Energy, Biomass, and Other Abstract Ideas

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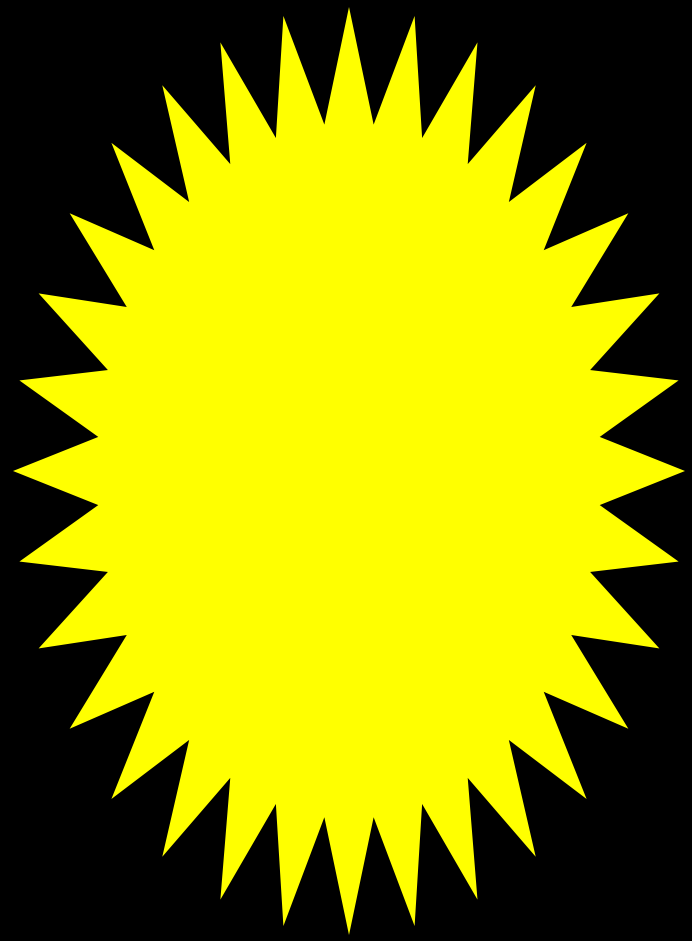
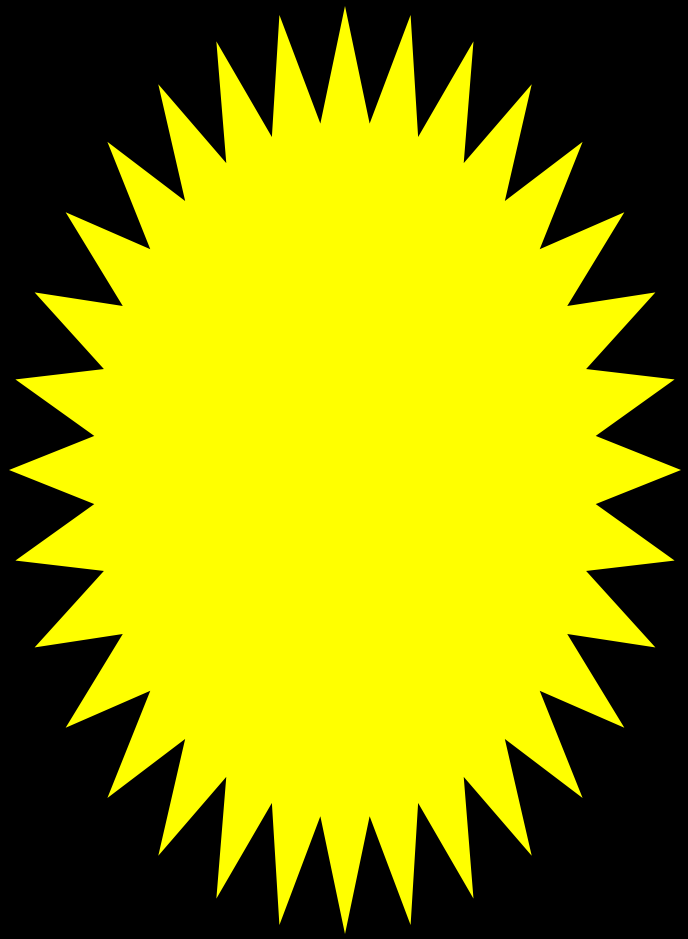
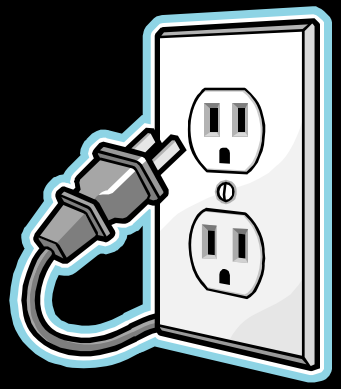
The best way to predict the future . . . is to invent it.

Coal, Natural Gas, Oil



Heat, Electricity, Fuel





What's Driving the Energy Concern?

