Allegheny HIGHLANDS ALLIANCE
Protecting Our Mountains for Future Generations

Rotary World Affairs Seminar 2015

Energy Alternatives

"Wind Power in the Central Appalachians and Beyond"

United States Fish and Wildlife Service

National Conservation Training Center

AFTER THIS SESSION YOU SHOULD KNOW

- **WHAT IS CRITICAL THINKING AND WHY IT IS IMPORTANT?**
- **IN THE U.S., HOW MUCH ENERGY COMES FROM WIND?**
- **THE DIFFERENCE BETWEEN A WIND MILL AND AN INDUSTRIAL WIND TURBINE.**
- **IN THE UNITED STATES AND IN OUR REGION, WHERE DOES THE WIND BLOW?**
- **HOW MANY TURBINES ARE THERE? HOW MUCH DO THEY COST?**
- **HOW MUCH OF THIS COST IS CHARGED TO THE TAXPAYER AND HOW DOES THAT COMPARE WITH OTHER ENERGY SOURCES.**
- **WHAT IS A BILLION AND HOW DOES $12 BILLION FIT INTO THIS PICTURE?**
- **THE DIFFERENCE BETWEEN THE RATED CAPACITY OF A TURBINE TO PRODUCE ELECTRICITY AND HOW MUCH ELECTRICITY IT ACTUALLY PRODUCES.**
- **WHAT DOES INTERMITTANCY AND VARIABLILITY MEAN TO INDUSTRIAL WIND?**
- **THE DEBATE OVER WHETHER INDUSTRIAL WIND ACTUALLY REDUCES CARBON EMISSIONS.**
- **HOW INDUSTRIAL WIND DEPENDS ON STRIP MINING.**
- **THE EUROPEAN EXPERIENCE**
- **PRESIDENT OBAMA'S NEW "WIND VISION" AND HOW IT DESERVES YOUR CRITICAL THINKING.**

WHO IS ALLEGHENY HIGHLANDS ALLIANCE?

AHA IS A FIVE STATE COALITION

WEST VIRGINIA

PENNSYLVANIA

MARYLAND

VIRGINIA

NORTH CAROLINA

PURPOSE

Research facts about industrial wind

Publicize the information

Favor “point of use” energy generation

Promote energy conservation

(Check our web site: www.**alleghenyhighlandsalliance**.org/

CRITICAL THINKING

- **A personal skill, developed over time from an intentional process.**
- **Clear and reasoned thinking involving critique of information received.**
- **Based on several questions:**
  - **Is the information unbiased and verifiable?**
  - **What may be unintended consequences?**
  - **What facts are being purposely omitted?**
  - **Is the issue controversial? Why?**
  - **How does my personal attitude influence my thought process on this issue?**
- **Critical thinking skills should evolve as one matures.**
- **The opposite of critical thinking is gullible thinking and faith based thinking.**

THE UNITED STATES ELECTRIC GRID

IN THE US, HOW MUCH ENERGY COMES FROM WIND?

In 2013, the United States generated about 67% of the electricity from fossil fuel (coal, natural gas, and petroleum), with 39% attributed from coal.

U.S. ELECTRICITY GENERATION BY ENERGY SOURCE

In 2013, energy sources and percent share of total electricity generation were

- Coal 39%
- Natural Gas 27%
- Nuclear 19%
- Hydropower 7%

Other Renewable 6%

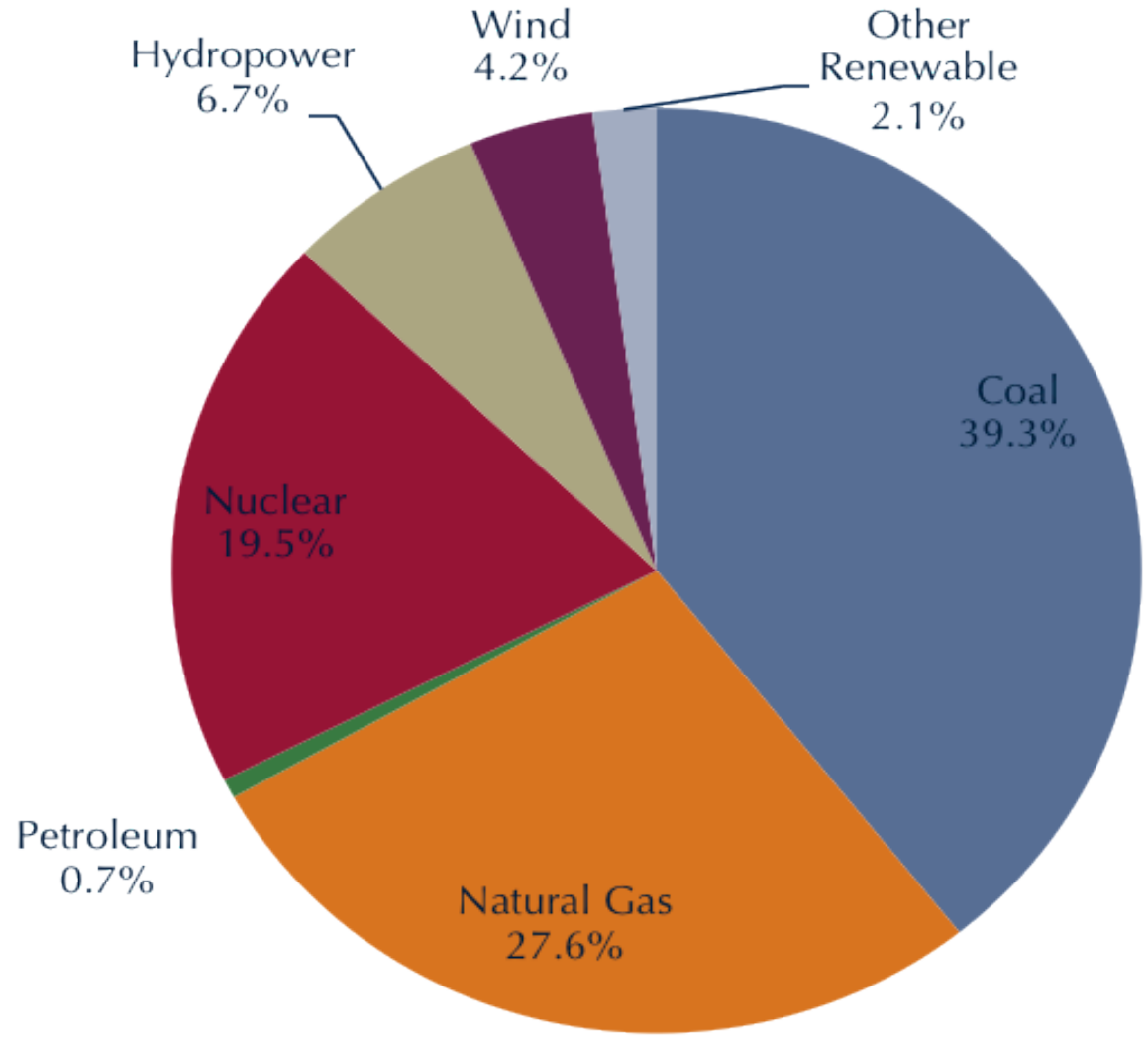
- Biomass 1.48%
- Geothermal 0.41%
- Solar 0.23%
- Wind 4.13%

