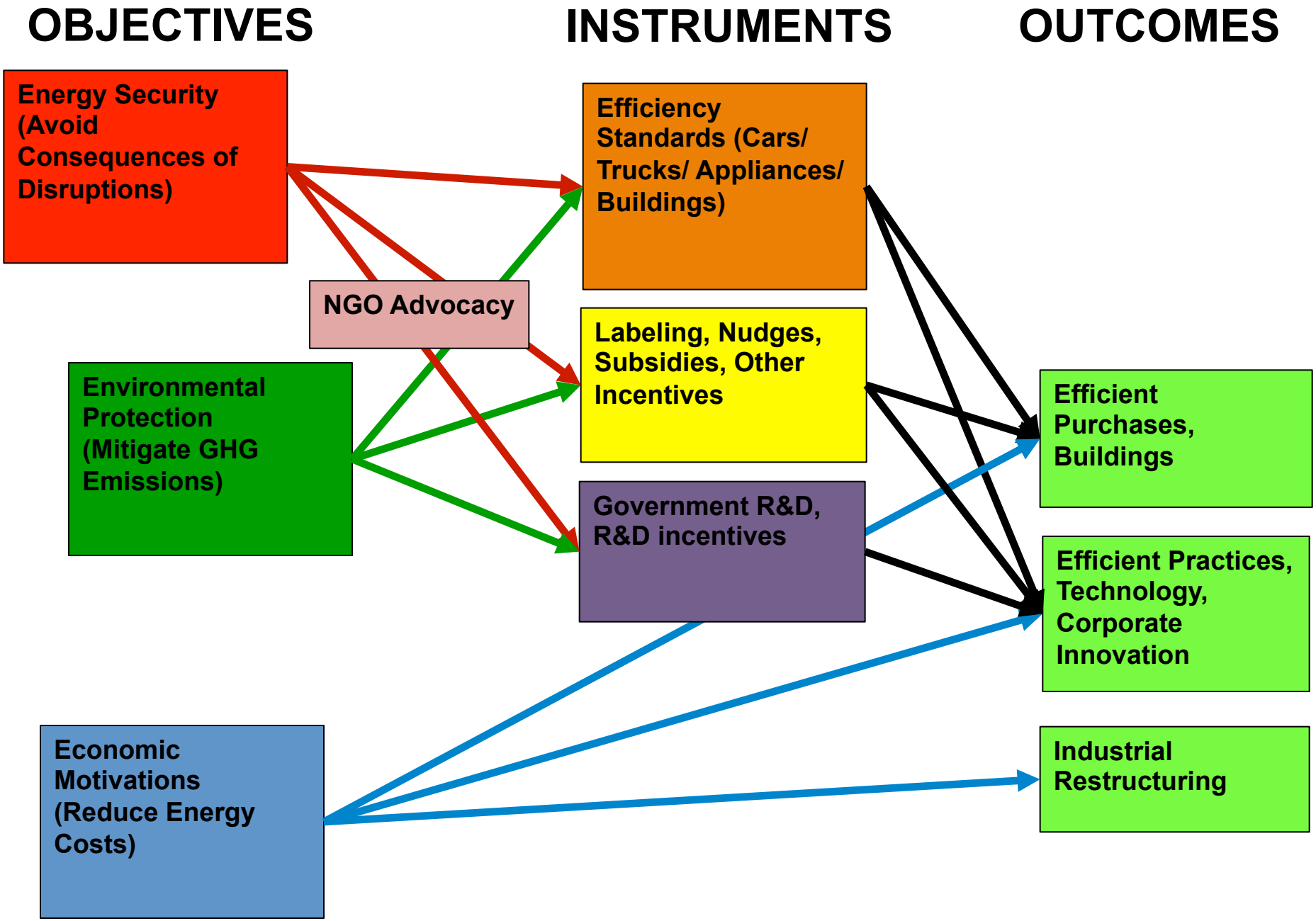
Comments on Instruments Related to the Demand for Energy

James (Jim) Sweeney

In order to effectively model ways of reducing the amount of energy used, it is important to look at instruments going beyond carbon taxes or other prices.