Instability

Rising Costs

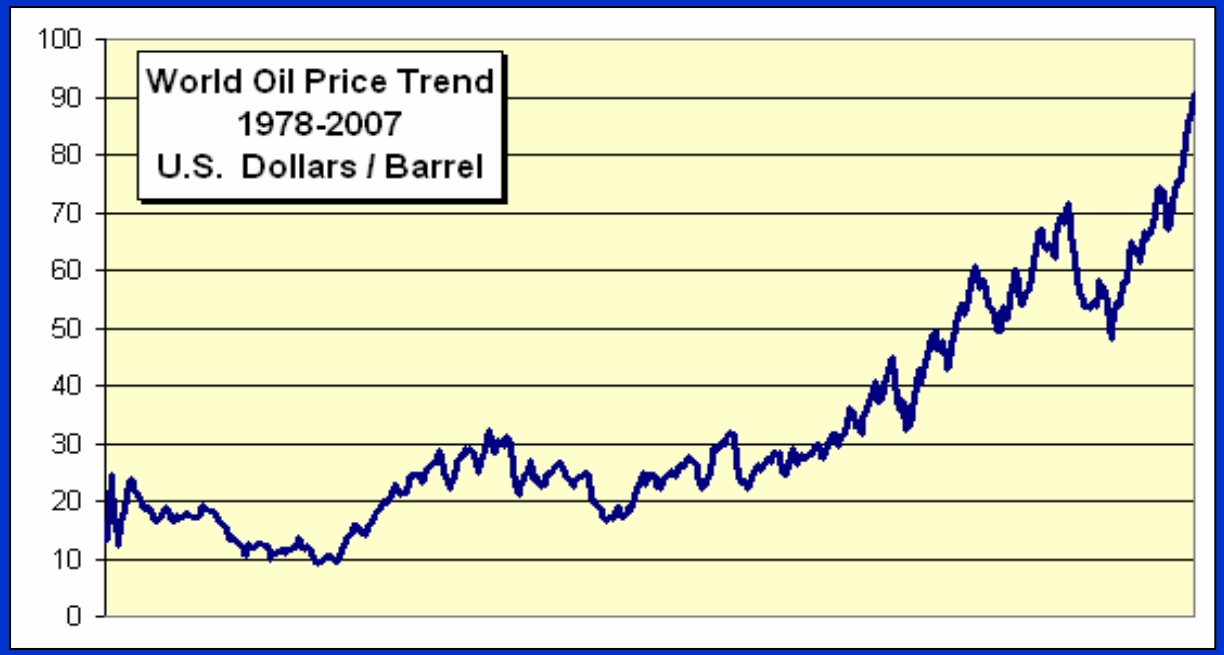
Increased Energy Demand

Limited Supplies

Environmental Impacts

Greenhouse Gas Emissions

Energy Prices Are Increasing and Not Likely to Go Down



Price of Oil

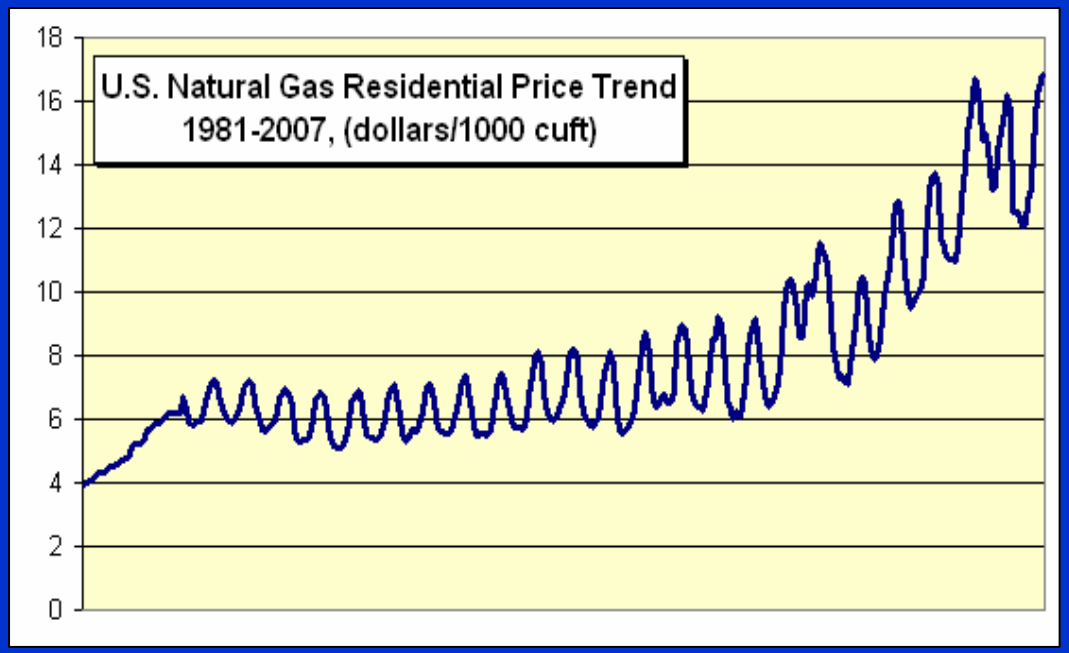
Hit $100/barrel January 2008

Hit around $130/barrel

Now down to about $50

Source: DOE Energy Information Administration

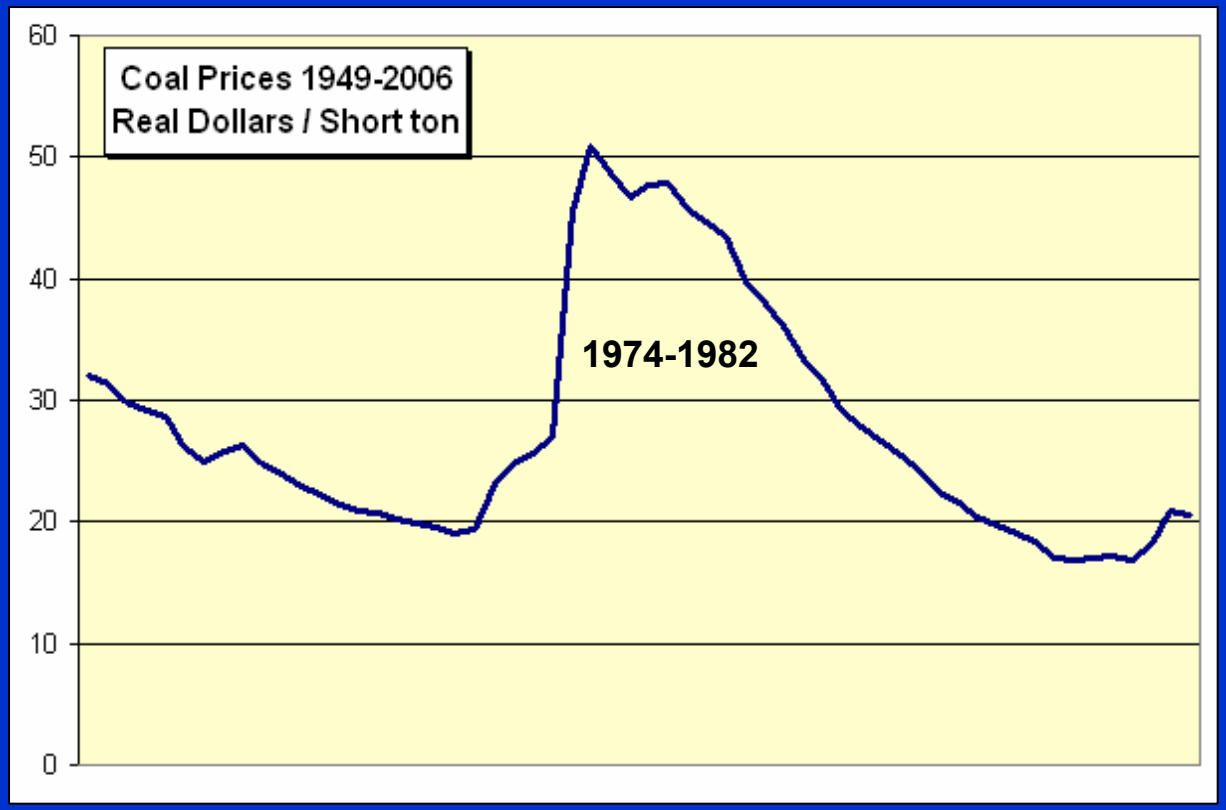
Energy Prices Are Increasing and Not Likely to Go Down



