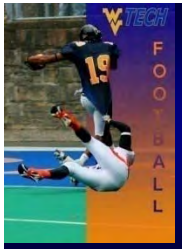

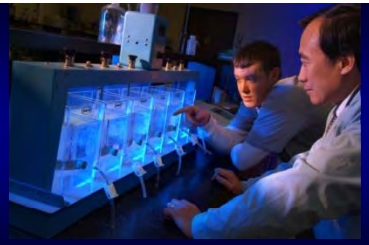

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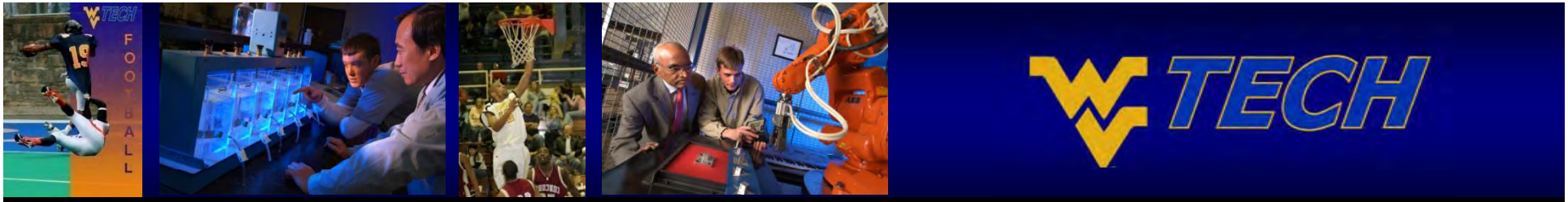
The Future of Energy

"All that Glitters is not Gold"