Petroleum 1%

Other Gases < 1%

(From the U.S. Energy Information Administration)

U.S. Net Electricity Generation by Energy Source (2013)



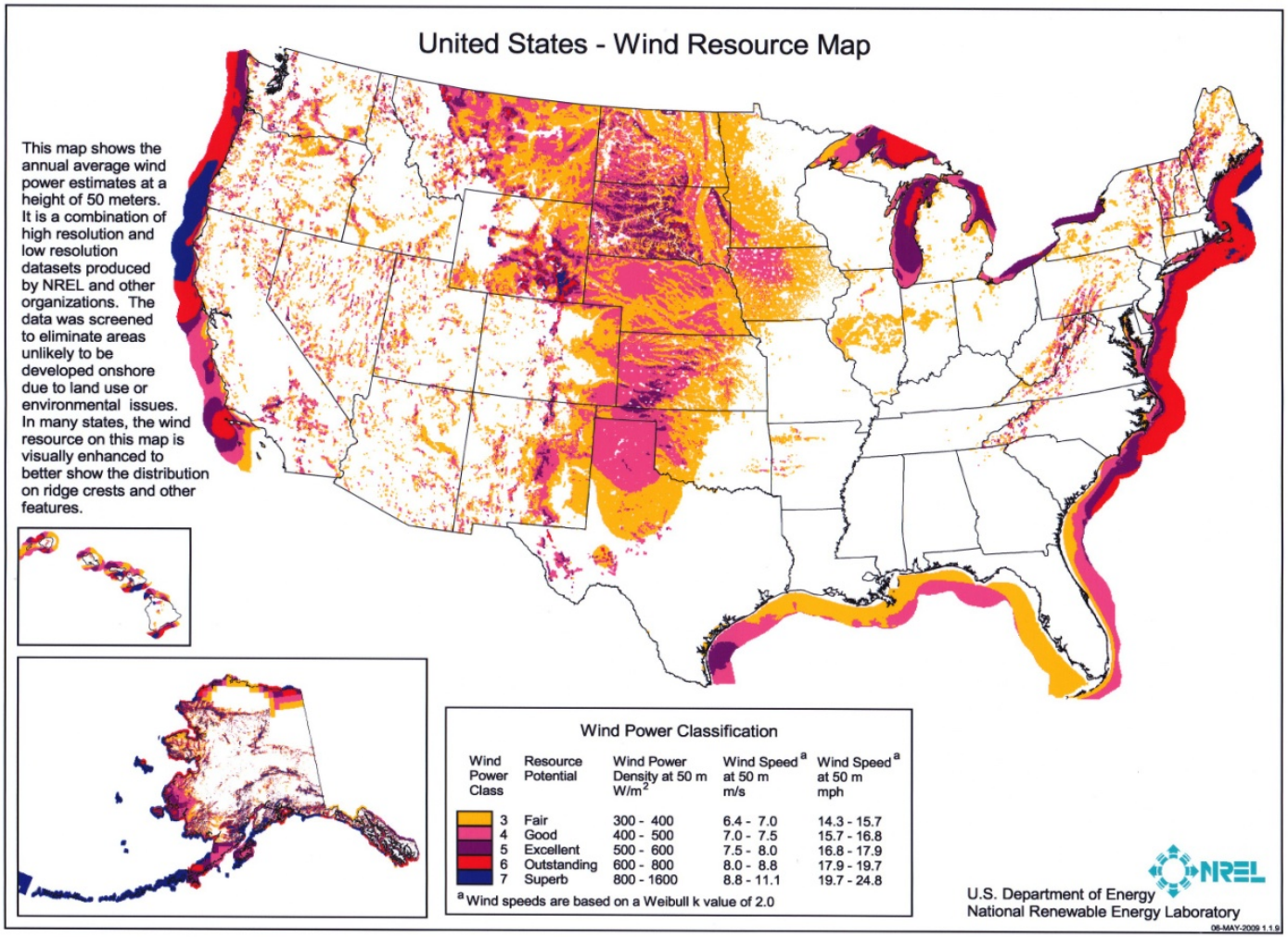
WIND MILL VS. INDUSTRIAL WIND TURBINE

THIS IS A WIND MILL

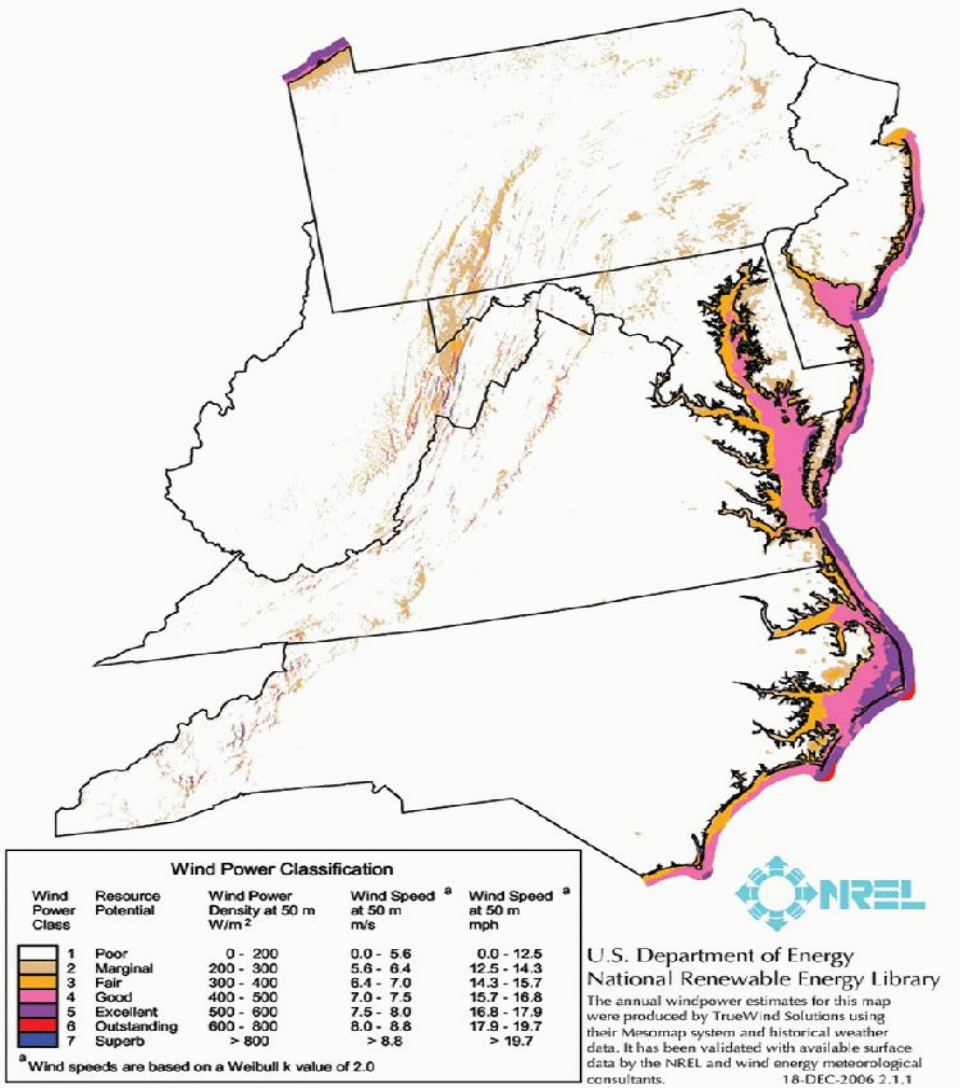
THIS IS AN INDUSTRIAL WIND TURBINE

THIS IS AN INDUSTRIAL WIND TURBINE FACILITY

Where the Wind Blows in the U.S.