U.S. Prices for Home Natural Gas

Source: DOE Energy Information Administration

Energy Prices Are Increasing and Not Likely to Go Down



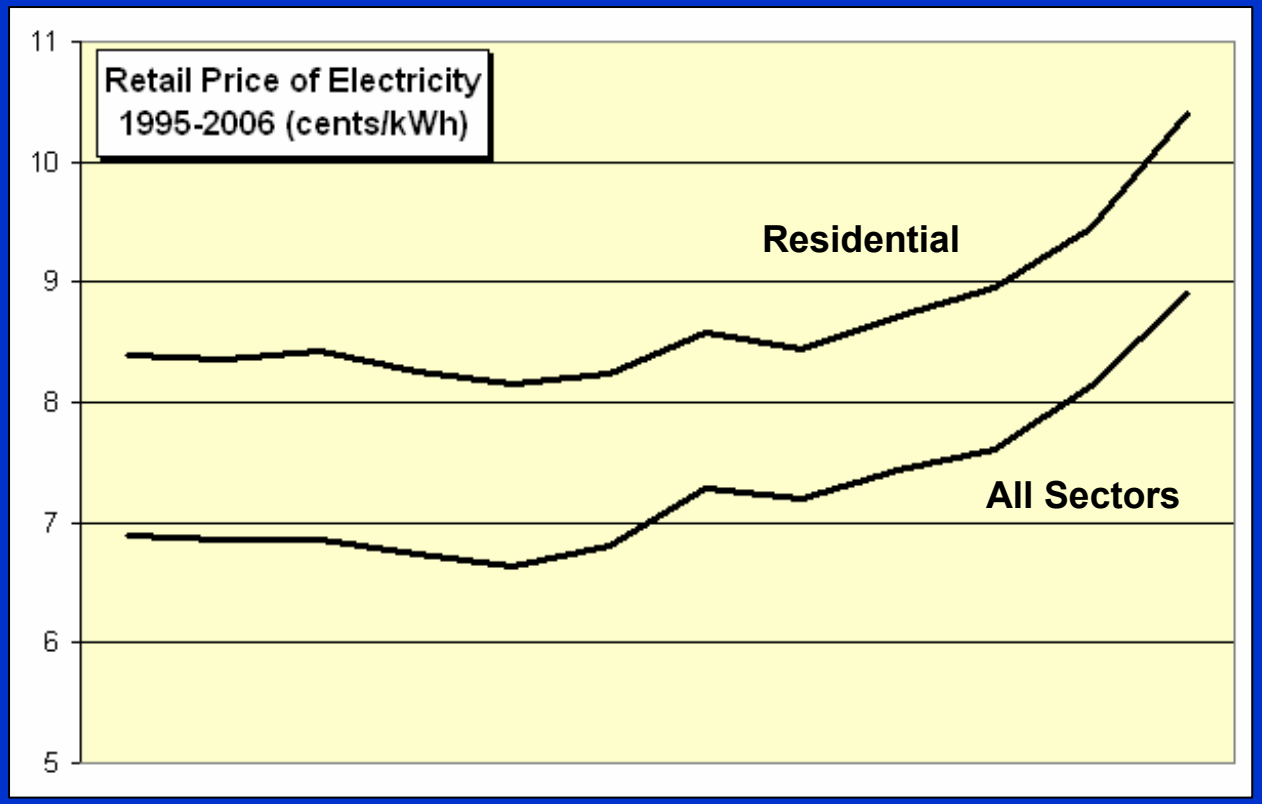
Price of Coal

Low Cost Huge Supply

$95/ton 2008

Source: DOE Energy Information Administration

Energy Prices Are Increasing and Not Likely to Go Down

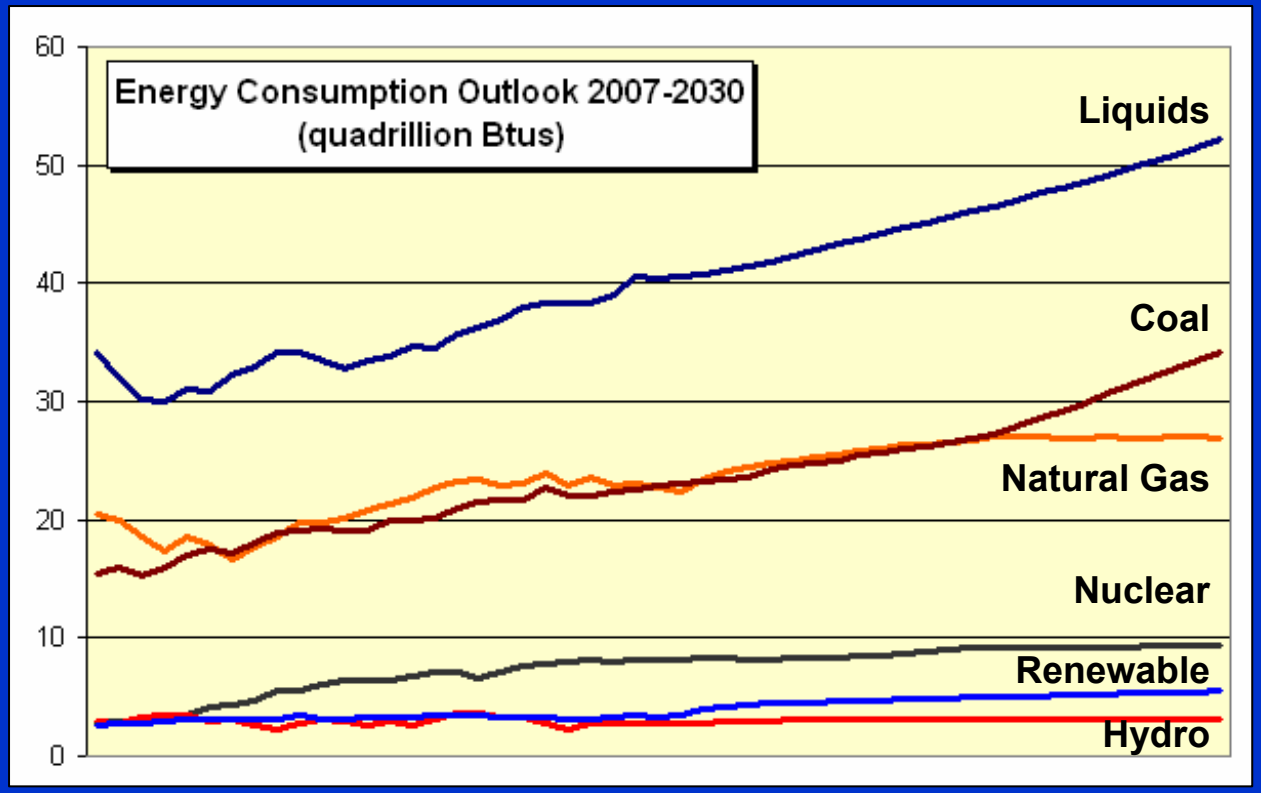


Price of Electricity

Largely Coal-Based and Some Nuclear

Source: DOE Energy Information Administration

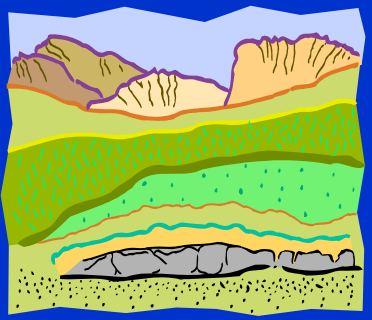
Energy Prices Are Increasing and Not Likely to Go Down



U.S. Energy Consumption

Source: DOE Energy Information Administration

Carbon Quickie



How much energy do we use?

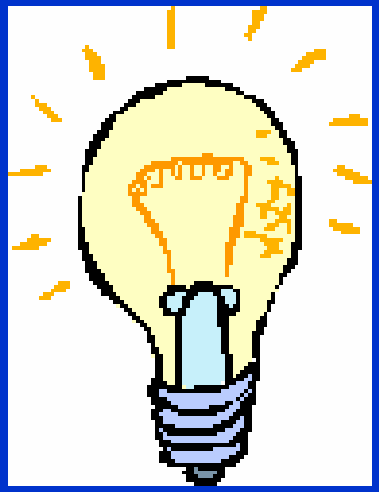
Michigan uses the equivalent of 3.1 quadrillion BTUs of energy

87% comes from FFs

Wisconsin uses 1.8 quads of BTUs

80% comes from FFs

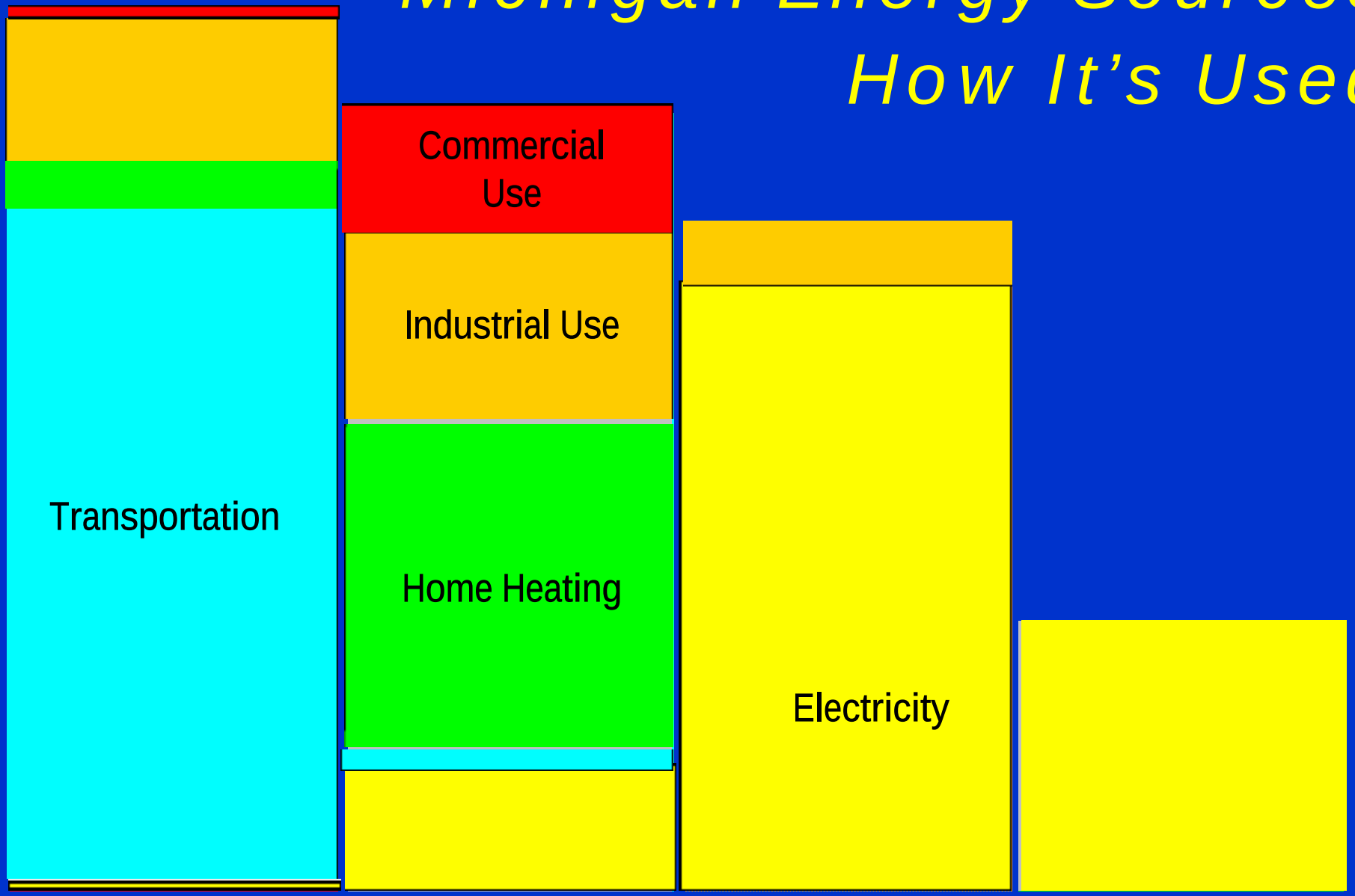
3 solutions . . .