History of energy efficiency gains in United States since the oil crisis shows that there were many factors in addition to energy prices that lead to cumulative process of energy efficiency gains.

Approximate Chain of Causation



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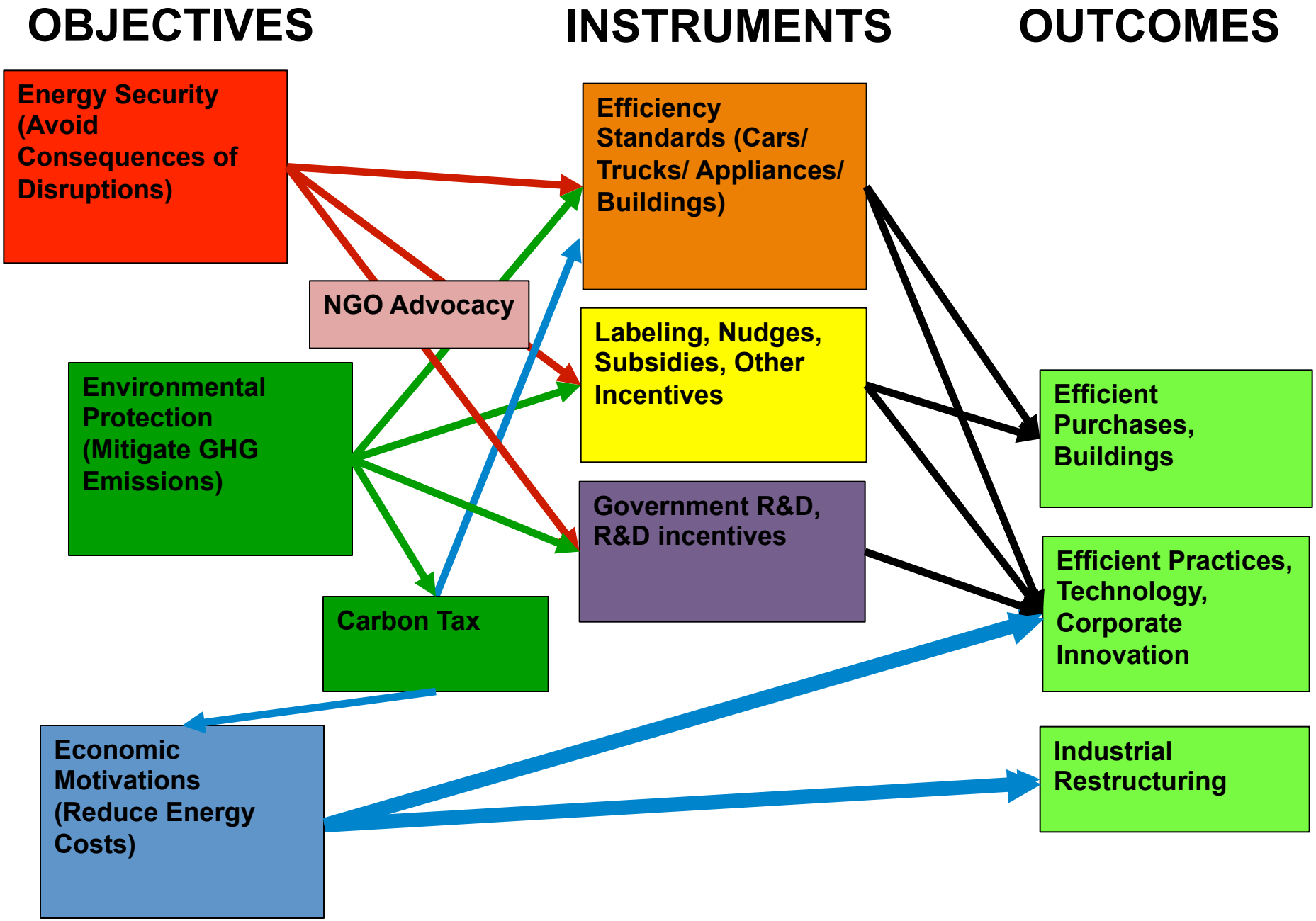
James (Jim) Sweeney

Adding a carbon tax in United States would be a strong and positive influence reducing energy use. But predicting impact requires understanding interaction with the many other instruments that are now in effect.

