efficiency

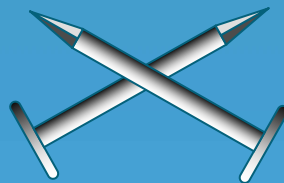
Dr. Stuart Dickinson

Dr. Donald H. Steinbrecher

Naval Undersea Warfare Center, Newport, RI

Stuart.dickinson@navy.mil

May 10, 2011



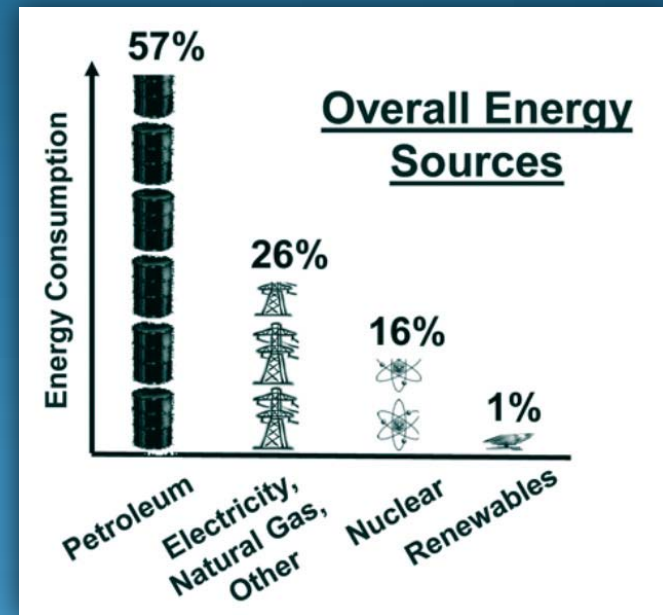
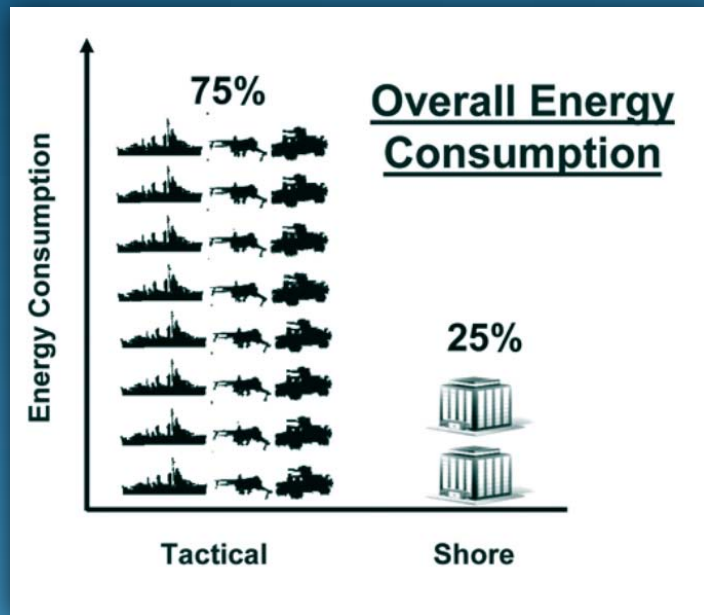
Approved for Public Release:
distribution is unlimited

**Environment,
Energy Security
& Sustainability
Symposium & Exhibition**



Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 10 MAY 2011		2. REPORT TYPE		3. DATES COVERED 00-00-2011 to 00-00-2011	
4. TITLE AND SUBTITLE White Nail. Radio Transmitter: Billion Dollar Savings Through Energy Efficiency				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Undersea Warfare Center Newport, 1176 Howell Street, Newport, RI, 02841-1708				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES Presented at the NDIA Environment, Energy Security & Sustainability (E2S2) Symposium & Exhibition held 9-12 May 2011 in New Orleans, LA.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 26	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Today: Naval Energy Use



Source: RADM Philip H. Cullom, Chapter 4.2 Climate and Energy Symposium 2010, Proceedings, hosted by JHU/APL and CNA