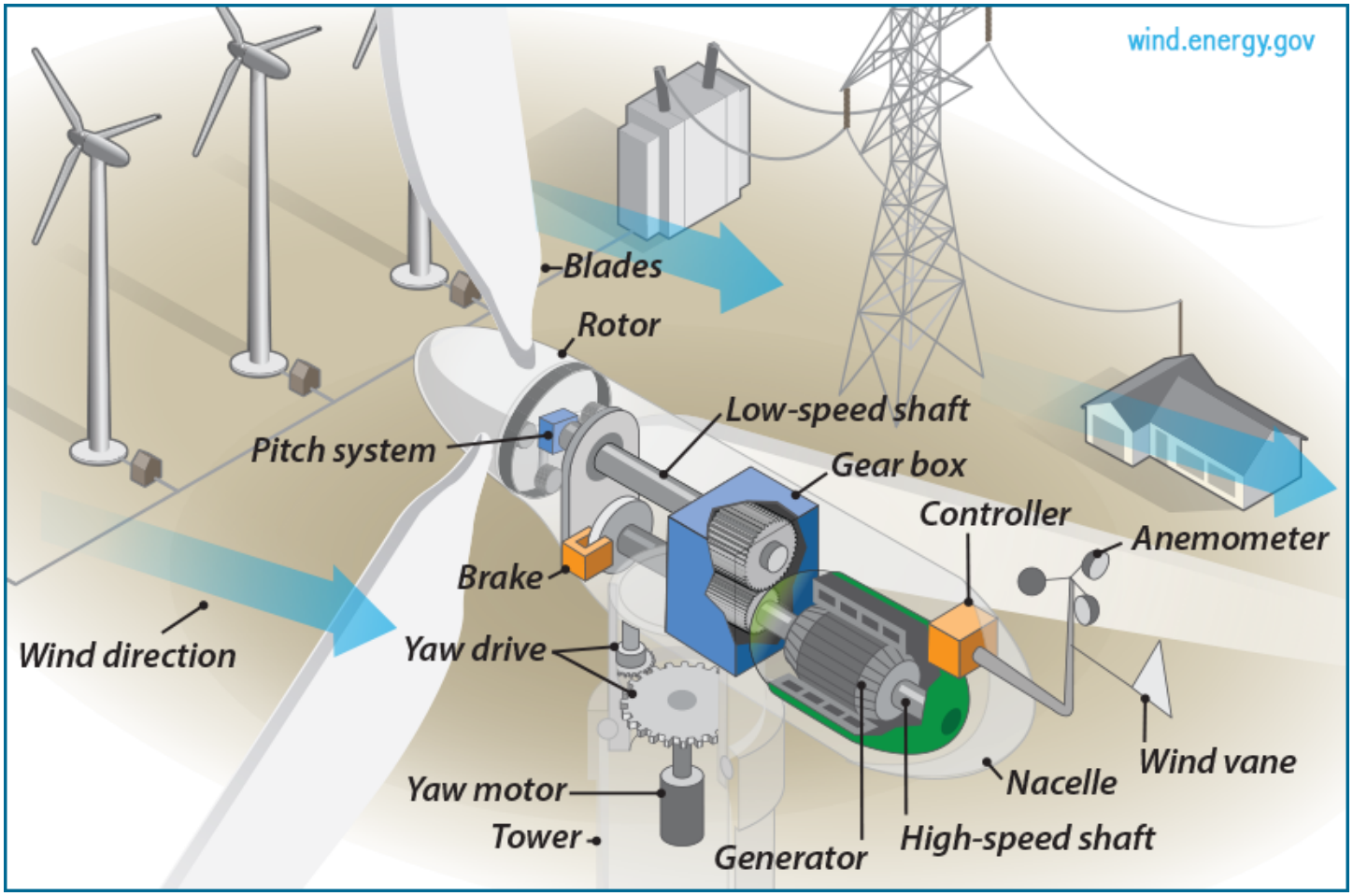


Where the Wind Blows in the Mid-Atlantic Region



HOW AN INDUSTRIAL WIND TURBINE WORKS

Wind turbines harness the power of the wind and use it to generate electricity. Simply stated, a wind turbine works the opposite of a fan. Instead of using electricity to make wind, like a fan, wind turbines use wind to make