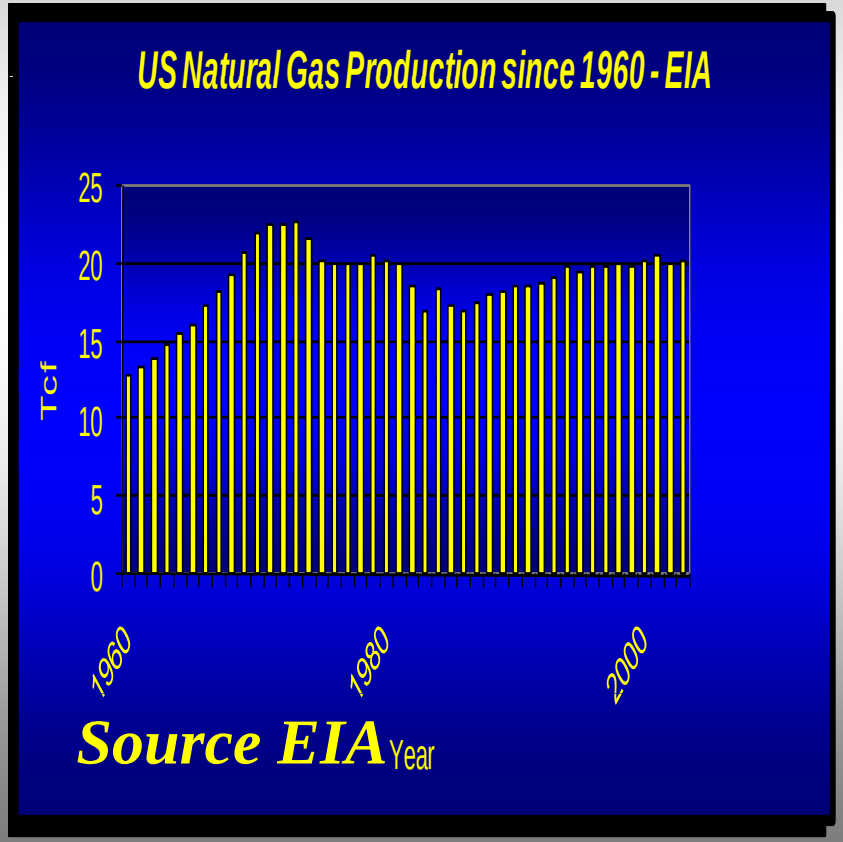


US Energy flow, 2005, Quads


NATURAL GAS

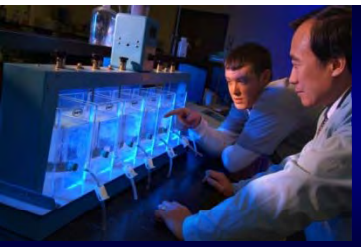
WV TECH

US NATURAL GAS PRODUCTION

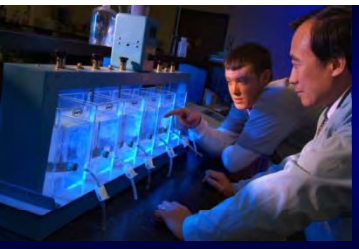


7.5

DEVELOPING COUNTRIES

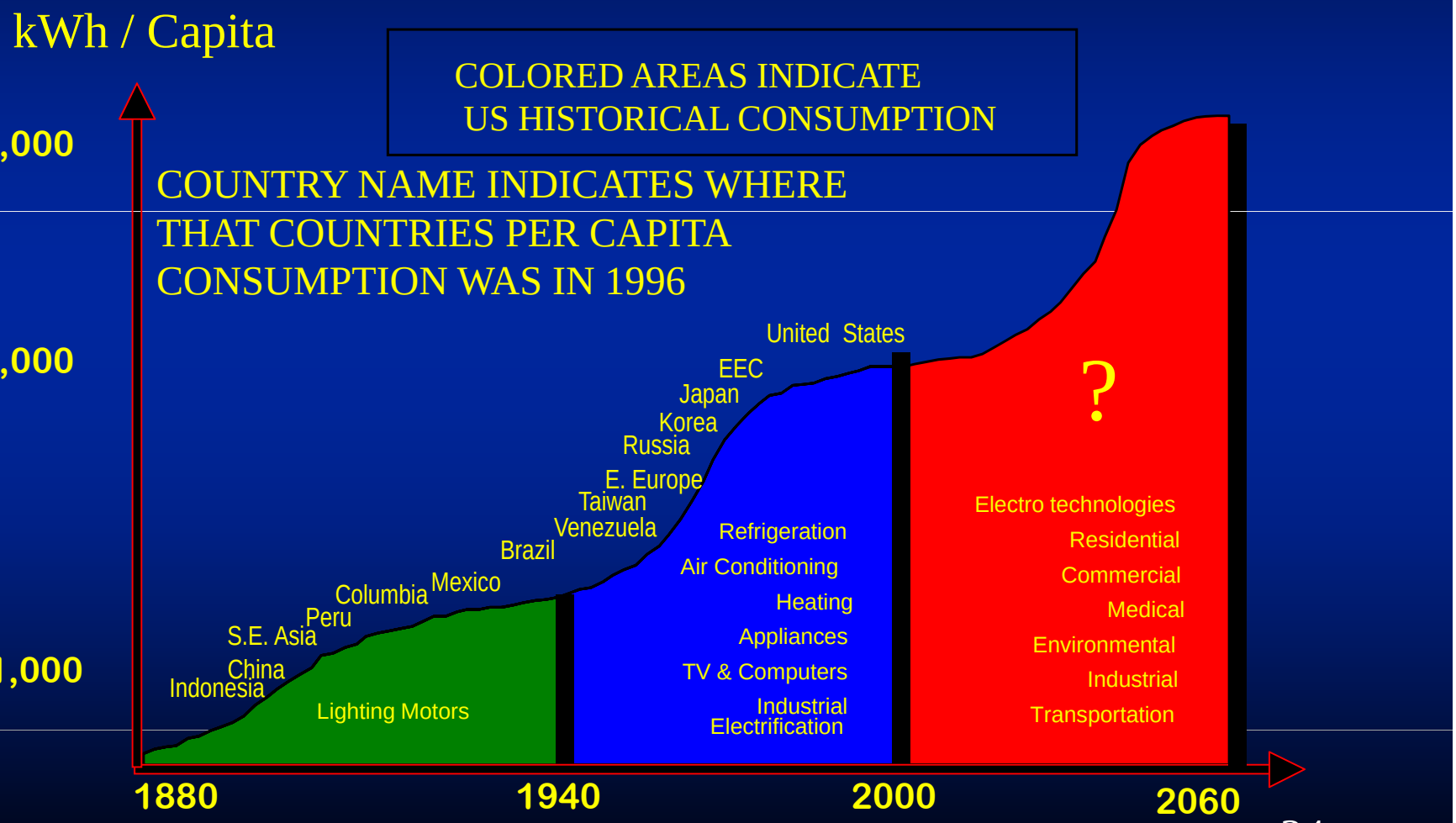


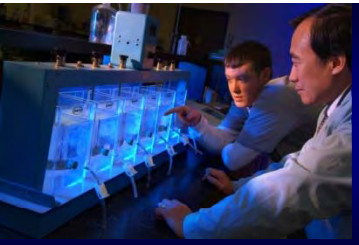
- ***THE DEVELOPING NATIONS ARE MAKING THE TRANSITION FROM A LABOR ECONOMY TO AN ENERGY ECONOMY THAT THE DEVELOPED NATIONS MADE YEARS AGO,***
- ***AS A RESULT THEY ARE CONSUMING A LARGER AND LARGER PORTION OF THE WORLDS ENERGY OUTPUT***



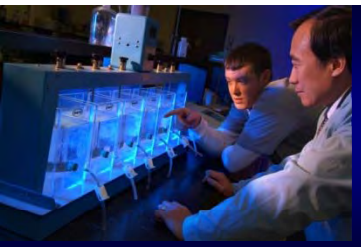
- ***THE US HAS ABOUT 4% OF THE WORLDS POPULATION AND USES ABOUT 29% OF ITS ENERGY.***
- ***BUT WE ALSO PRODUCE ABOUT 26% OF THE WORLDS TOTAL GDP***
- ***AS OTHER COUNTRIES CATCH UP IT WILL PUT TREMENDOUS PRESSURE ON PRICES***

Stages in Expansion of Electricity Consumption





- ***TODAY NO FORESEEABLE DEMAND REDUCTION IN THE DEVELOPED WORLD DUE TO CONSERVATION OR PRICE ELASTICITY WILL OFFSET THE GROWTH IN THE DEVELOPING COUNTRIES.***



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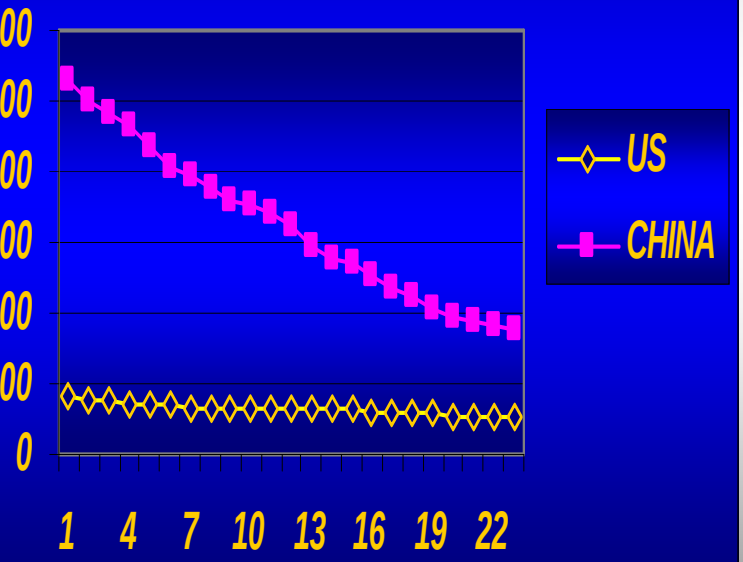
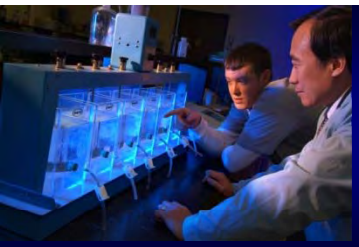
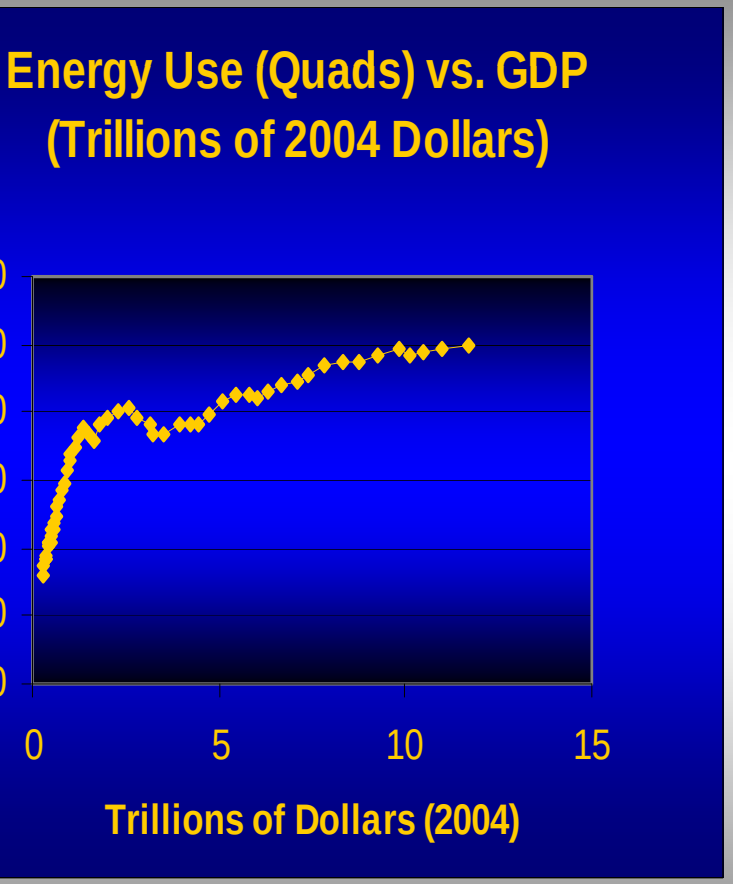
ENERGY INTENSITY US AND CHINA
BTU PER 1995 US DOLLAR



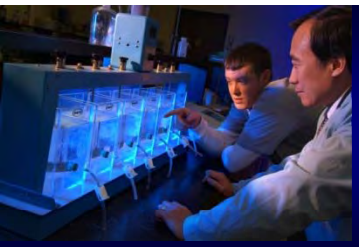
CHINA IS MAKING GREAT STRIDES IN REDUCING ITS ENERGY INTENSITY

BUT IT IS STILL MUCH MORE INEFFICIENT THAN THE UNITED STATES





- ***THERE IS A VERY STRONG CORRELATION BETWEEN GDP GROWTH AND ENERGY GROWTH***
- ***FOR OTHER COUNTRIES TO GROW GDP THEY MUST GROW ENERGY***
- ***BUT AS THEY BEGIN THEIR CLIMB THEY WILL BE ON THE STEEP PART OF THE CURVE***



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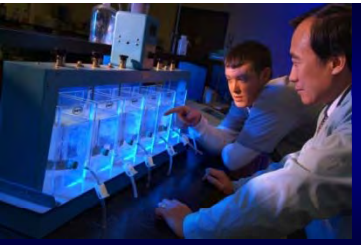
Can the emerging economies make the transition at such high prices ?