“Every day, the Navy consumes ... 20,000 megawatt hours of electricity ashore “ Navy energy Vision, P2
= 7.3 Billion kilowatt hours per year

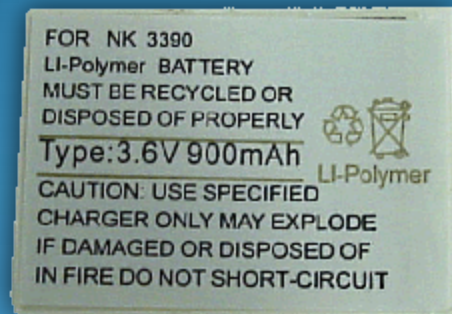
Efficiency and Conservation Ashore:
By 2020, the Navy will increase
efficiency and reduce overall energy
consumption ashore by 50 percent

CNO, Navy Energy Vision, P 10

White Nail Vision



Your Cell Phone



Cell Infrastructure

250,000 Towers in USA



Radio Frequency Power



Grid Power

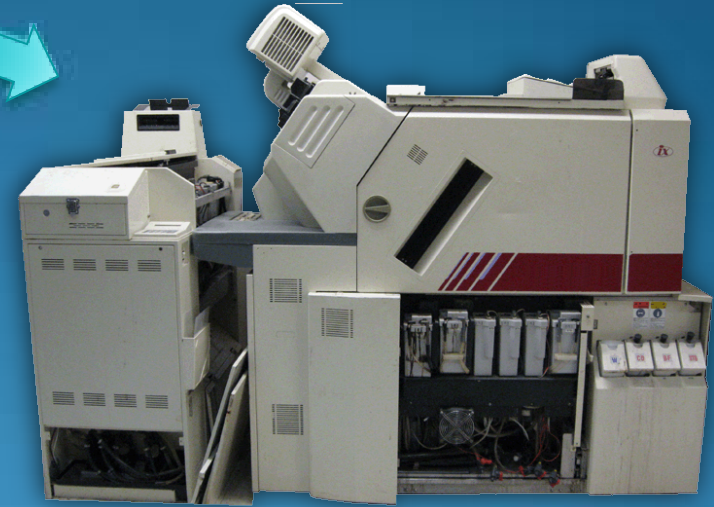
208V 3 Phase



Cooling Power