electricity. The energy in the wind turns two or three propeller-like blades around a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity. This illustration provides a detailed view of the inside of a wind turbine, its components, and their functionality.



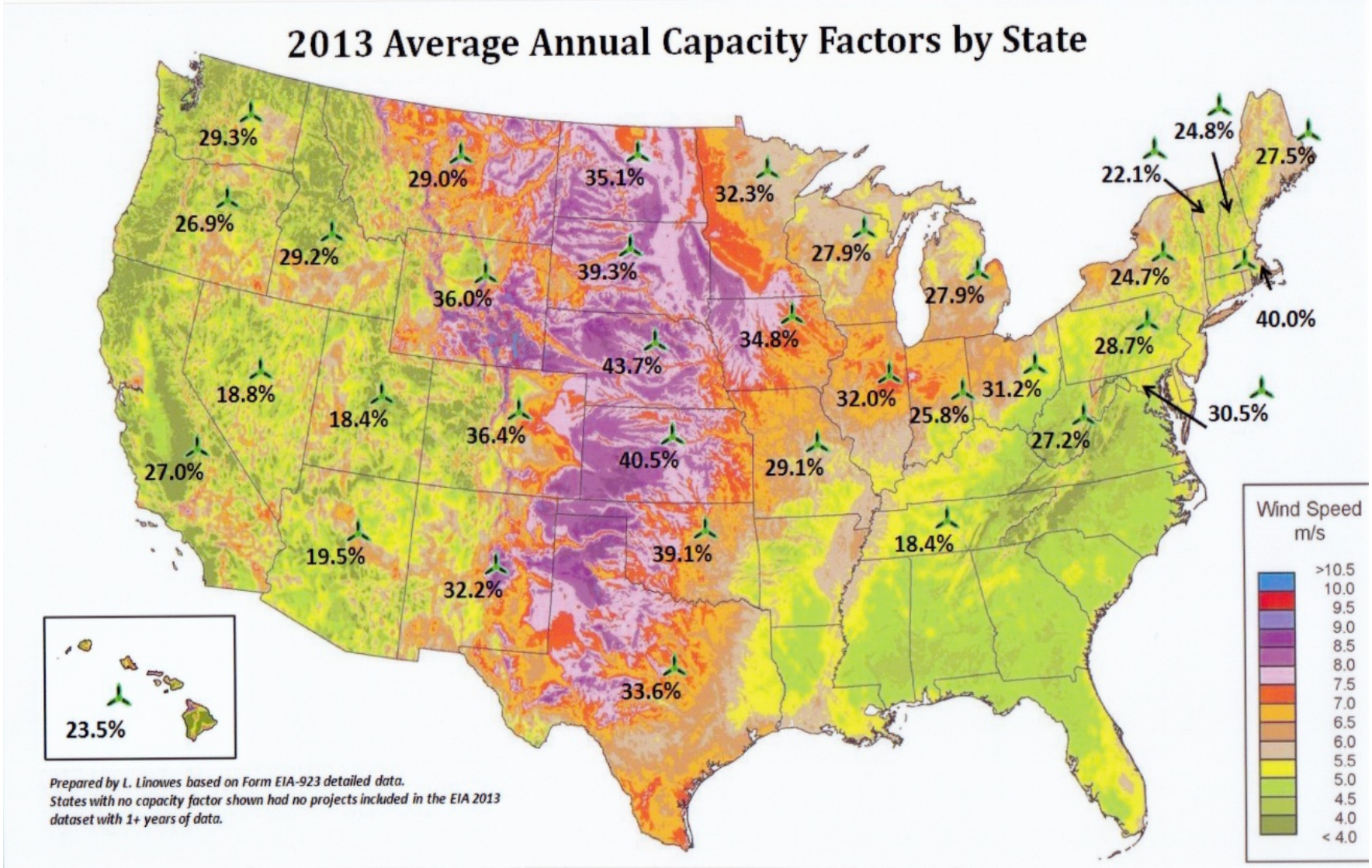
The Difference Between Turbine Capacity and Turbine Generation