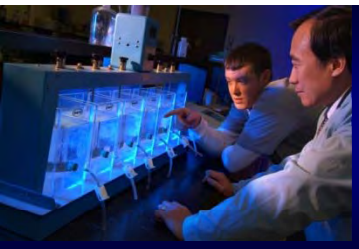
- ***AT $65 / BARREL***
- ***MOTORS, TRACTORS ETC.***



Elasticity

- ***DIFFERENT ITEMS HAVE DIFFERENT ELASTICITY FOR DIFFERENT PEOPLE***
- ***INSULIN – DIABETIC***
- ***GREEN CARD – FOREIGN NATIONAL***

REEN CARD



TECH

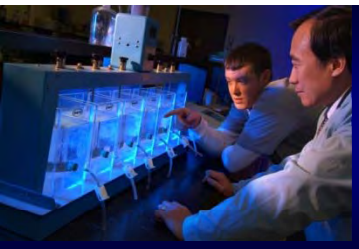
DRIVING TO MINOT, ND

TWO MILES FROM ANY EXIT

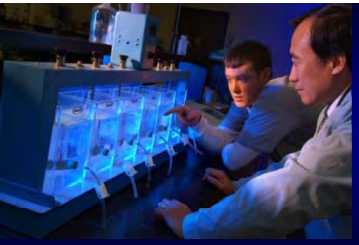
BLIZZARD

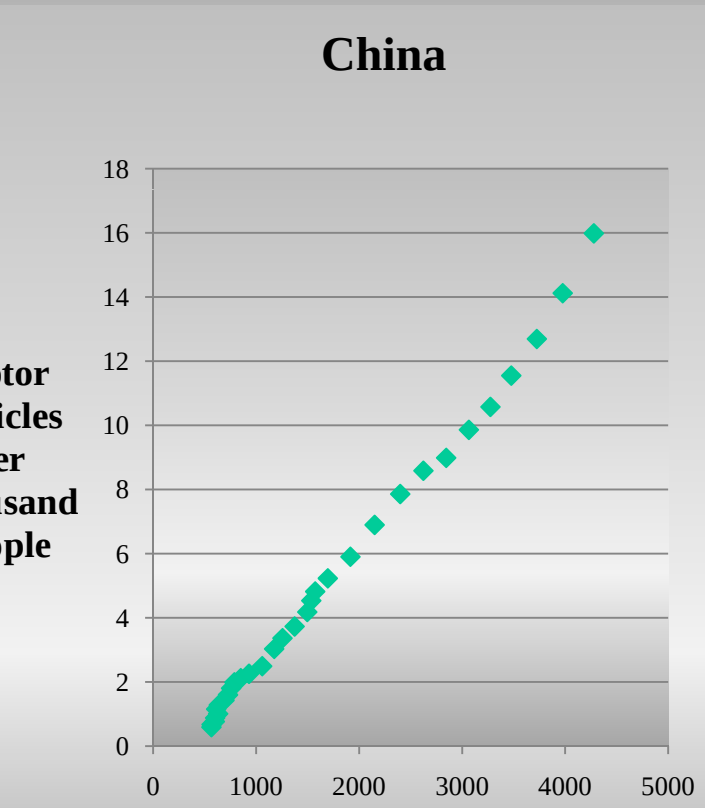
OUT OF GAS

HOW MUCH WILL YOU PAY TO GET BACK IN THE ENERGY ECONOMY

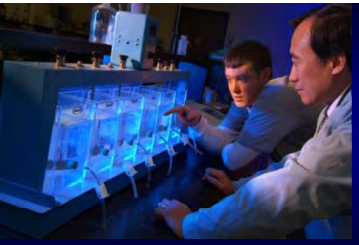


- ***BETTER OFF AT $2/GALLON THAN $3***
- ***BETTER OFF AT $4 THAN $5 ---***
- ***NOT THE RIGHT QUESTION***
- ***BETTER OFF AT $9 THAN WITH OXEN***

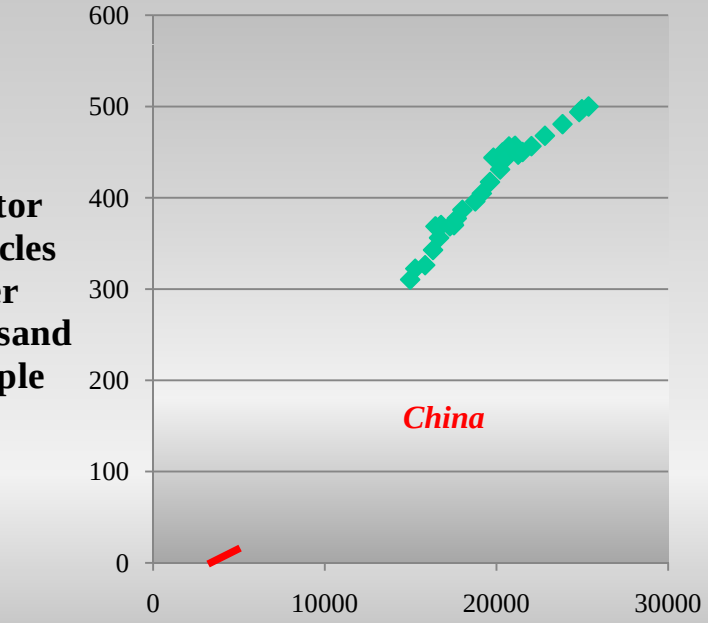




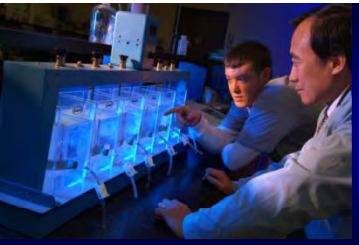
Motor Vehicles per thousand people correlates closely with GDP per capita

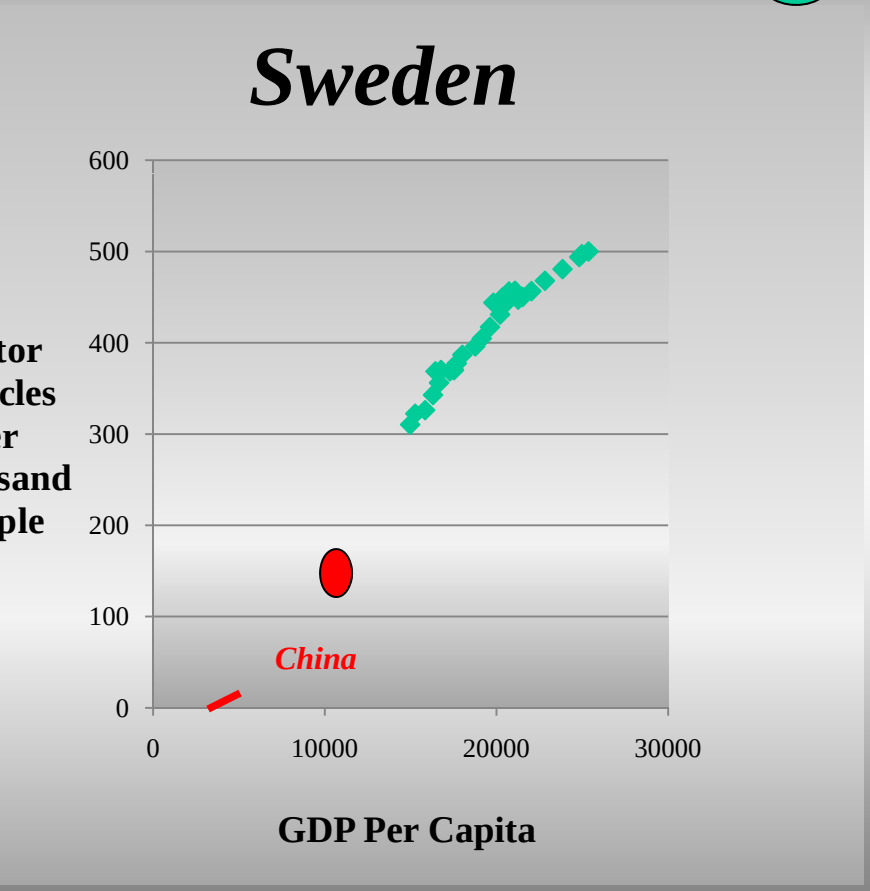


Sweden



This data is for Sweden as it is a very "Green" Country.
Yet China is currently at about 16 motor vehicles per thousand. (Let's call it 20)