Carbon tax would reinforce other instruments, would somewhat change appliance regulations, would change price expectations, and would add to economic motivations. But it may not alter the other pathways influencing energy use.

Approximate Chain of Causation



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Examining the history over the last several decades gives insights into the future possibilities.

Carbon intensity of the economy-wide energy system (Tonnes of CO_2 per US $ of real GDP, PPP) has decreased around the world, except the Middle East, from 1980 through 2011.* Average rate of reduction (other than Middle East) ranges from about 0.3% annually in Central and South America to a bit over 2% annually in North America.

* These are only energy data. They do not include non-energy GHG. Data from EIA.

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Rate of change of carbon intensity of the economy-wide energy system is sum of rate of change of energy intensity of economy *plus* rate of change of carbon intensity of energy consumption (Kaya Identity.)

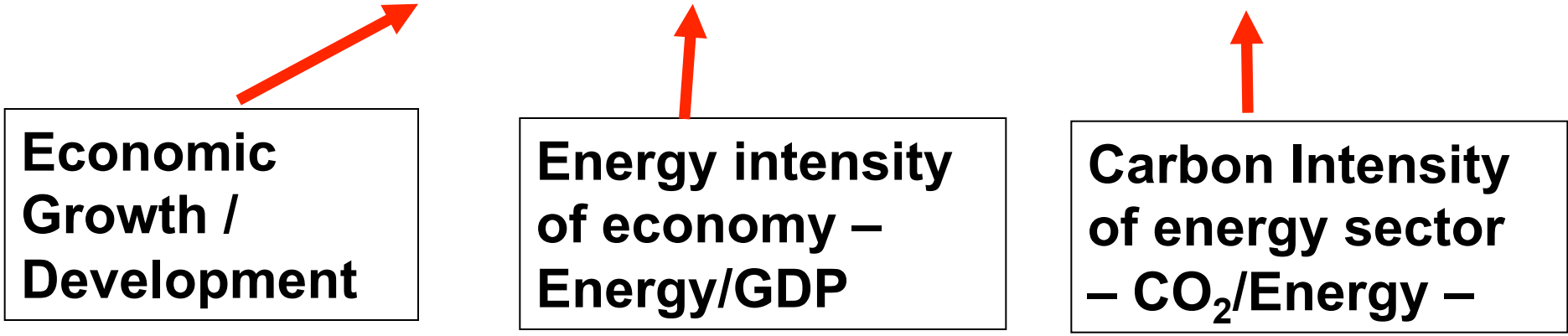
Rate of change of energy intensity of the economy varied from + 2% annually in the Middle East to - 1.8% annually in North America.

Rate of change of carbon intensity of energy consumption varied from roughly zero in Asia/Oceana to - 0.9% in Middle East. The world average was – 0.2% per year.