- *use less energy*
- *use fewer FFs*
- *use more wood*
  (and other renewables)

This does not necessarily mean a reduction in either productivity or lifestyle

Michigan Energy Sources
How It's Used



How Does Woody Biomass Fit Into This Picture?

Reduce Fossil Fuel Use

Vigorous Forests Draw More Carbon

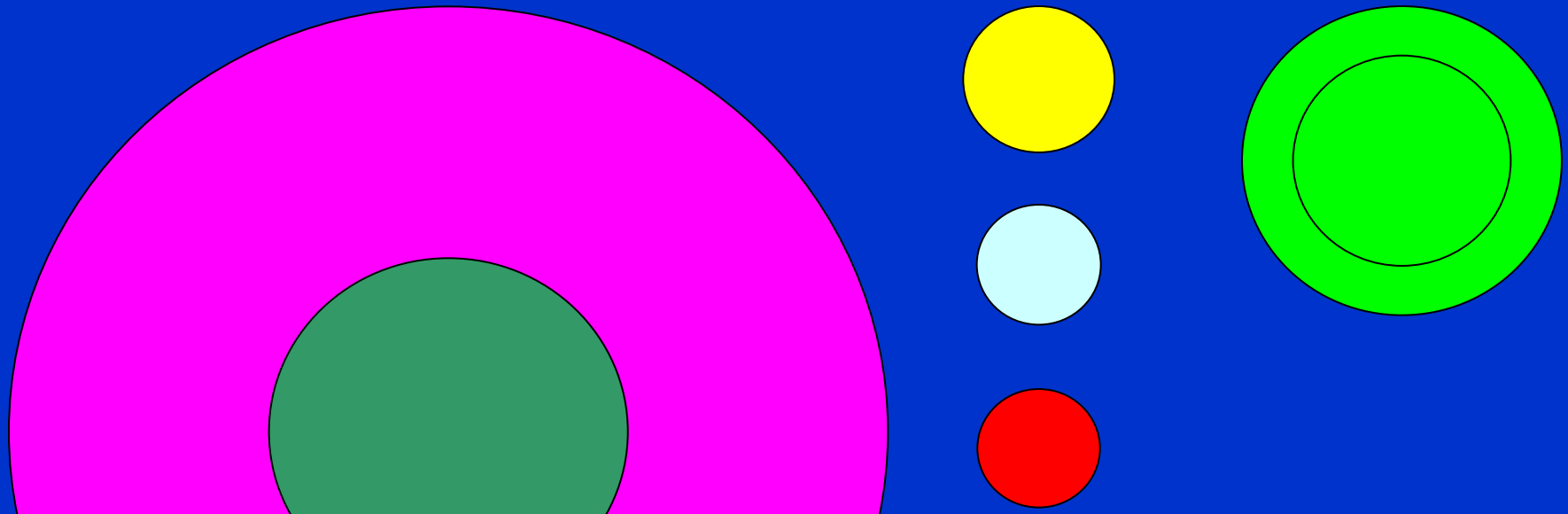
Help Rural Economies

Use Local Resources

Keep More Money Local

It's What We Have!!

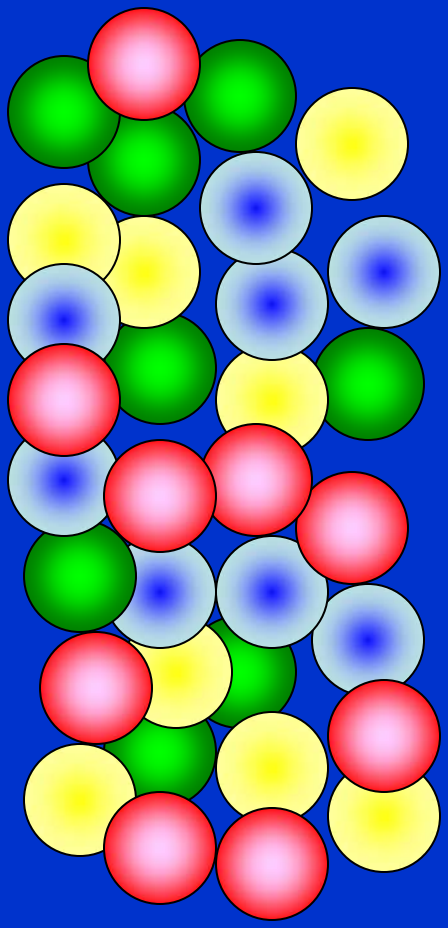
Biomass ~3% of Michigan Total



PINK: Total MI Energy Consumption = 3,119 trillion BTUs (EIA data)
YELLOW: Current MI Energy supply from biomass = 90.6 trillion BTUs (EIA data) – mostly forest industry
SM.GREEN: Annual gross forest growth (net+M) = 189.0 trillion BTUs (FIA)
LG.GREEN: Add 37.8 trillion BTUs for slash = 226.8 trillion BTUs (5:1 ratio). Add 172.2 trillion BTUs for energy ptns = 399.0 trillion BTUs (6 million acres abandoned farm x 2.0 cords/acre/year)
LT.BLUE: Potential wind btus equivalent from MI Renewable Energy Commission (right org?) – they claim 5% of MI electric consumption
RED: Potential combined crop residues + switchgrass on CRP + slash + mill residue + MSW (33% of forest)
DK.GREEN: all renewables combined, about 16.7% of total 3.1 quads (NOT solar)