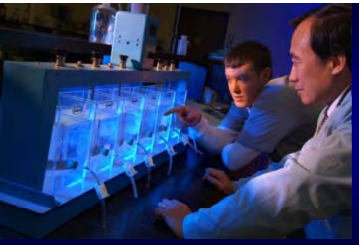


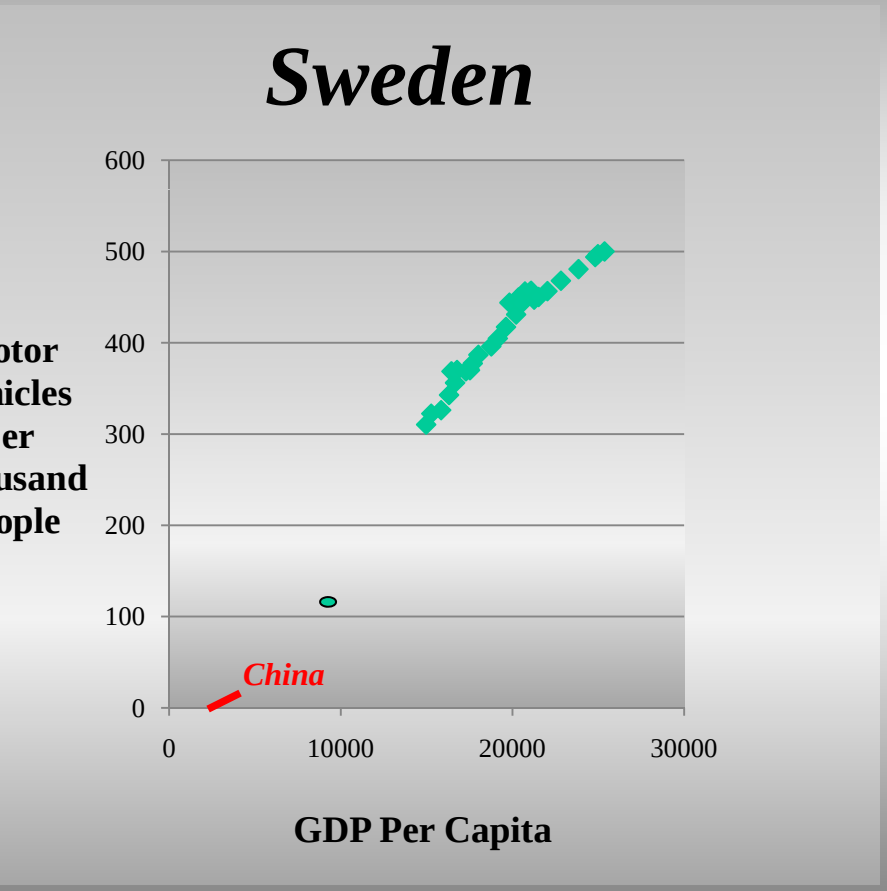


Let's assume that over the next few years that China gets up to 120 cars per 1000 People.

That is an extra 100 cars per 1000 people.

1.3 billion people is 1.3 million thousand people Which would translate into 130 million additional vehicles assuming the



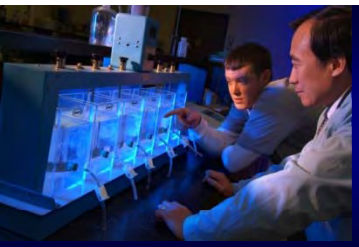


Assume that each of these cars drove 5000 miles per year and averaged 30 mpg.

That's 21,666,666,666 gallons of gas.

Or, assuming 55 gallons of oil makes 20 gallons of gas (US Average is 19.5)

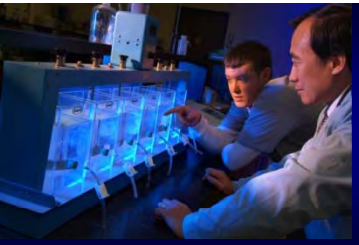
That's an increase of about 1billion barrels of oil per year.



A Chinese increase of 1 billion barrels of oil per year equals about 3 million barrels per day or a 15% increase in US Demand and that is only China.

Total Demand is about 83 million bpd

OPEC supplies about 33 million bpd



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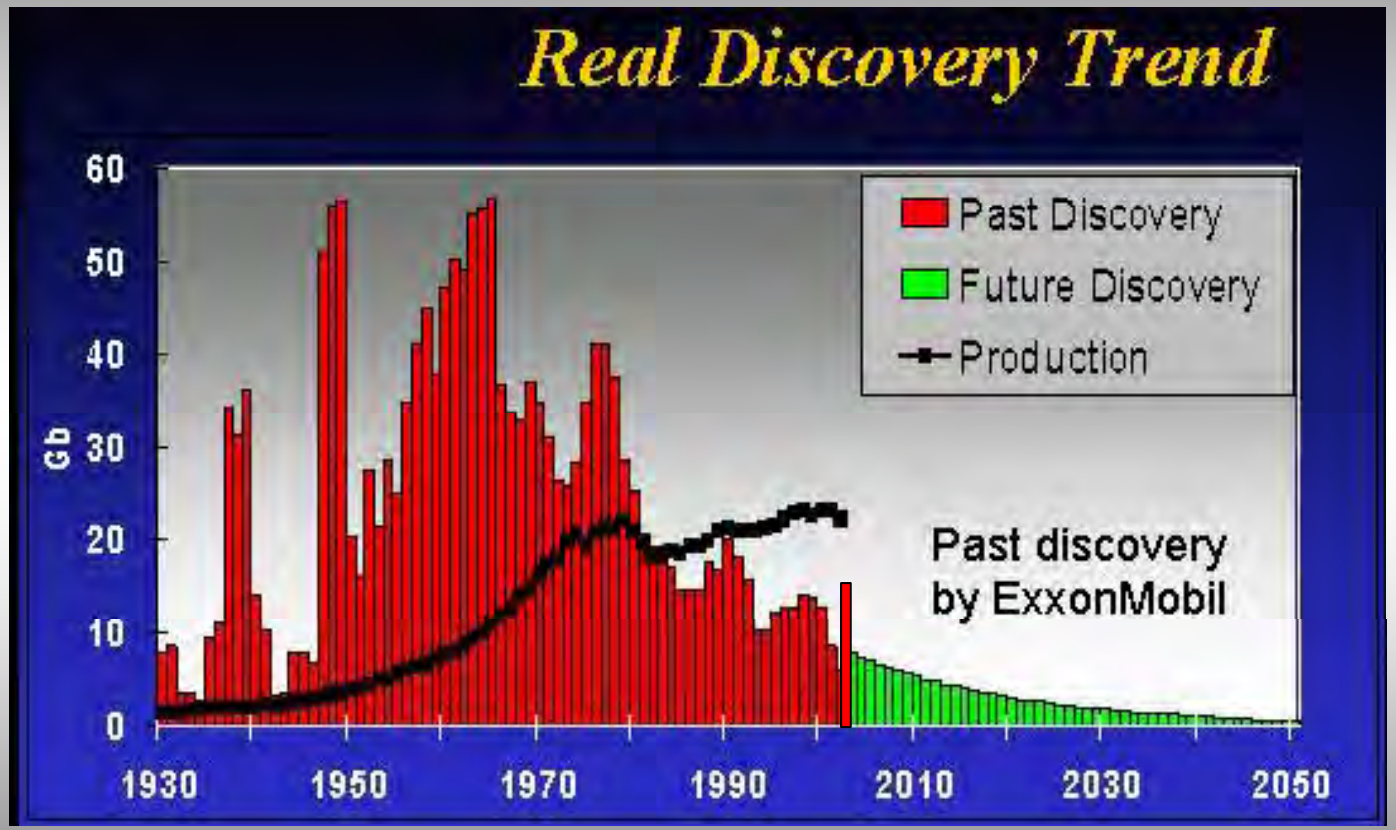
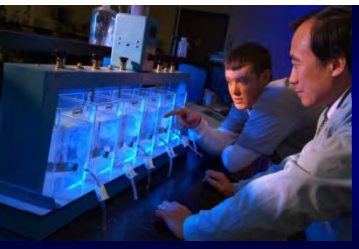
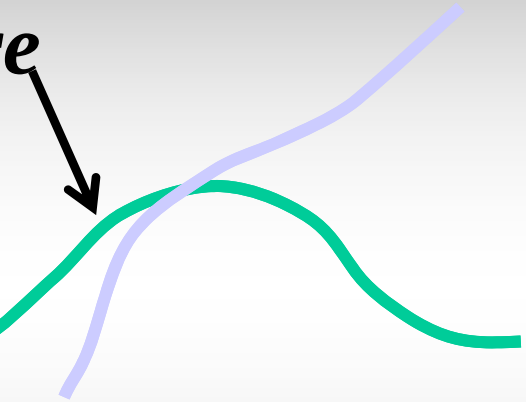