Turbines must have reliable wind in adequate speed levels in order to meet the immediate demand of homes, businesses and hospitals. Mother Nature has her foot on wind's pedal and when it comes to producing electricity, speed matters. The graphic below demonstrates the loss of electricity generation relative to wind speed.

This graphic demonstrates wind "potential" and turbine output by state in terms of capacity factor.

EIA Wind Production Numbers

(Courtesy- L. Linowes)



STORAGE: INDUSTRIAL WIND'S ACHILLES HEEL

- CURRENT BATTERY TECHNOLOGY CAN STORE ENOUGH ELECTRICITY FOR HOME BASED, OFF GRID USE

- LARGE ARRAYS OF BATTERIES CAN ALSO IRON OUT THE UNDULATING AND STUTTERING NATURE OF ELECTRICITY SENT TO THE ENERGY GRID, BUT AT SIGNIFICANT COST.

- DESPITE A GREAT EFFORT TO DO SO, THERE IS NO WAY TO STORE ELECTRICITY FOR FUTURE "ON DEMAND" USE BY THE ELECTRICITY GRID.

- THAT IS WHY THE ELECTRICITY GRID MUST HAVE BASE LINE SOURCES (COAL, GAS, NUCULEAR, HYDRO) READILY AVAILABLE (ON DEMAND) TO BACK UP WIND, SOLAR AND OTHER INTERMITTANT SOURCES.

AES BATTERY STORAGE FACILITY

AES BATTERY STORAGE FACILITY

5 Projects Currently in Operation in West Virginia 2013 Capacity

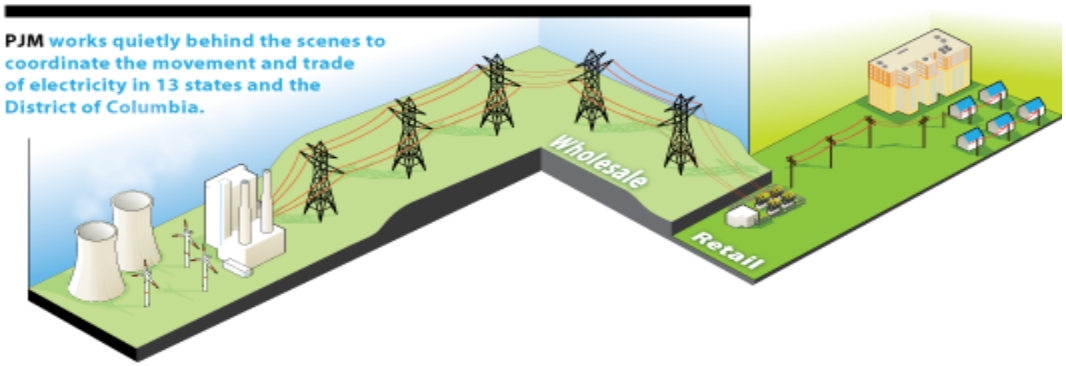
	Rated Capacity	Production	Actual Capacity
Mountaineer	578,160	171,376	29.64
Beech Ridge	880,380	226,031	25.67
Mount Storm	2,312,640	600,277	25.96
Laurel Mountain	858,480	212,363	24.84
Pinnacle	481,480	181,065	37.58
Total	5,111,460	1,391,112	27.23