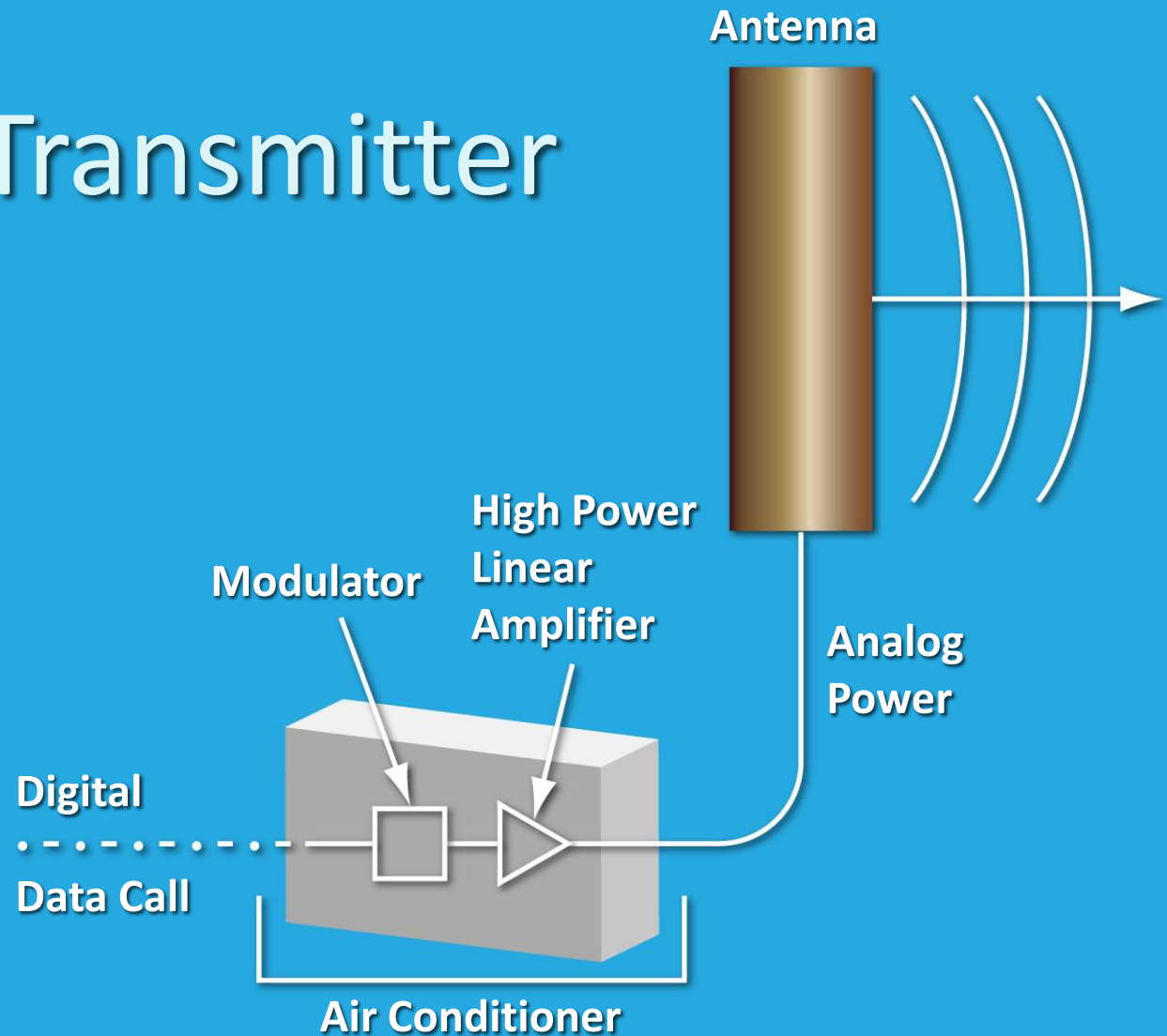
Film Camera



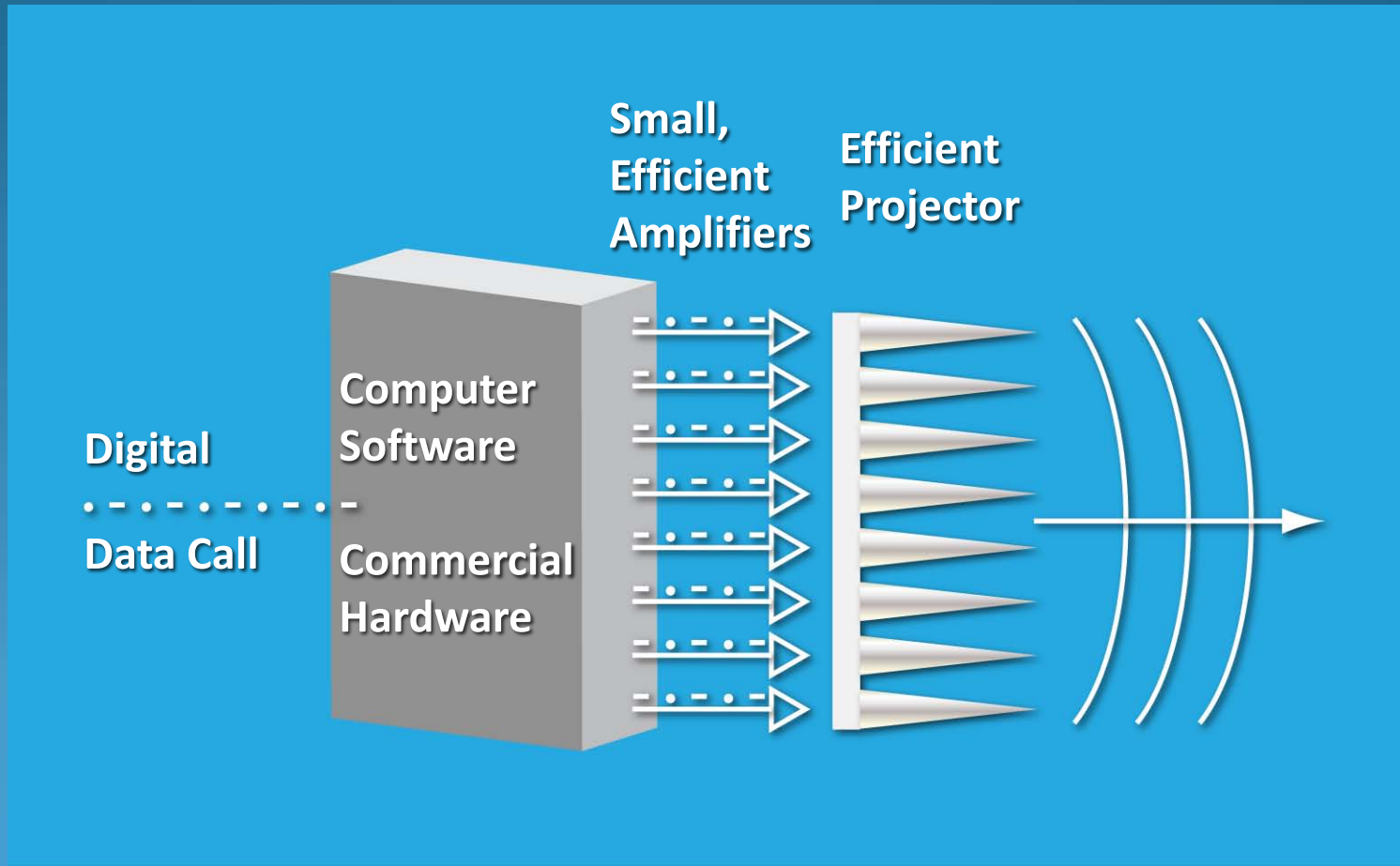
Digital Camera



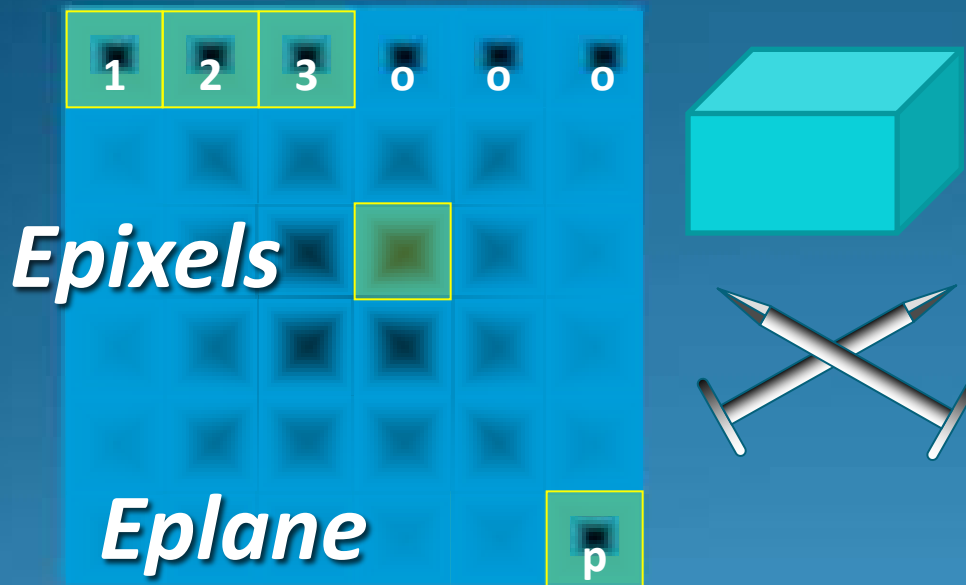
Cellular Transmitter



White Nail Transmitter



White Nail

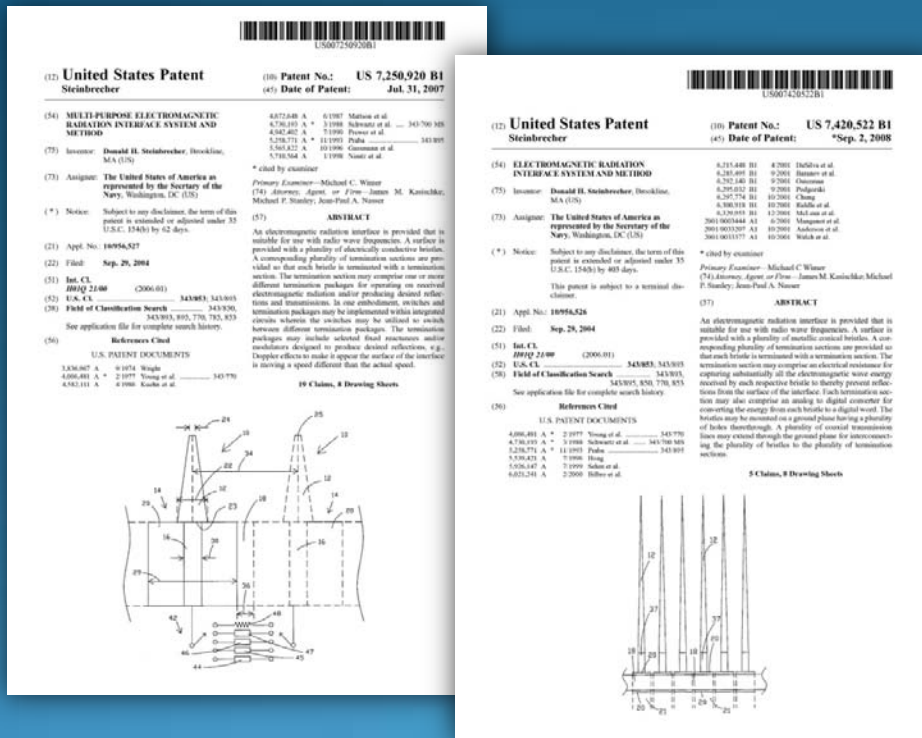


White Nail air interface
in chamber for testing

The White Nail Eplane effective aperture is partitioned into p equal area Epixels, each of which captures a small 'piece' of the incident RF signals. The pieces are processed individually and reassembled in the digital domain to create a digital image of the incident