Environment: Carbon Dioxide Emissions from Energy Consumption

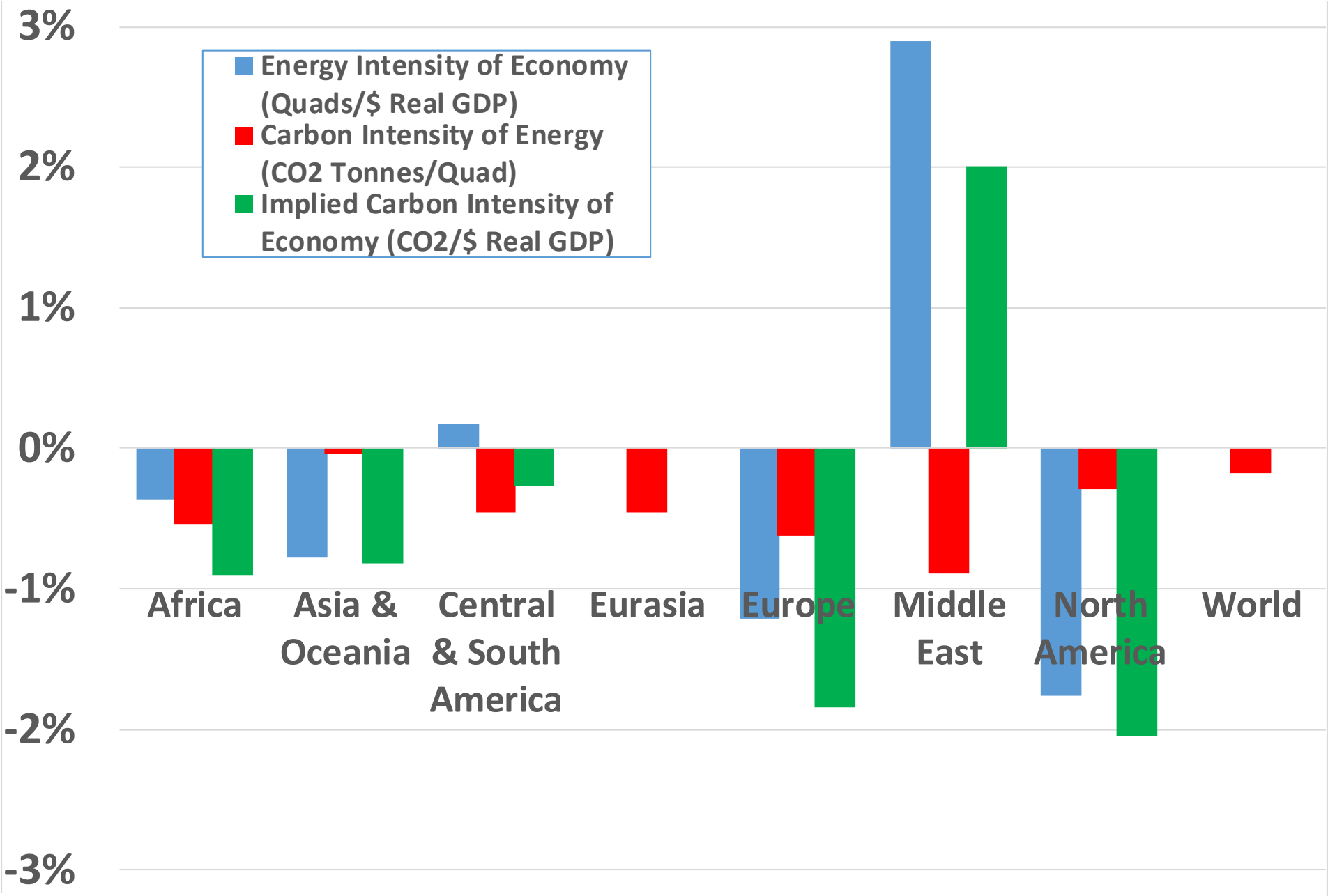
- **Decompose carbon dioxide emissions from energy consumption into three factors:**