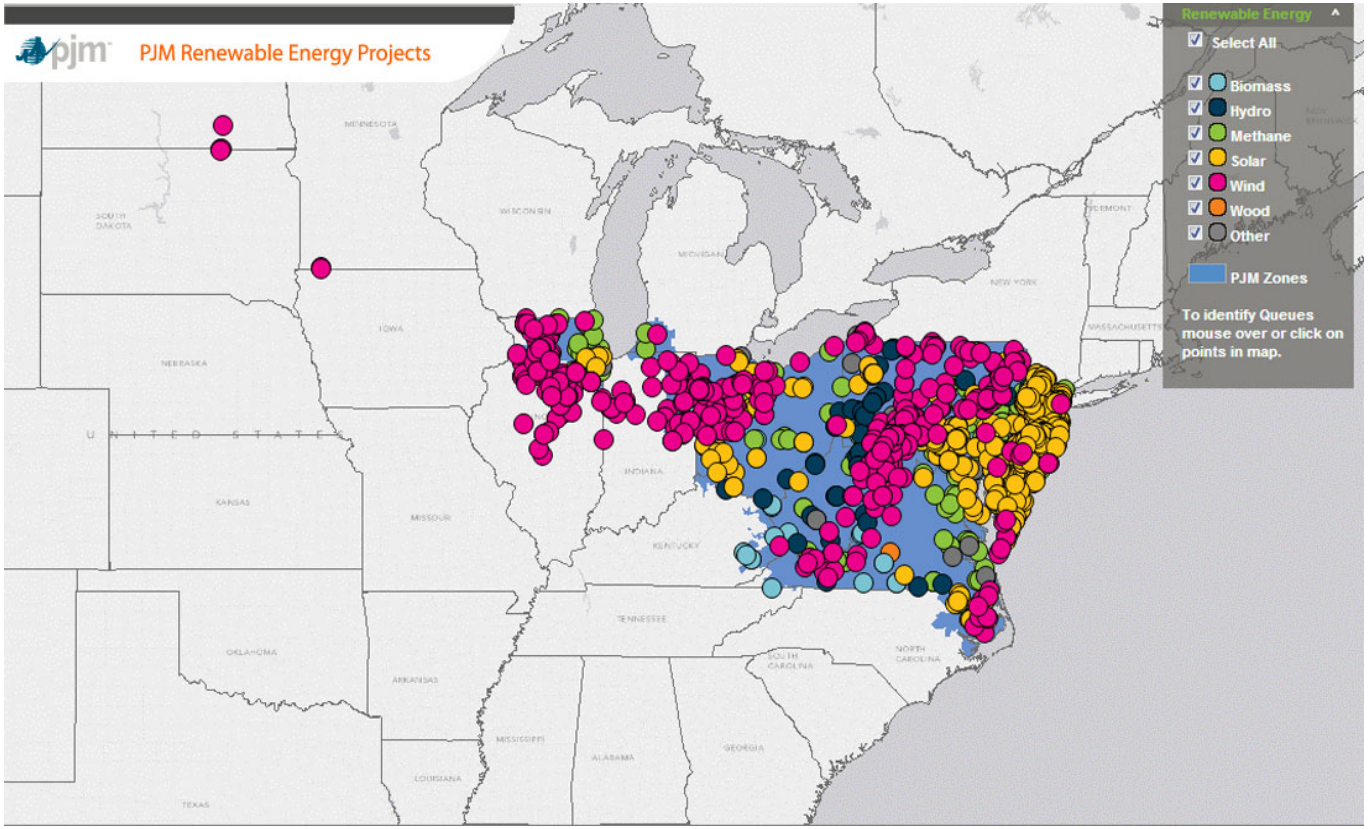
HOW MANY INDUSTRIAL WIND TURBINES ARE THERE

- 48,000 installed across 39 U.S. states and Puerto Rico (American Wind Energy Association)

- 225,000 operating around the world in about 80 countries by the end of 2012. (Global Wind Energy Council)

- 1,111 turbines are operating in AHA's geographical area. Many more are planned.


PJM works quietly behind the scenes to coordinate the movement and trade of electricity in 13 states and the District of Columbia.
Wholesale
Retail


PJM Renewable Energy Projects
Renewable Energy
Select All
Biomass
Hydro
Methane
Solar
Wind
Wood
Other
PJM Zones
To identify Queues mouse over or click on points in map.
MINNESOTA
WISCONSIN
MICHIGAN
VERMONT
NEW YORK
MASSACHUSETTS
IOWA
NEBRASKA
INDIANA
KANSAS
MISSOURI
KENTUCKY
TENNESSEE
OKLAHOMA
ARKANSAS
MISSISSIPPI
ALABAMA
GEORGIA
LOUISIANA
TEXAS

HOW MUCH DOES A WIND TURBINE COST?

- THREE MILLION DOLLARS!

  (personal conversations with two wind developers)

- Since federal tax subsidies approximate 1/3 of this cost, every time you see an industrial turbine in the distance, you are looking at ONE MILLION DOLLARS of taxpayer's money.

Subsidies and Support to Electricity Production by Selected Primary Energy Sources

Source	Megawatts Generation	Subsidies and Support	Subsidies Per Megawatt
Coal	1,572,000,000	901,000,000	.57
Natural Gas and Petroleum Liquids	1,033,000,000	690,000,000	.67
Nuclear	789,000,000	1,660,000,000	2.10
Renewables			
Biomass	57,000,000	118,000,000	2.07
Geothermal	165,000,000	245,000,000	1.48
Hydropower	266,000,000	392,000,000	1.47
Solar	19,000,000	4,393,000,000	231.21
Wind	168,000,000	5,936,000,000	35.33

PERCENT OF SUBSIDIES VS ELECTRICITY PRODUCTION

- **Solar gets 27% of the total subsidy money while generating only .48% of the total electricity.**
- **Wind gets 37% of the total subsidy money while generating only 4.3% of the total electricity.**
- **Hydro gets 3 % of the total subsidy money while generating 6.8% of the total electricity.**
- **Coal gets 6% of the total subsidy money while generating 40.1% of the total electricity.**
- **Natural Gas gets 4% of the total subsidy money while generating 26.4% of the total electricity.**
- **Nuclear gets 10% of the total subsidy money while generating 20.1% of the total electricity.**

SECTION 1603 GRANTS TO REGIONAL INDUSTRIAL WIND TURBINE INSTALLATIONS

MD:		
• Criterion	$39,147,263 (7/22/2011)	28 turbines
• Roth Rock	$31,766,924 (9/8/2011)	20 turbines
W V:		
• Laurel Mountain	$81,965,141 (2/3/12)	61 turbines
• Beech Ridge	$68,609,459 (9/22/10)	67 turbines
• Pinnacle	$44,184,807 (8/23/12)	23 turbines
PA:		
• Big Savage	$65,460,892 (1/24/13)	68 turbines
• South Chestnut	$28,873,226 (5/8/12)	24 turbines

http://www.treasury.gov/initiatives/recovery/Pages/1603.aspx

WHAT IS A BILLION DOLLARS?