Begin With Wood Made of Chemicals

Re-assemble Chemicals to Form Ethanol, Oils, and Other Valuable Products



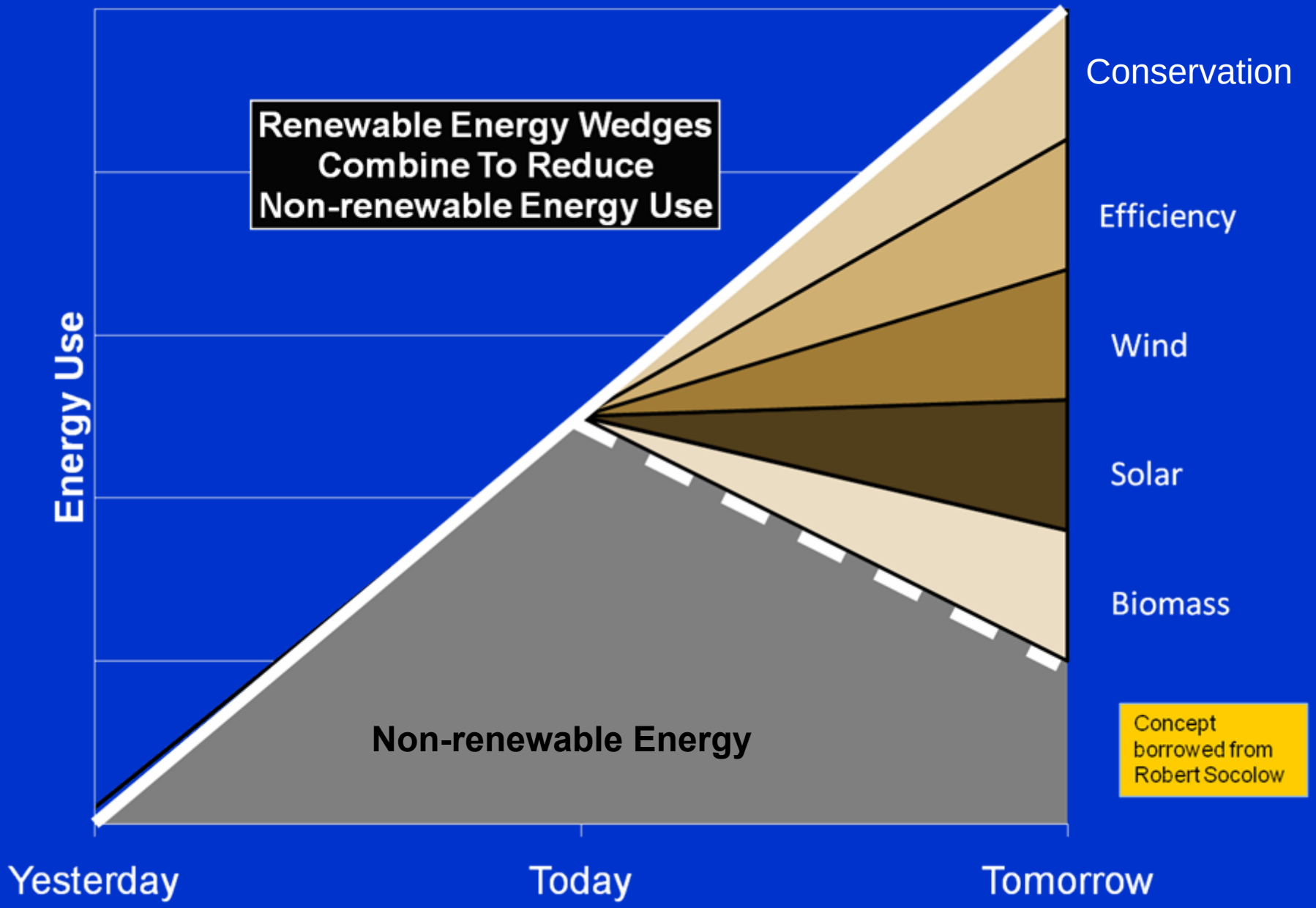
How to Get the Energy?

The biochemical process:
Hydrolyze & ferment → Fuels & chemicals

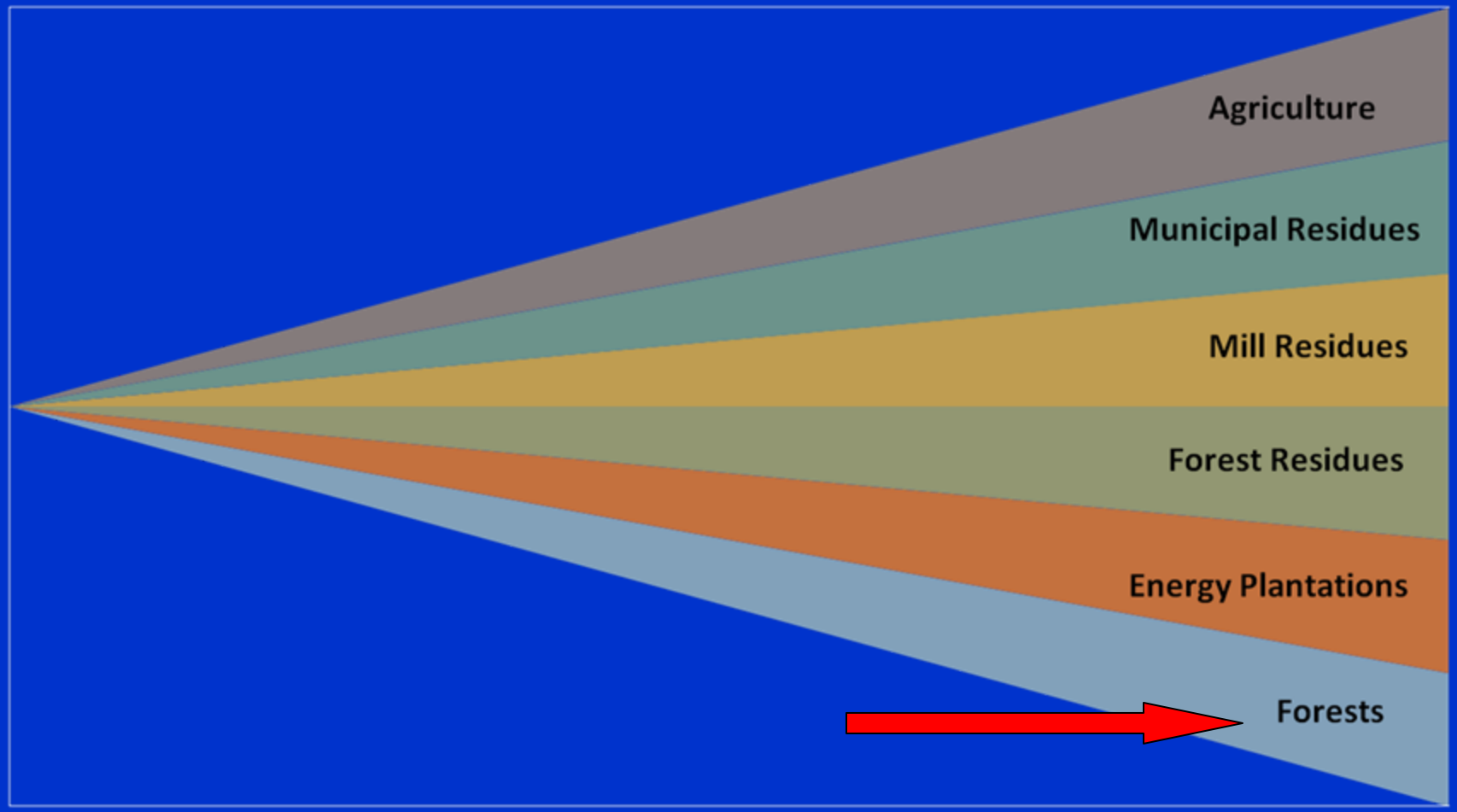
The thermo chemical process:
Pyrolize & reform → Fuels & chemicals

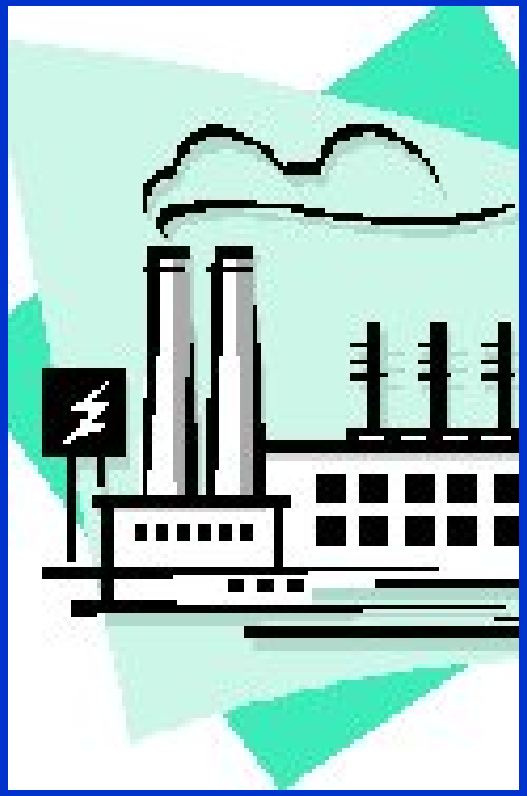
Burn wood morfe eficiently:
CHP & District Heating Systems

Note: Various processes require different feedstock quality characteristics.