RF signal set. When transmitting, the Epixel signal pieces are transmitted independently and spatially reassembled to form a beam.



Naval Warfare Center Technology



- 12 Years of Basic Research and Exploratory Development

Dr. Donald H. Steinbrecher
Also 6,460,167; others in process

Leveraging World Class Expertise

Cell Phone Transmitter Efficiency

An Efficiency Performance Comparison

Parameter		Conventional Transmitter		White Nail Transmitter	
		Units		Units	
Antenna EIRP		Watt	6,014.25	Watt	6,014.25
Antenna Gain		ratio	50.12	ratio	50.12
Transmitted Power		Watt	120.00	Watt	120
Antenna Aperture Efficiency		ratio	0.6	ratio	0.94
RF Output Power		Watt	200.00	Watt	127.66
RF Generation Efficiency		ratio	0.3	ratio	0.51
Supplied Power		Watt	666.67	Watt	250.00
Supplied power saved				Watt	416.67
Estimated Total Number of transmitters			3,000,000		
Estimated total power saved		Watt	1,250,000,000		

1.25 Gigawatts saved

– Power

11 Billion Kilowatt Hours per year saved

– Energy

\$1.6 Billion Dollars per year saved

– Cost

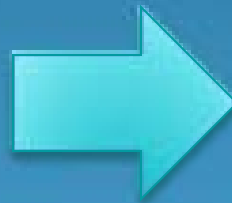
10.4 Million metric Tons CO₂ per year saved