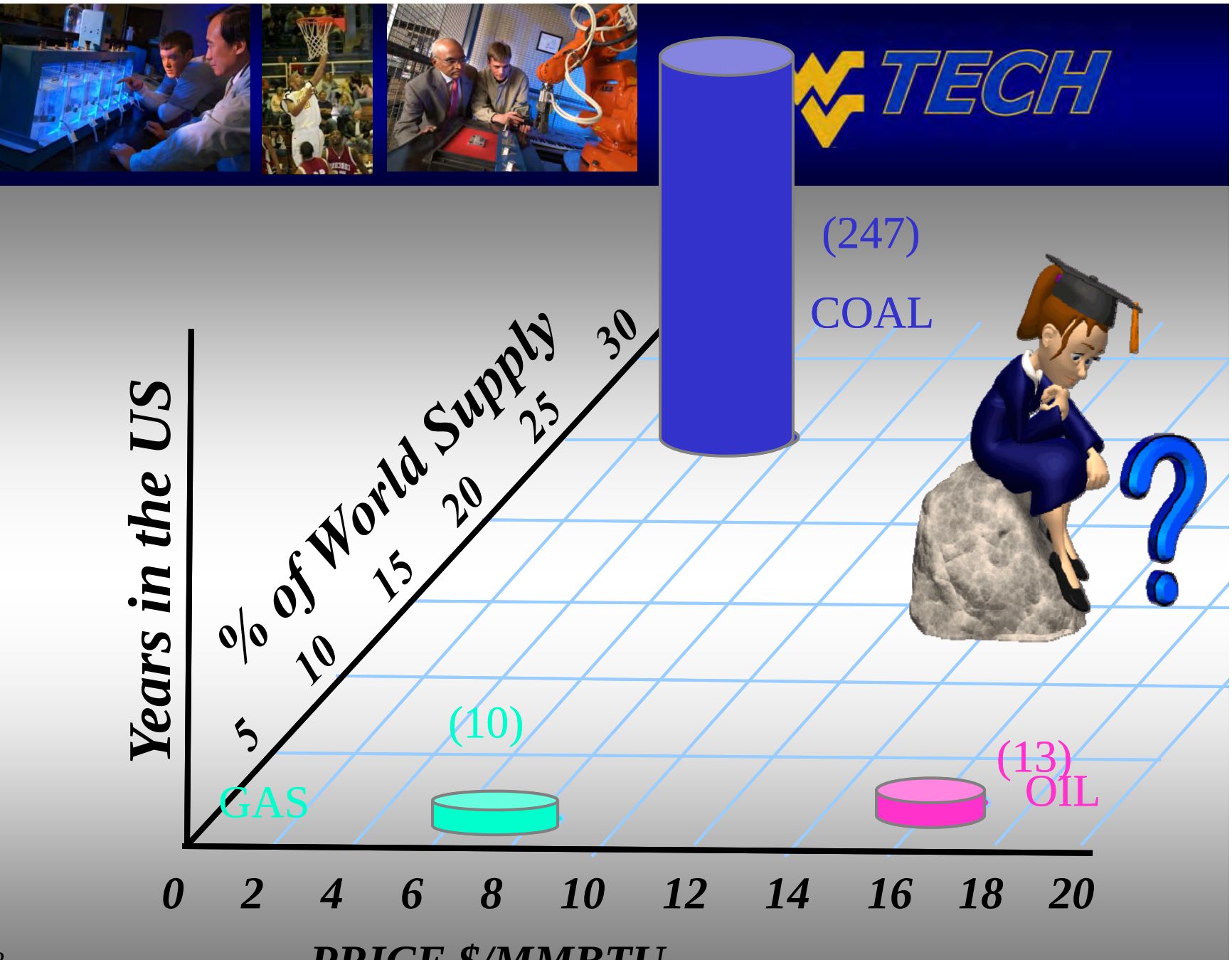
OPEC Figures ???