Renewable Energy Wedges
Combine To Reduce
Non-renewable Energy Use
Energy Use
Conservation
Efficiency
Wind
Solar
Biomass
Non-renewable Energy
Concept
borrowed from
Robert Socolow
Yesterday
Today
Tomorrow

The Biomass Wedge





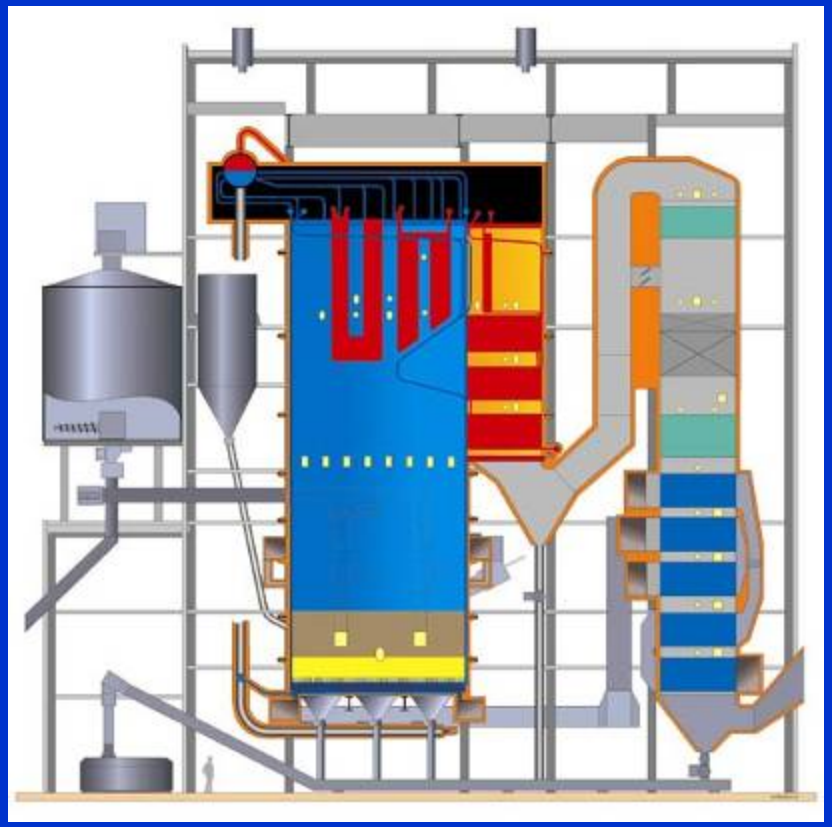
Use Better Technology

Huge energy losses in a coal-burning plant

70% up the stack

Transmission line loss

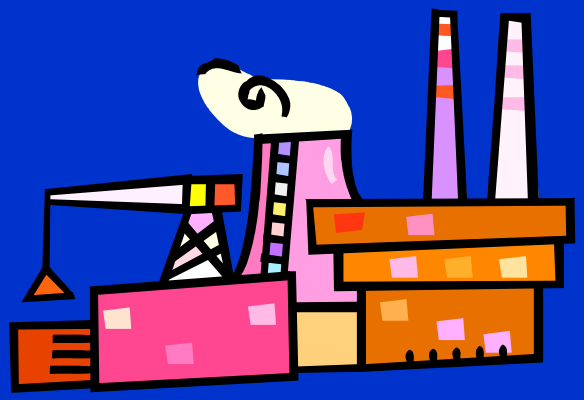
Newer ideas are: DE-CHP, better efficiencies, transportation fuels, integrated operations



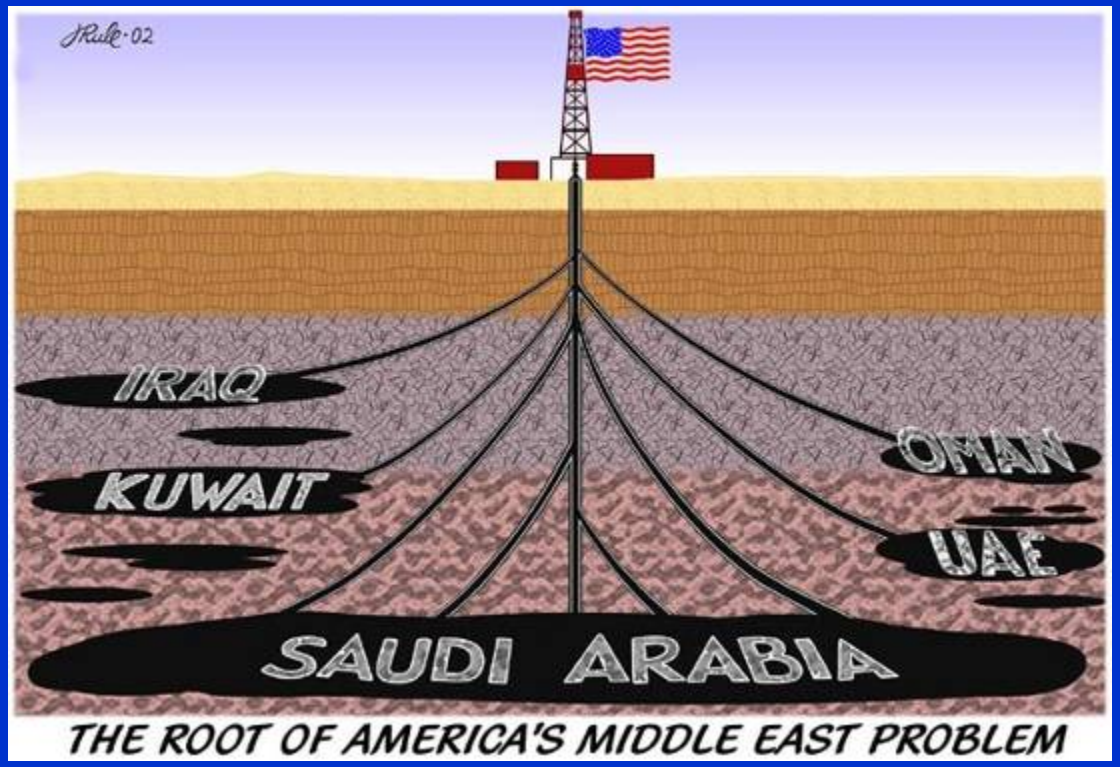
Hot Water Heat
Electricity

60-70%
energy capture

Newer ideas are: DE-CHP, better efficiencies, transportation fuels, integrated operations



Newer ideas are: DE-CHP, better efficiencies, transportation fuels, integrated operations



Ethanol
Other alcohols?
DME
Emerging technologies

Newer ideas are: DE-CHP, better efficiencies, transportation fuels, integrated operations

Pulp

Paper

Chemicals?