CO_2 Emissions = GDP x Energy Use/GDP x CO_2/Energy Use



Growth Rate of CO_2 Emissions = Sum of Three Growth Rates

Average Annual Rates of Intensity Change: 1980 to 2011



Data Source: EIA

Precourt Energy Efficiency Center

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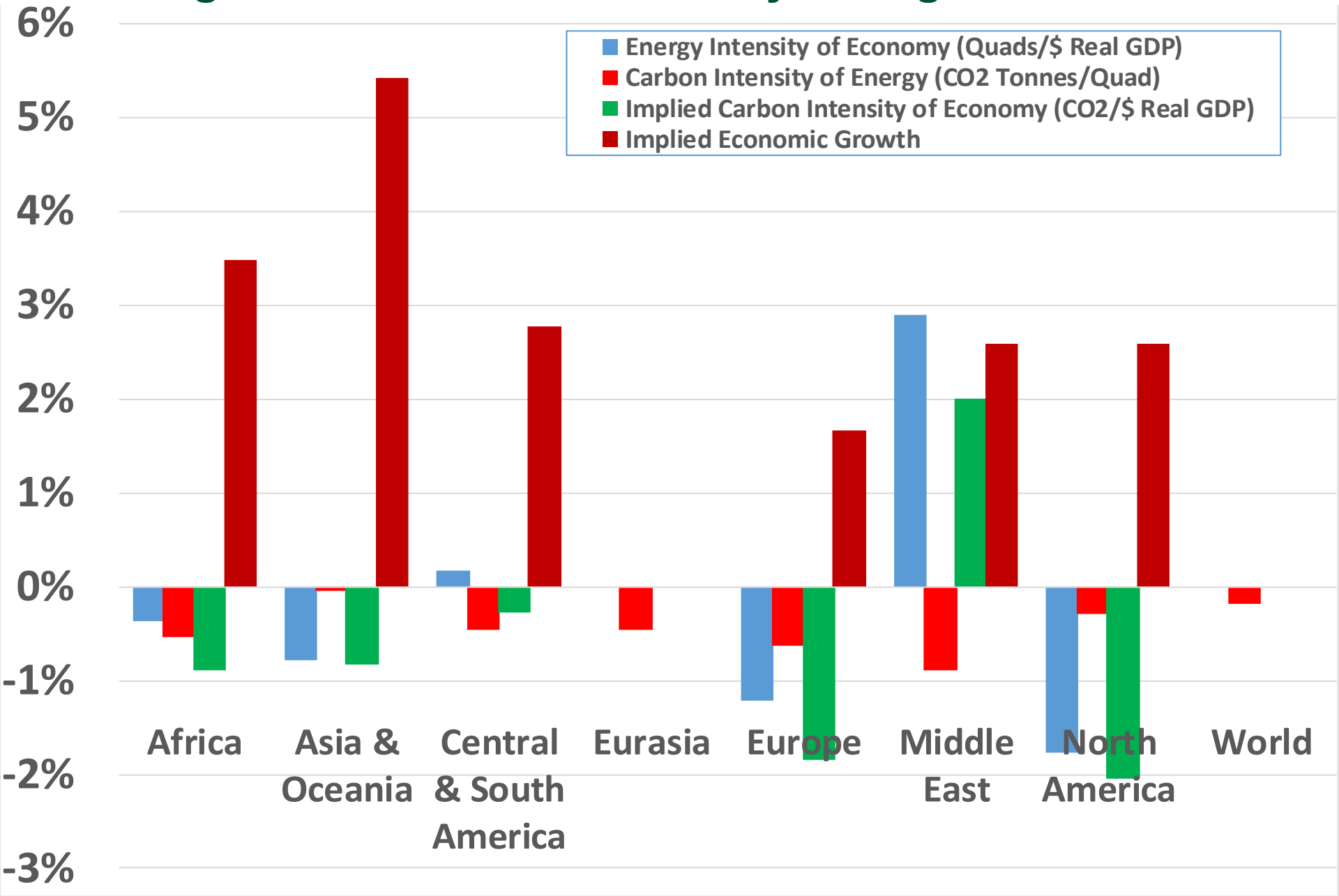
The climate system is impacted not by intensities but by actual quantities of carbon. Economic growth rates have substantially exceeded rates of economy-wide energy system carbon intensity reduction, except for Europe and US, where economic growth has been about equal to decarbonization rates, leading to little slow average growth of carbon emissions in North America and slow average decrease rates in Europe. (Data 1980 through 2011. More recent data differs in North America.)