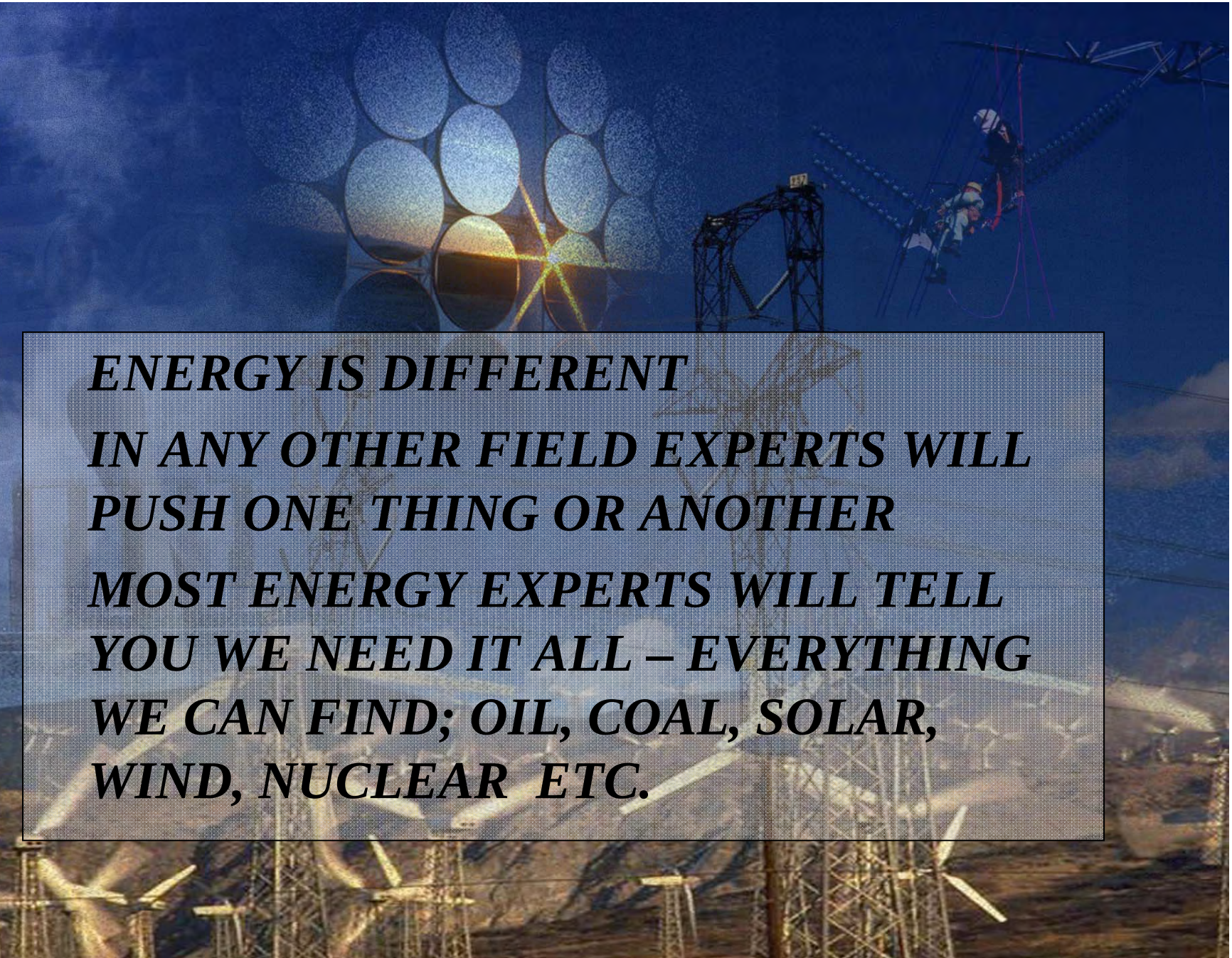


Hubbard Peak



- ***PROBLEM OCCURS LONG BEFORE 42 YEARS***
- ***AND MAY OCCUR YEARS BEFORE THE PEAK***
- ***PROBLEM OCCURS WHEN DEMAND EXCEEDS SUPPLY***

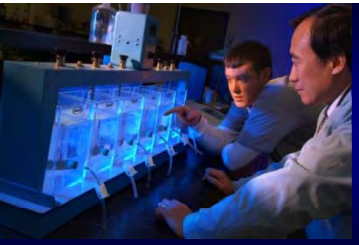

TECH
(247)
COAL
Years in the US
% of World Supply
5
10
15
20
25
30
(10)
GAS
(13)
OIL
0
2
4
6
8
10
12
14
16
18
20
PRICE $/MMBTU



ENERGY IS DIFFERENT

IN ANY OTHER FIELD EXPERTS WILL PUSH ONE THING OR ANOTHER

MOST ENERGY EXPERTS WILL TELL YOU WE NEED IT ALL – EVERYTHING WE CAN FIND; OIL, COAL, SOLAR, WIND, NUCLEAR ETC.



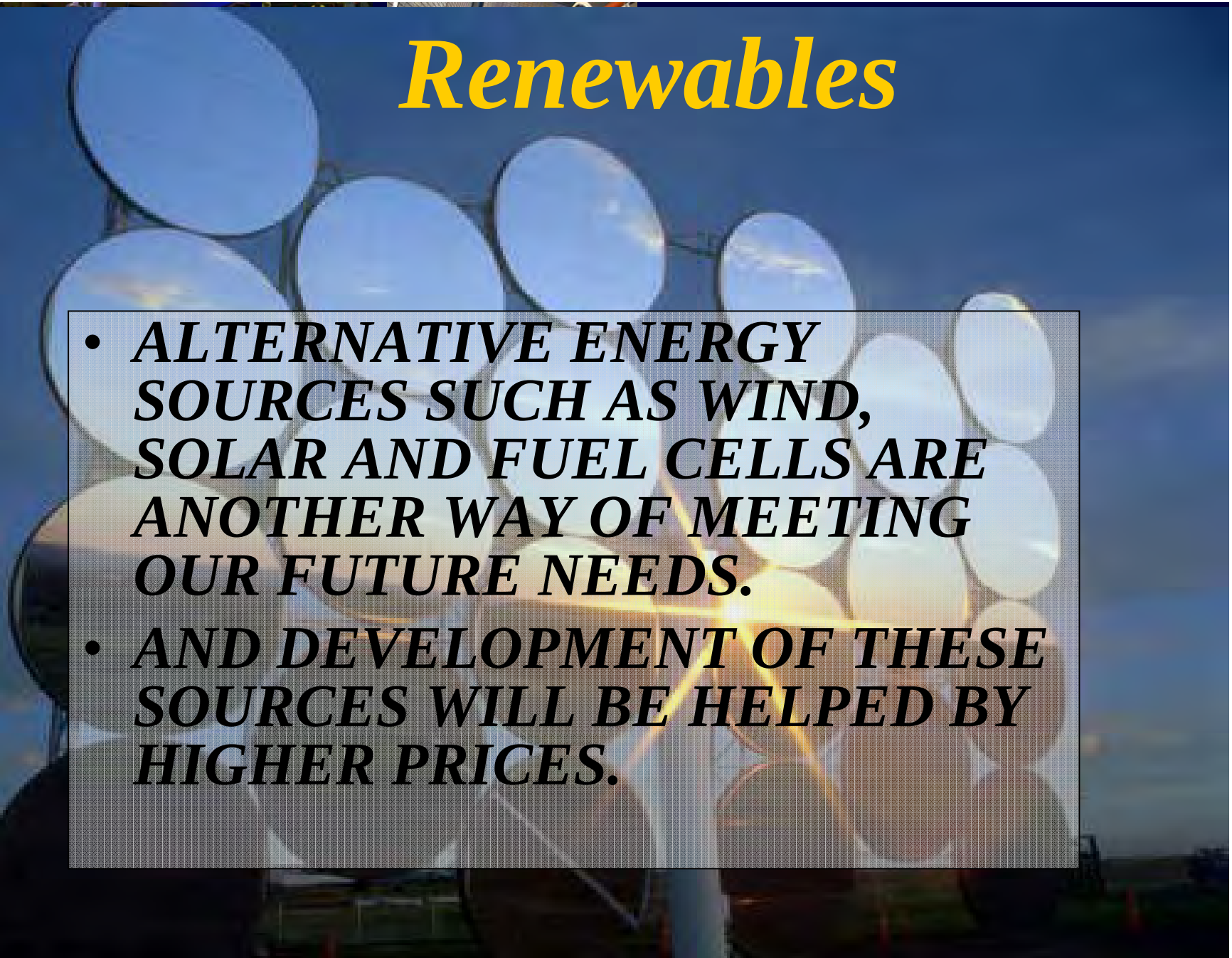
WV TECH

PERCENT ELECTRICITY GENERATED

NUMBER OF OPERATIONAL PLANTS

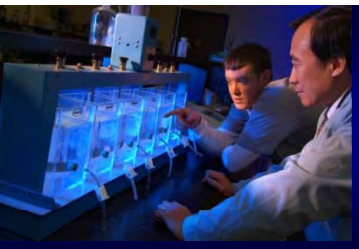
NGDOM	27	27
A	22	14
STATES	103	20
CE	59	75
NY	18	32

13	27	RUSSIA
33	18	SOUTH KOREA
35	52	JAPAN
2	14%	INDIA
47	13	UKRAINE



Renewables

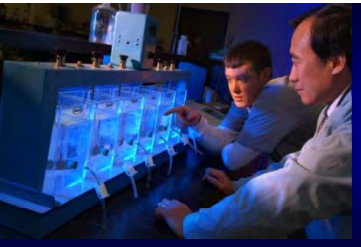
- ***ALTERNATIVE ENERGY SOURCES SUCH AS WIND, SOLAR AND FUEL CELLS ARE ANOTHER WAY OF MEETING OUR FUTURE NEEDS.***
- ***AND DEVELOPMENT OF THESE SOURCES WILL BE HELPED BY HIGHER PRICES.***



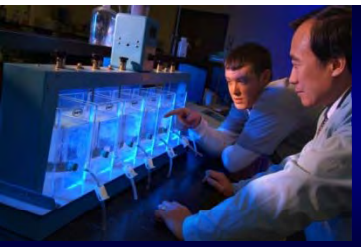
Capacity vs. Energy

The plants on the electric system must produce at any time or be able to produce and store energy.