Electricity

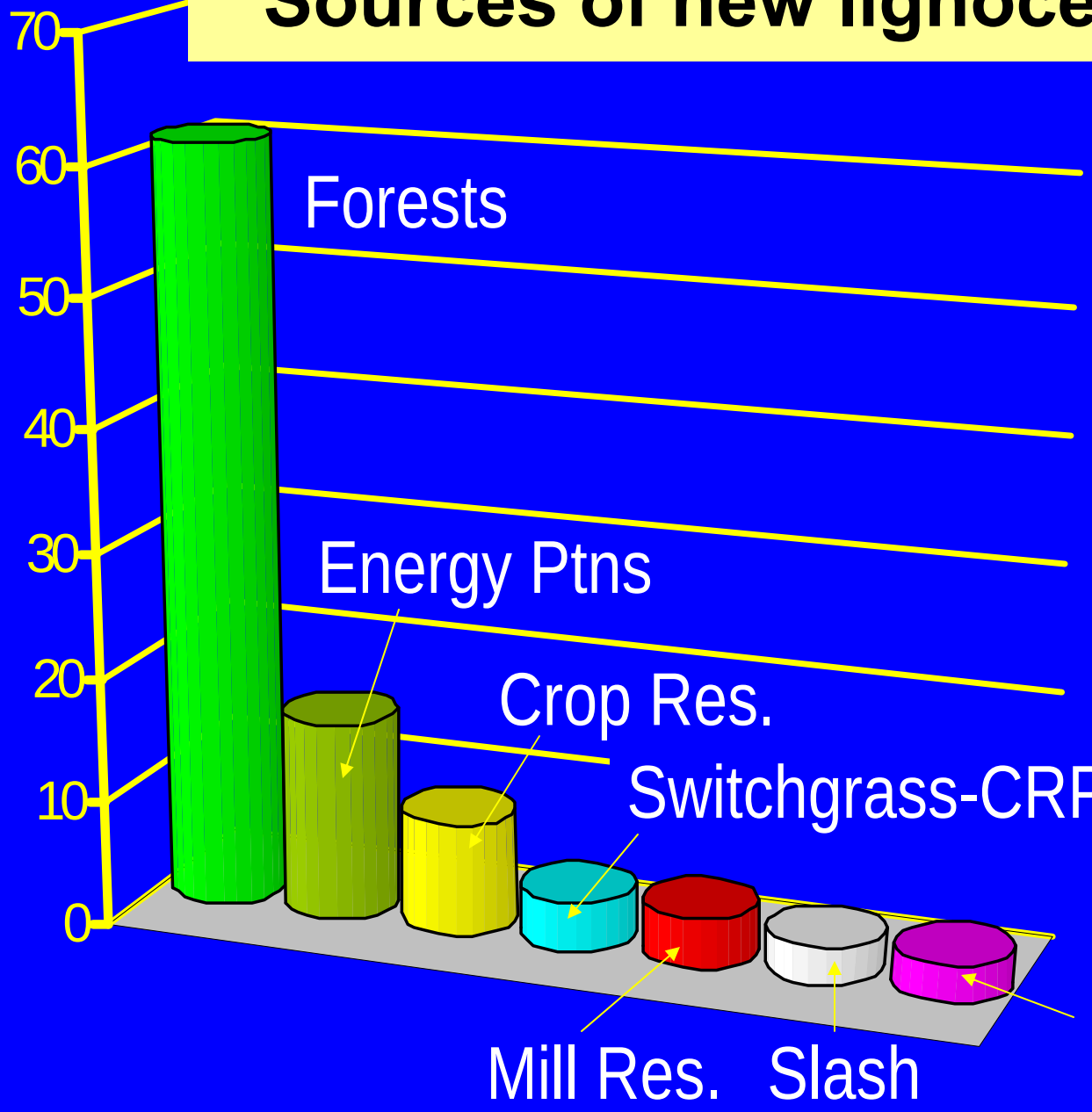
Heat

Fuels

Demand Side Innovation

Let's cool a building - demand
Simply use more energy?
Building design & orientation
Construction and insulation
Thermostat control
Multiple energy sources?
Use trees-landscaping for shade
Capital costs and payback time

Sources of new lignocellulose



Possibly 40 million dry tons annually

Estimations by R. Miller


A MILLION CUBIC METERS OF WOOD
(~440,000 cords, ~500,000 dry tons)
Michigan grows ~26 times this much wood each year
~50 million gallons ethanol
Electricity for ~half million homes
1/2 wood supply for Mascoma
80% of Weyerhaeuser mill
2 Grayling power plants

Use More Wood – How?

Wood is what Michigan has!
Can also use wind, solar, corn, other cellulosics, hydro, nuclear.

Wood is not a silver bullet, but it's one of the weapons in the energy independence arsenal and especially appropriate for the Lake States.

Some Advantages of Wood

- *Few inputs*
- *Available all seasons*
- *Low storage costs*
- *Less combustion residue (than ag)*
- *More natural systems (other outputs)*
- *Known heat & electricity technology*
- *Local nearly everywhere*
- *Carbon issues, little soil C loss*


Perhaps, we need to curb
our enthusiasm?

Some Challenges with Wood

- *High transportation costs*
- *Competition with traditional industry*
- *Habitat impacts (+ & -)*
- *Nutrient limitations on some soils*
- *Harvest technology*
- *Supply chains poorly understood*
- *Inconsistent logging infrastructure*
- *Public attitude about harvesting*
- *Perception of smoke, truck traffic*
- *Liquid fuel conversion technology*

Environmental and Availability Issues

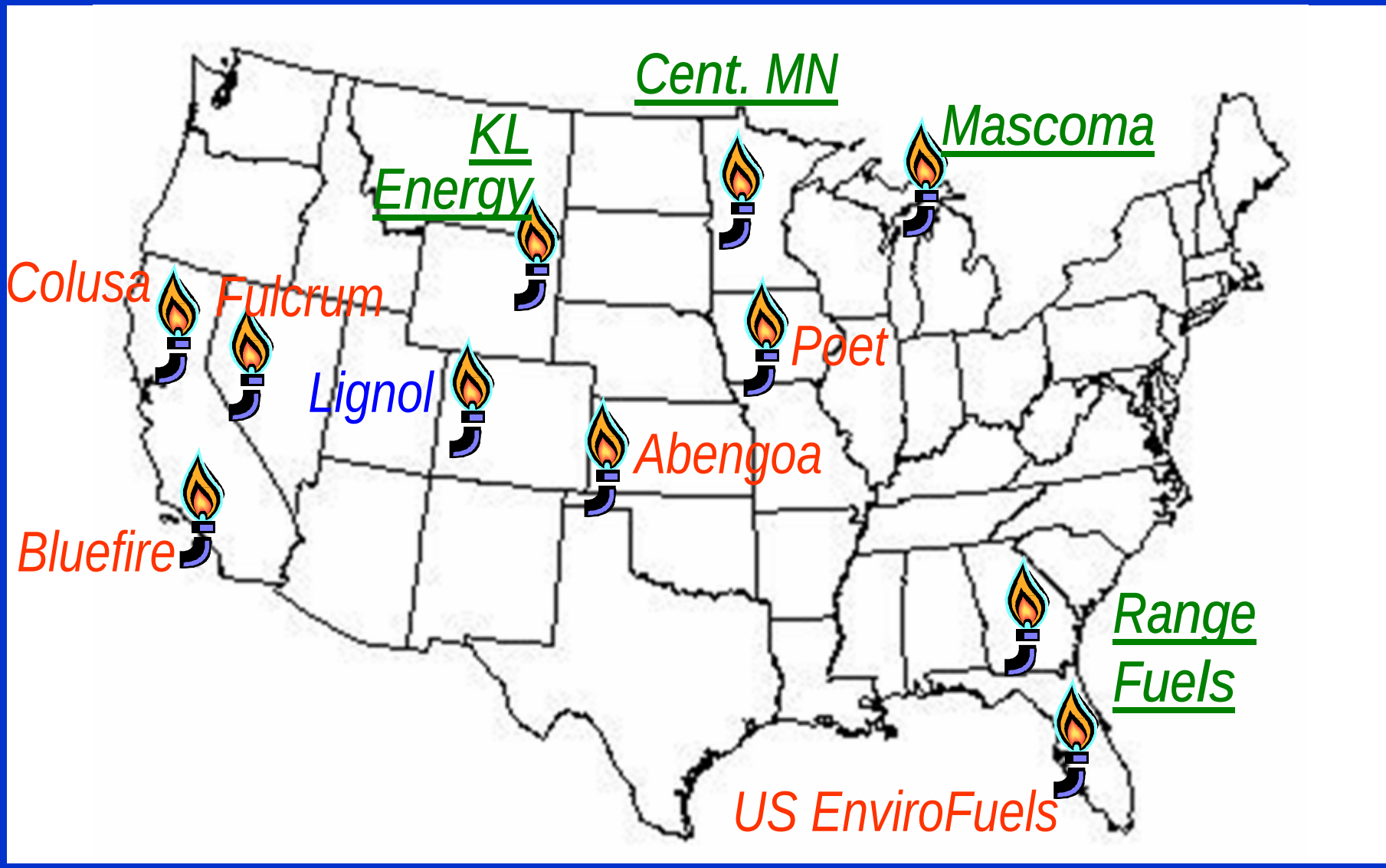
- Wood comes from the forest.
- Loggers need economical access.
- The forest is an ecosystem with limits.
- Sustainable harvest needs to continue and many safeguards, policies, etc. are already in place.
- Need to look at the potential impacts of increased biomass removal from currently managed forests as well as currently under/non utilized forests.

