Common Sense Solutions for Management of Global Warming

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Popular Notions on Global Warming

- Increasing Global Carbon Dioxide Levels (2.7%/year) Causes Global Warming and Ocean Acidification
- This is a Result of Increased Use of Fossil Fuels
- Global Environmental Disaster will ultimately Result
- Popular Perspectives advanced in the Media:
  - Fossil Fuels are “evil” and must be eliminated as an energy source beginning with Coal
  - Replace Fossil Fuels with Renewables beginning with Coal (No mention of When of If this is possible)
  - No mention of the COSTS of these “solutions” to the Global Economy or Human Populations
On April 13, 2012, the U.S. Environmental Protection Agency (USEPA) promulgated new regulations that amounted to a prohibition on the Best Technologies Currently Available for constructing new coal fired power plants (640g/kilowatt-hour). Instead USEPA would mandate that unless a coal fired power plant met the same carbon dioxide (CO$_2$) emission levels as achievable with power plants fueled by natural gas (454g/kilowatt-hour), it could not be built.
World Total Energy Consumption by Fuel Type

- Petroleum
- Coal
- Natural Gas
- Nuclear
- Other

Data for 2014 and 2005 is compared in the chart.
Total 2014 World Energy Consumption in Percent by Fuel
World Coal Production by Region

- North America
- Western Europe
- OECD Asia
- Non-OECD Asia
- Rest of World

Comparison between 2014 and 2009.
World coal consumption by leading countries, 2010-2040
2010 Global Electricity Production by Fuel Source

- Trillion KWH, Coal, 8.05
- Trillion KWH, Natural Gas, 4.48
- Trillion KWH, Renewable, 4.18
- Trillion KWH, Nuclear, 2.62
- Trillion KWH, Liquids, 0.91
2010 Global Electricity Production by Fuel Source in Percent of Total

- **Percent, Coal, 40, 39%**
- **Percent, Natural Gas, 22, 22%**
- **Percent, Liquids, 5, 5%**
- **Percent, Renewable, 21, 21%**
- **Percent, Nuclear, 13, 13%**
2012 U.S. Electric Generation by Fuel Source (thousand megawatts)
2012 U.S. Electric Generation by Fuel Source (Percent)
<table>
<thead>
<tr>
<th>Source</th>
<th>2011 (billion kwh)</th>
<th>2040 (billion kwh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>1730</td>
<td>1829</td>
</tr>
<tr>
<td>Natural Gas</td>
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<td>1582</td>
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<tr>
<td>Nuclear</td>
<td>790</td>
<td>903</td>
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<tr>
<td>Renewables</td>
<td>526</td>
<td>858</td>
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TIME Required for Renewables to Replace Coal Electric Power in the U.S.

- 2012
  - Coal 37% of total fuels used
  - Renewables 12% of total fuels used

- 2040 (30 years = apx one generation)
  - Coal 32% of total fuels used (*A reduction of 5% in a generation*)
  - Renewables 16% of total fuels used

7 (30 year) GENERATIONS REQUIRED FOR RENEWABLES TO REPLACE COAL FOR ELECTRIC POWER IN THE U.S.
2014 WORLD POPULATION
7.210 billion with Fossil Fuels or 1.226 billion without
Currently, about 83% of the world population depends upon fossil fuel as an energy source.

A “renewables only world” is improbable in any foreseeable future and if pursued would result in a level of social injustice of “catastrophic” proportions.

Advocating that the world halt progress on “clean and efficient” fossil fuel production and use is likely to delay reductions in CO$_2$ emissions because the world is not prepared to do without current levels of energy consumption.
A Relevant Lesson from History
U.S. Alcohol Prohibition 1920-1933

- Total Alcohol Consumption Levels was reduced by 50%
- ORGANIZED CRIME under Al Capone came to control the supply of beer from Canada to Florida bringing in $60 million a year in profits at his 10,000 speakeasies.
- The repeal of prohibition championed by Franklin Roosevelt and others emphasized the need to raise tax revenue and weaken the base of ORGANIZED CRIME!
The Goal of Prohibition
The Result of Prohibition

PUBLIC ENEMIES

AL "SCARFACE" CAPONE
"BUGSY" SIEGEL
"PRETTY BOY" FLOYD
FRANK COSTELLO

"MACHINE GUN" KELLY
JOHN DILLINGER
"BABY FACE" NELSON
"LUCKY" LUCIANO
US Prohibitions on Fossil Fuels beginning with coal by establishing legal barriers to construction of State of the Art, High Efficiency Coal Fired Power Plants sends a message to the world that efforts to implement clean coal technology are useless. The result is that the world is discouraged from building more efficient less polluting technologies leading to greater levels of global CO² not less.
Impacts of Fossil Fuel Prohibition

- The popularization of propaganda that fossil fuels are “an evil” will stigmatize any person or institution involved with its production or use such that only those that have no problem with that label will be associated with it.
The Goal of a Renewables Only World
The Result of a Renewables Only World

FAMINE

POVERTY

WAR

DEATH
The current Worldwide average **efficiency** for coal used to produce electricity is **30%**.

The conversion of all US coal power plants to existing improved “ultra-supercritical 700 degree C” technology for producing electricity with coal would increase efficiency to **50%**. A **40%** increase in efficiency (resulting in the production of the same amount of electricity with less coal).

This same technology results in an additional **40%** reduction in carbon dioxide emissions from the coal that is burned.

It is conceivable that the world could make this conversion a reality in the foreseeable future **profoundly reducing the global production of Carbon Dioxide**.
Efficiency of Coal Conversion Related to Current Technologies

Coal Efficiency %

- World Average
- Europe
- State of the Art
- 700 Deg C Tech
Carbon Dioxide Produced Related to Coal Fired Power Technologies

CO2 in grams/kwh

- World Average
- Europe
- State of the Art
- 700 Deg C Tech

CO2 in grams/kwh
Conclusions

- Solutions must be globally applicable to be effective.
- Solutions that negatively impact the global economy and human population quality of life will not be adopted.
- Quantitative US fossil fuel reductions will have very little impact globally.
- The unmanageable TIME FRAME for replacement of fossil fuels with renewables demands that all fuels be made increasingly efficient with reduced rates of carbon emissions as quickly as technology allows.
- Prohibitions of fuel specific BACT solutions will have a negative rather than positive impact on the problem.
Sources of Data

- Energy data is from the U.S. Energy Information Administration at: www.eia.gov
- Global Human Population figures based on U.S. Census Bureau data found at: http://www.census.gov/popclock
- U.S. Environmental Protection Agency (USEPA): www.epa.gov
Questions?