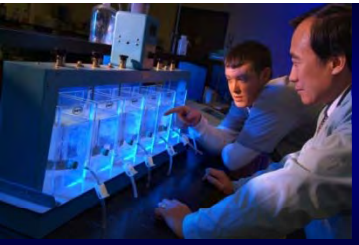
NAERC rules on Capacity



- ***Solar and wind have one big drawback – They cannot be used as capacity.***
- ***Thus if we build 1000mw of wind or solar we still need to build 1000mw of coal, gas etc for those days when the wind isn't blowing or the sun isn't***



- ***To get the equivalent of 20,000 mw of coal in solar you need about 50,000 mw.***
- DOE-" This breakthrough may lead to systems with an installation cost of only $3 per watt,…"
- ***So at $3,000/kw for 50,000,000kw that's $150,000,000,000 an increase of $90 billion over coal.***
- ***And that doesn't count storage.***



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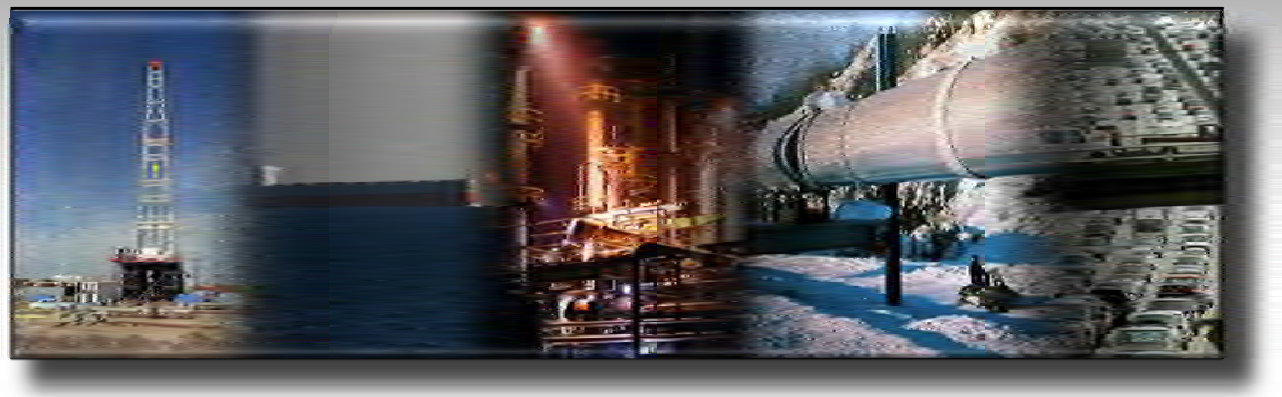
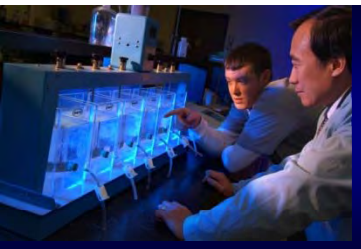


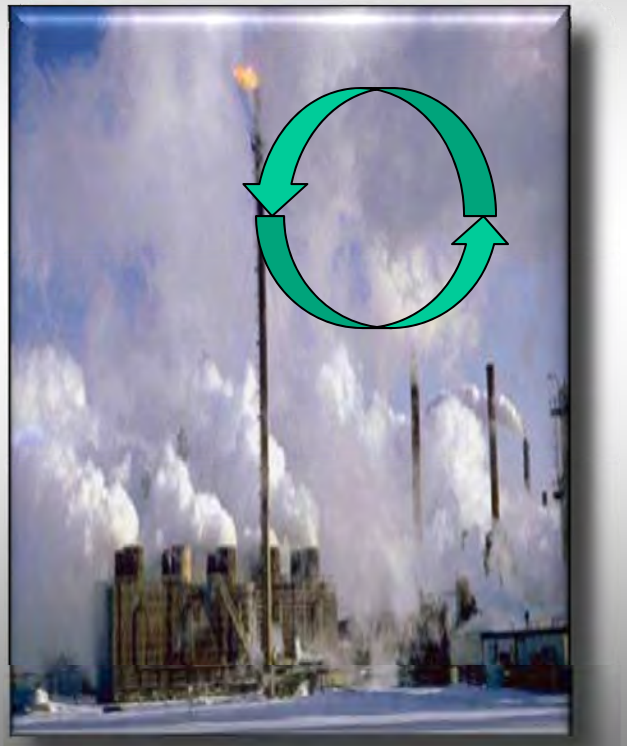
Petroleum
39 Quads

Coal
20 Quads

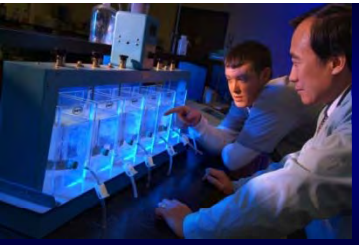
Renewables
6 Quads



Recycled Energy

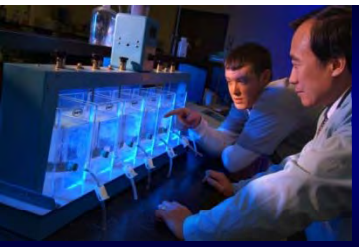


- *With the rapid run up in energy prices it no longer is acceptable to waste energy*
- *Why not put the wasted energy to use*



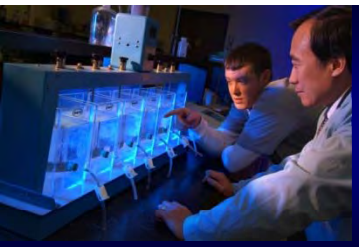
Oil Shale

- Kerogen
- Fossilized Organic Matter (MW>1000)
- Needs Heat to break down.
- Massive reserves
- Massive Energy Use.