– Greenhouse Gas

Power



4



1

Energy

Navy Use

7.3 Billion kWh

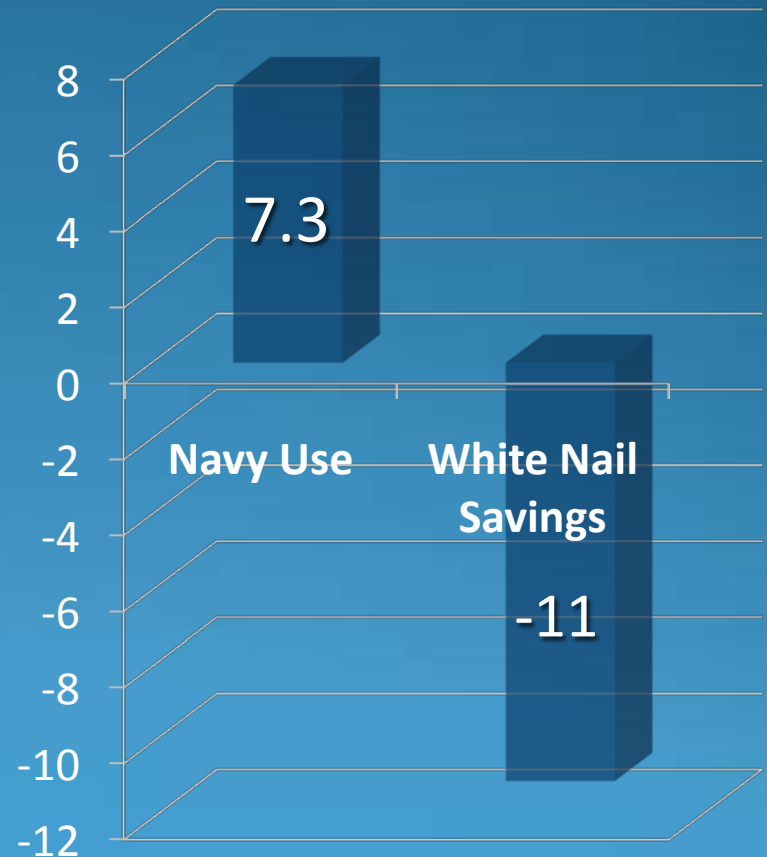
White Nail Cell Phone Savings

11 Billion kWh

One and a half times!!!

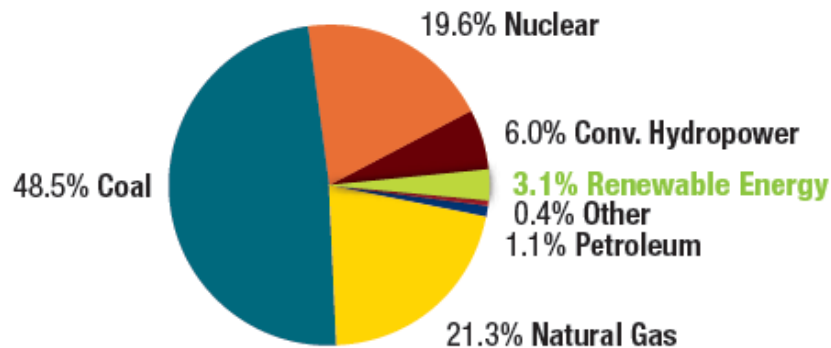
Saves the output of four
of Massachusetts' six
coal fired power plants

Annual Energy Use
(kWh x 1B)



US electrical energy in 2008

4,112 billion kWh

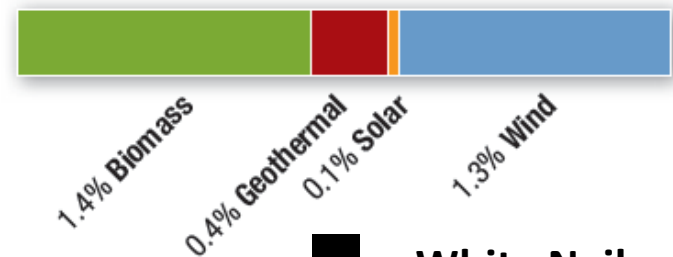


Source: EIA

Other includes: pumped storage, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, tire-derived fuels, and miscellaneous technologies.