Average Annual Rates of Intensity Change: 1980 to 2011



Data Source: EIA

Precourt Energy Efficiency Center

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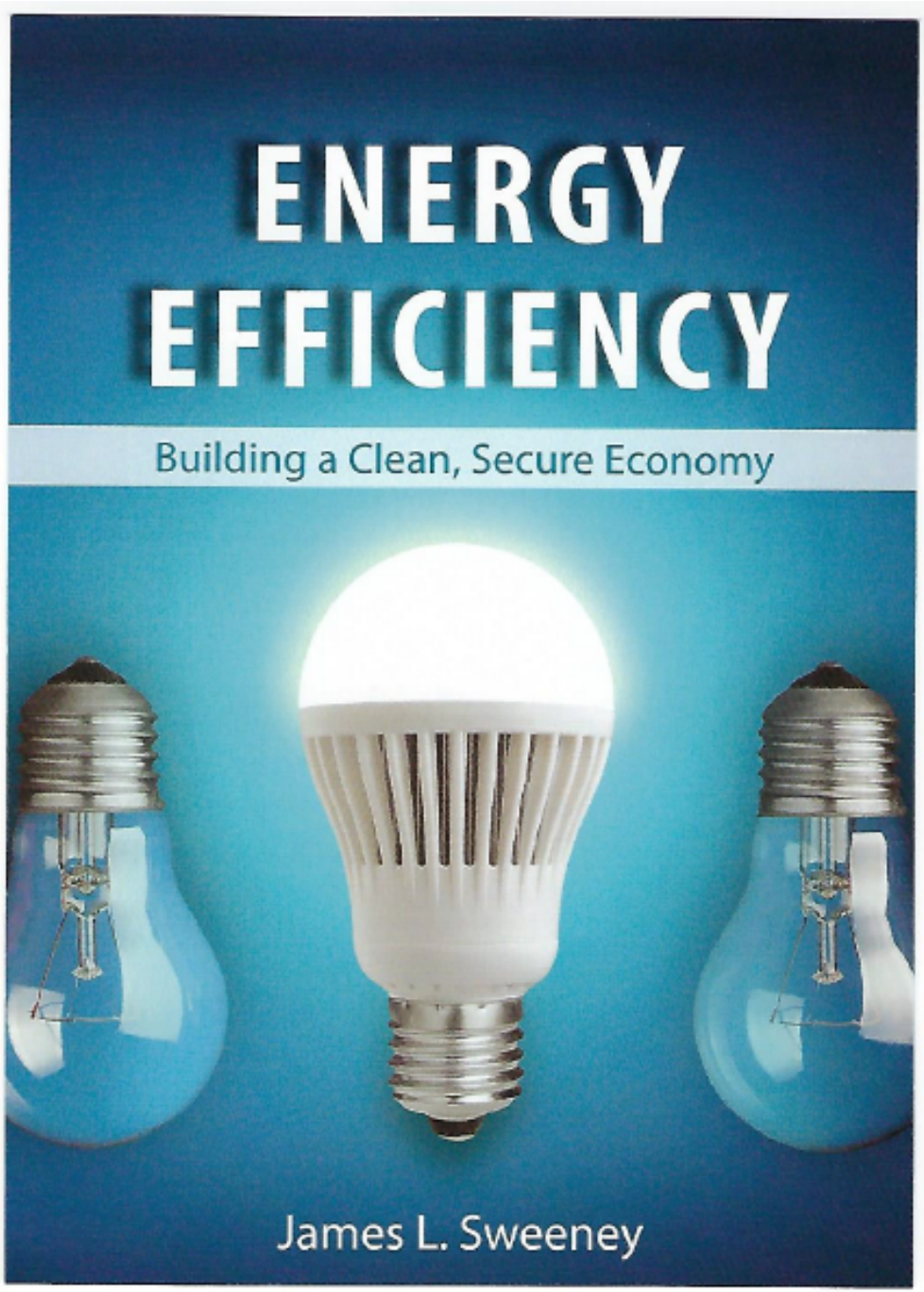
My opinions re modeling future energy consumption:

- **Countries around the world are unlikely to sacrifice economic growth rate so as to reduce emissions; International institutions are likely to continue promoting development. Thus economies will continue to grow.**
- **Limiting energy consumption growth therefore requires increasing rates of energy intensity reductions.**
- **If we plan to model regional energy intensity reductions significantly faster than about 1.5% to 2.0% per year, then we must understand and analyze instruments we anticipate will be used to cause these changes.**



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