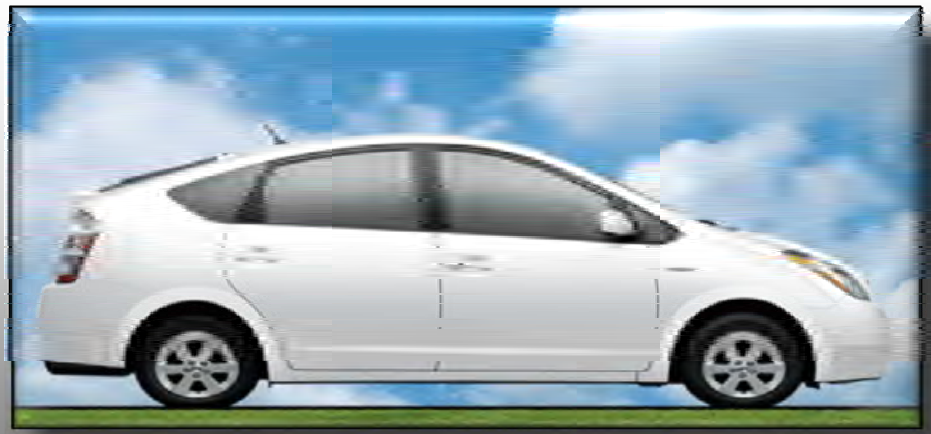
Tar Sands

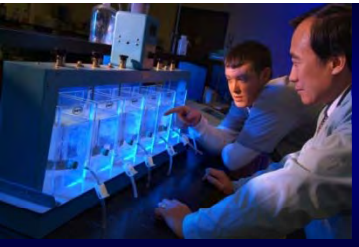
- Bitumen, Solubule
- Massive Reserves in Alberta
  - Athabasca
  - Peace River
  - Cold Lake
- Upgrading
- Needs Heat, Water



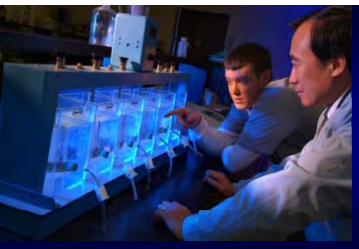
Energy Efficiency

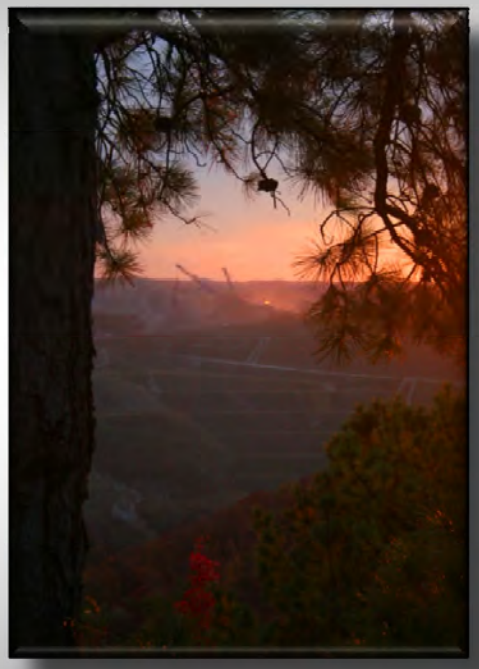
Long-Term Elasticity



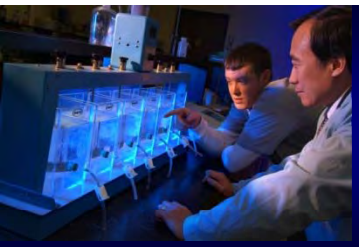


- We lost the Nuclear PR battle.
- We can’t afford to lose the coal battle.



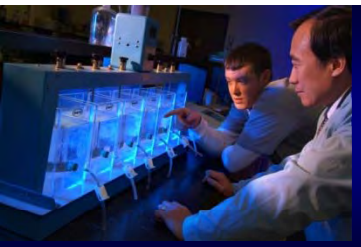


- Mountaintop removal
- Benefits vs. burdens
- Schumpeter



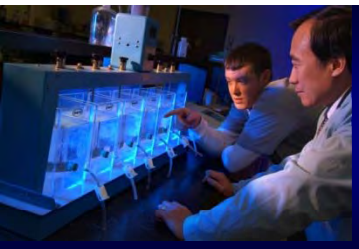
Global Warming

- *Global warming*
- *GWEP GWE(E)P*
- *Doesn't lend itself to price solutions*
  - *Benefits vs Costs*
  - *Price to High*
- *Needs strong National Leadership*



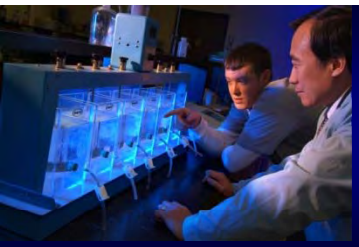
Lack of price signals is a major reason I don't believe renewables will fill the gap.

- ***Externalities***
- ***Cost-definite***
- ***Benefits-Diffuse and nebulous***

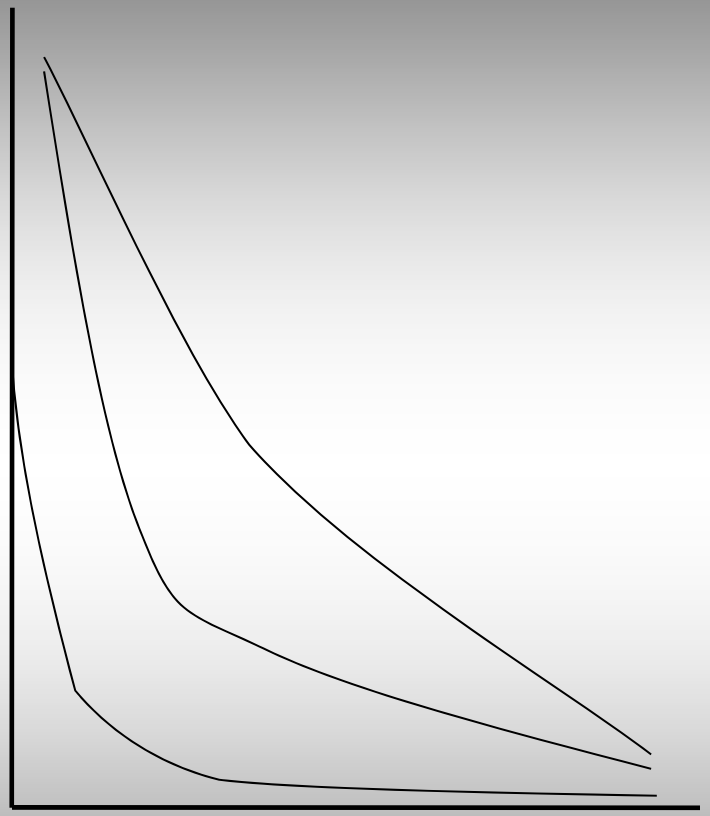


Mercury, Arsenic etc.

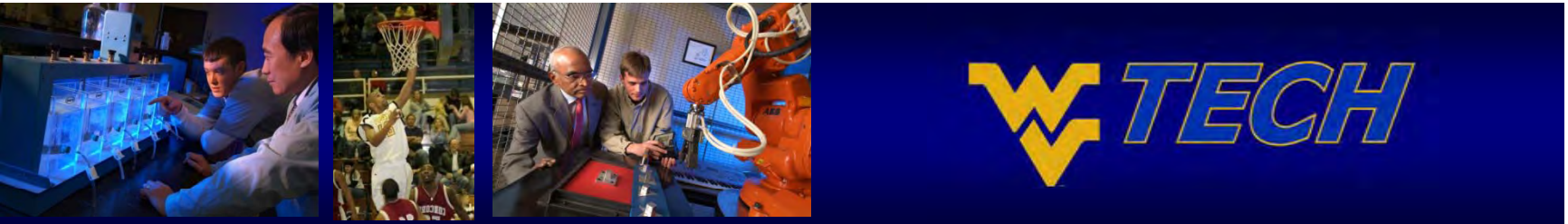
EPA will continue to ratchet down the limits.



- Indifference Curves



Perceived
Environmental Pain



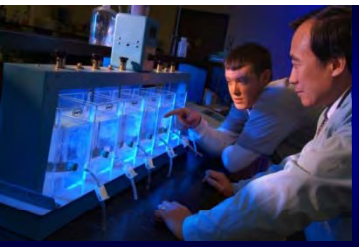
CONSERVATION

++Externalities

PRICE →

Greens

Bubba



Must proactively tackle problems

Must get our message out.

Must address the problems up front or Government will address them for us.


WV TECH
The Future of Energy
"All that Glitters
is not Gold"


VVU TECH