* Includes on- and off-grid capacity.

U.S. Renewable Generation: 125 billion kWh



← **White Nail**
.25% Savings

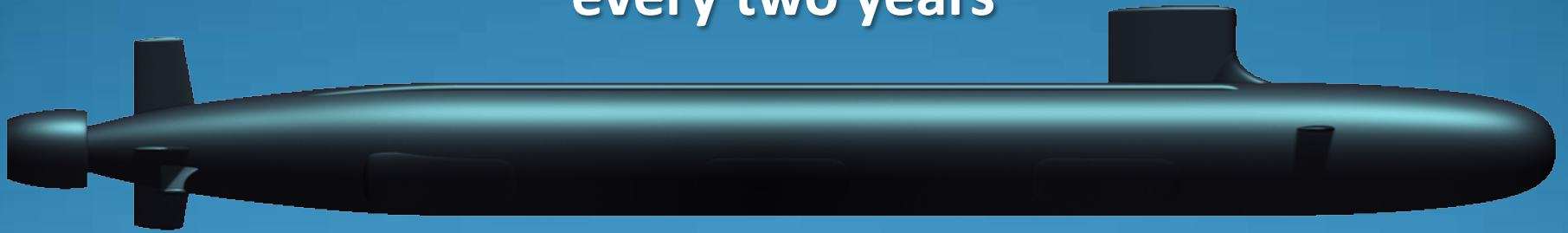
U.S. Energy Background Information | July 2009

11 Billion kWh = Savings 0.25%

We are on the national map!!

Financial Savings
\$1.6 B/yr

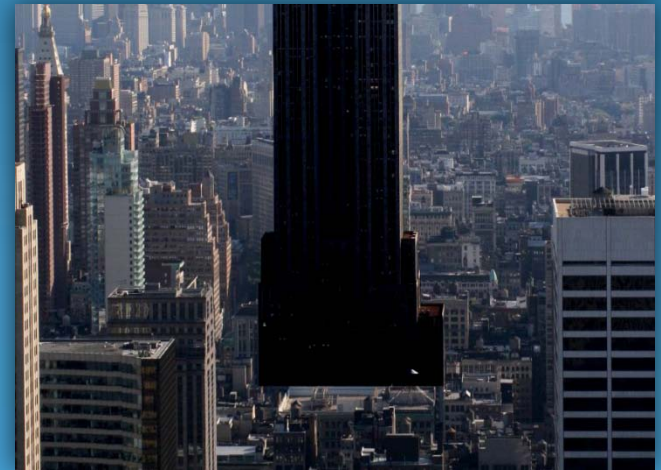
**Additional Virginia class submarine
every two years**



Annual Carbon Reduction



$$1 + 1/2$$



10.4 Million Metric Tons CO₂ as Glassy Carbon (C) Volume

Naval Impact Potential

- DoD portion of commercial wireless
- Radar
- Shipboard “Topside Integration”
- Shipboard electrical generation fuel savings
- Satellite – size, weight and power
- Expeditionary unit’s wireless efficiency

Valley of Death

Way ahead Development

- Technology: System level demonstration
- Commercial prototype and demonstration
- Commercial industrial production

Spiral Two

- DoD/Navy Innovation using commercial components



Our Request from YOU

- Contacts
 - Commercial wireless industry
 - Infrastructure architects
 - DOE
- DoD/Navy
 - What are the appropriate issues to address
 - National Energy Security vs. Military Energy Security
- Innovator, Technologist: Talk to us
- Resource Sponsor: Opportunities to propose

Navy Technology + Commercial Application