If we wanted to pay down a billion dollars of the US debt, paying one dollar a second, it would take 31 years, 259 days, 1 hour, 46 minutes, and 40 seconds.

EASIER TO REMEMBER:

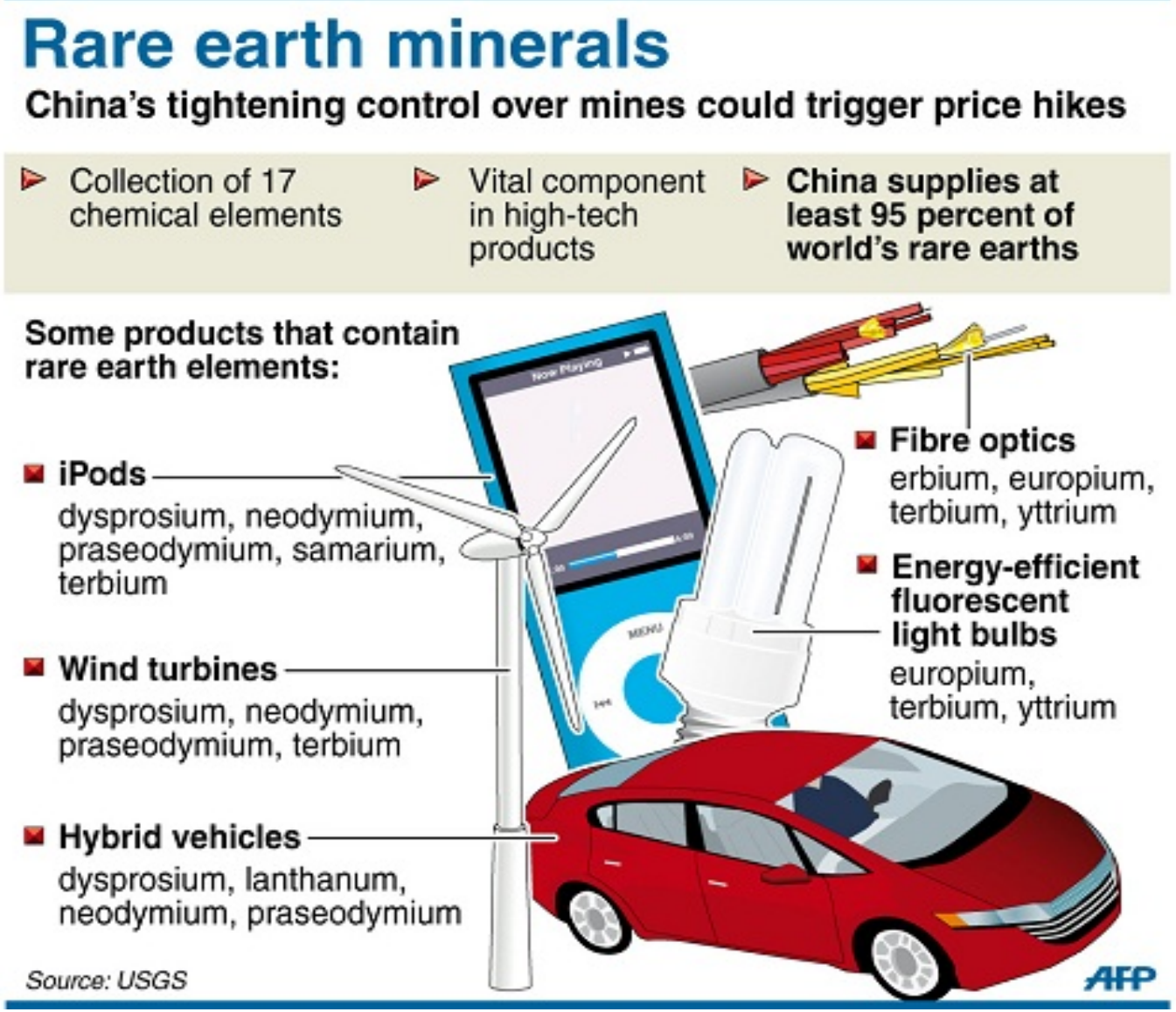
$1 PER SECOND FOR 31.7 YEARS = $1 BILLION