Michigan has lots of wood, but how much is available and what cost?

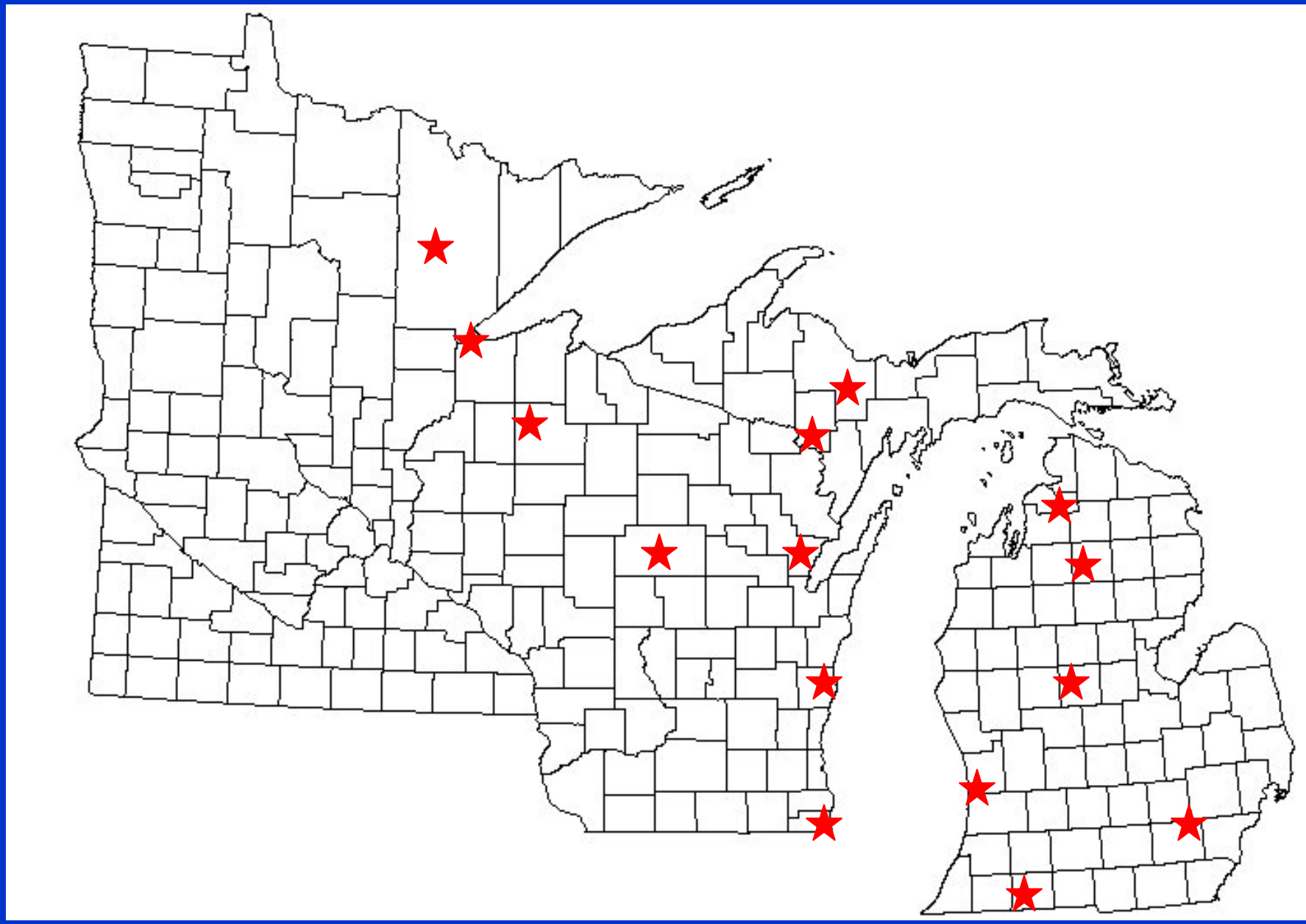
Threats to fiber supply
- high costs, global markets
- ownership parcelization
- owner reluctance to harvest
- land use changes

Limits are primarily social & economic, not biological or ecological

Major Cellulosic Ethanol Efforts



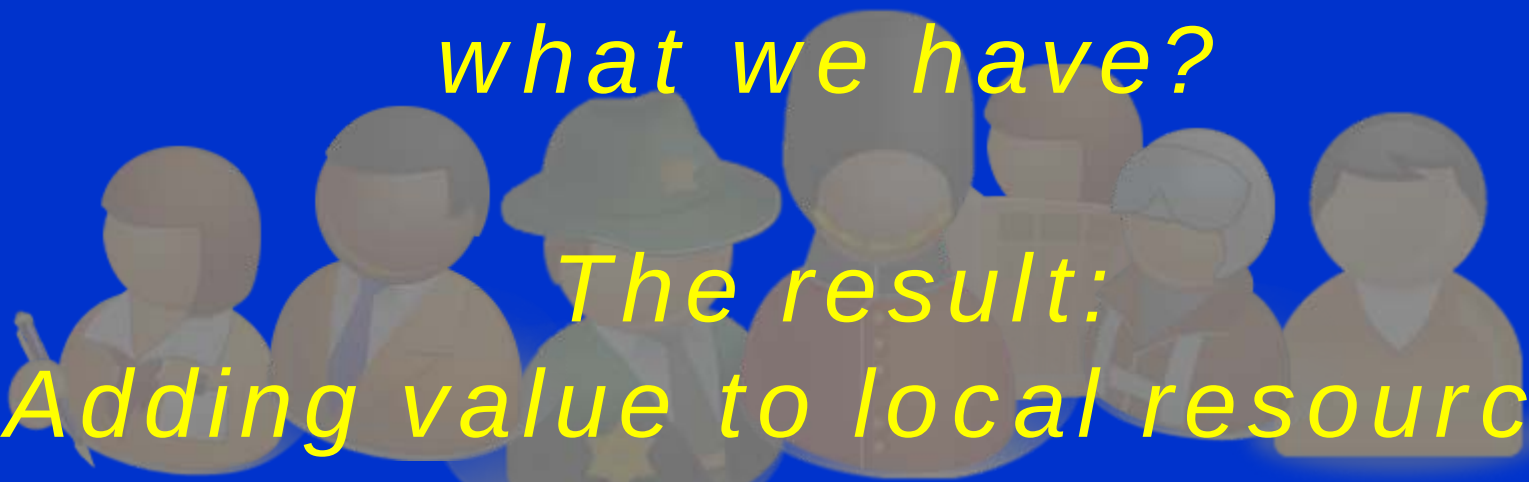
Wood Pellet Plant Locations



In the United States we ask:
How can I buy the biggest, shiniest, cheapest thing?
(kilowatt, TV, gasoline, T-shirt)

The result:
We shop at Wal-Mart for goods made in China, and close our factories.

The question might be:
How can <u>WE</u> get the most out of what we have?



The result:
Adding value to local resources and pay attention to consequences.

Upshots?

Adapt

Be smart

Use what ya got

Keep your money local

Be part of the solution

Change is inevitable . . . survival is optional.