WHAT IS 12 BILLION DOLLARS TO THE INDUSTRIAL WIND INDUSTRY

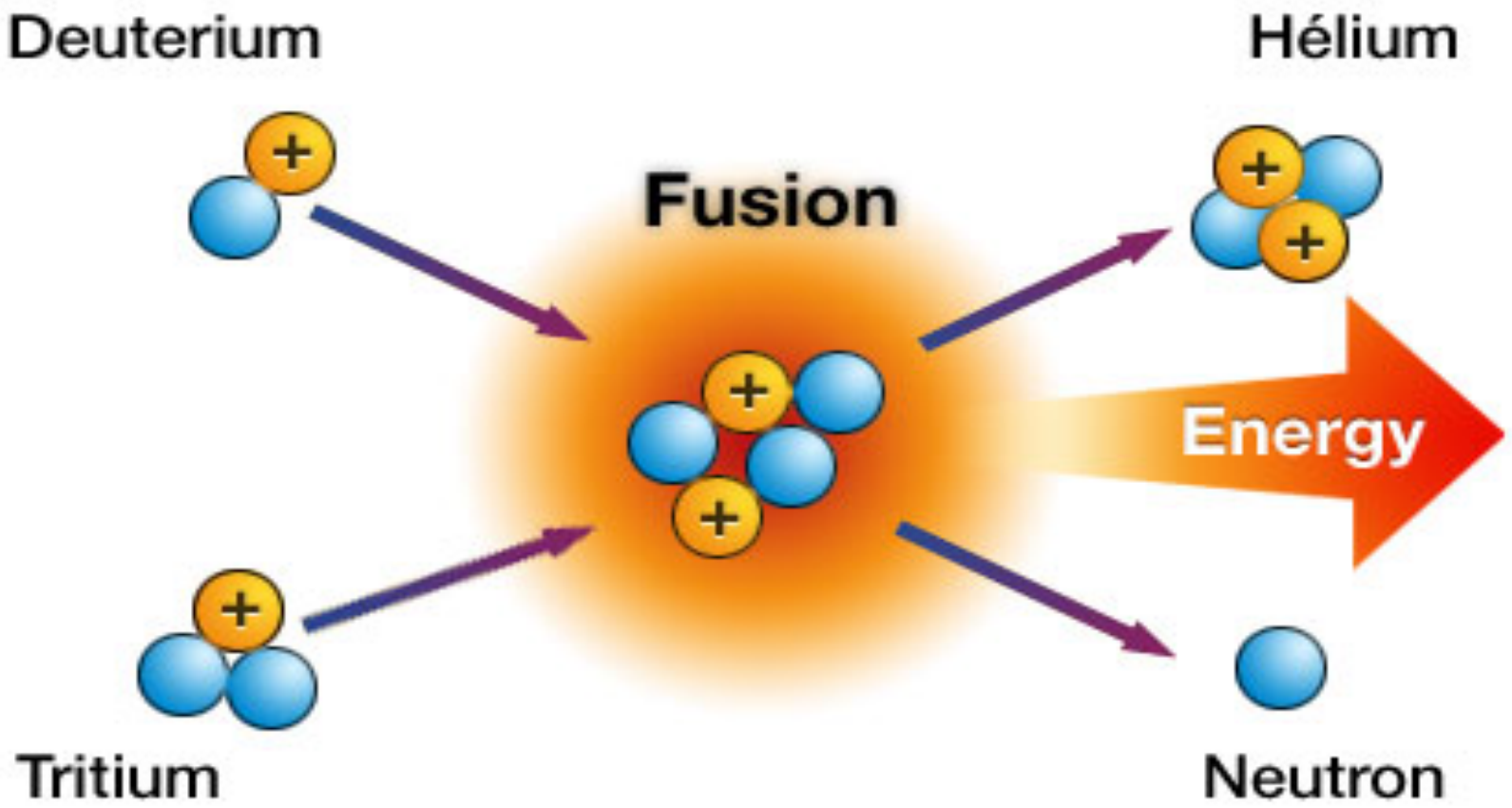
- **FOR EVERY YEAR THAT THE PRODUCTION TAX CREDIT IS RENEWED, THE FEDERAL GOVERNMENT SUBSIDIZES INDUSTRIAL WIND $12 BILLION OVER THE NEXT 10 YEARS**
- **THIS TAXPAYER SUBSIDY ALLOWS INDUSTRIAL WIND COMPANIES TO UNDERBID OTHER ENERGY SOURCES WHICH IN TURN DISRUPTS THE ENERGY MARKET.**

RARE EARTH MINING IN CHINA

RARE EARTH USES



IF NOT WIND, WHAT?
That is your homework assignment!



THE PROMISE OF FUSION

- **Could be available by the middle of this century.**
- **Does not take up very much space.**
- **Is safe.**
- **Has an inexhaustible material supply, water.**
- **Doesn’t leave any long-lived radioactive waste.**
- **Has spawned an international research effort.**

FISSION

- LARGE ATOM SPLIT IN TWO
- DOES NOT OCCUR IN NATURE
- RADIOACTIVE PARTICLES

FUSION

- TWO SMALL ATOMS INTO ONE
- OCCURS IN STARS, (THE SUN)
- FEW RADIOACIVE PARTICLES

THIS TECHNOLOGY WILL BE PERFECTED IN YOUR LIFETIME!

MOLTEN SALT REACTORS

- Under private development
- Recycles spent nuclear fuel
- No residual radioactivity
- Very small units

FUSION REACTORS

- Under international development
- Uses water as a fuel
- No residual radioactivity
- Large or small units

GERMANY MUST SCRAP ITS GREEN ENERGY LAW, SAY EXPERTS

REUTERS, FEB. 26, 2014

Neither was it a cost-efficient climate protection tool, nor did it have a positive effect on innovation, the experts concluded in their 2014 report

GERMAN LAWMAKERS VOTE TO REDUCE RENEWABLE ENERGY SUBSIDIES

BloombergBusiness 06-07-14

Merkel Backs Plan to Cut Germany's Green Energy Subsidies Chancellor Urges Cabinet to Adopt Cuts and Stop Bickering

Wall Street Journal Jan. 22, 2014

THE ADMINISTRATION'S NEW WIND VISION

- PUBLISHED MARCH, 2015 *http://www.osti.gov/scitech*
- 10% WIND BY 2020, 20% BY 2030, AND 35% BY 2050
- ASSUMES A 12.3 GIGATONNES OF AVOIDED GREEN HOUSE GAS = $400 BILLION AVOIDED GLOBAL DAMAGE.
- WIND VARIABILITY WILL HAVE MINIMAL AND MANAGABLE IMPACT ON GRID RELIABILITY.