

# **GREEN MACROECONOMICS: Classical, Keynesian, and Ecological Perspectives**

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<http://ase.tufts.edu/gdae>

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# Classical Economics Perspectives

- Malthus: General Glut, Resource Limits.
- Ricardo: Importance of Land and “original and indestructible powers of the soil”.
- J.S. Mill: Stationary State.
- Marx: Exploitation, Inequality.
- “Big” classical themes dropped out of the picture with neoclassical school.
- But seem to be relevant today.

# Renewed Relevance of Keynesian Economics

“The outstanding faults of the economic society in which we live are its failure to provide for full employment and its arbitrary and inequitable distribution of wealth and incomes”

-- Keynes, *The General Theory*, 1936.

“Keynes did not focus on issues of ecological sustainability, but from our current standpoint, it certainly seems reasonable to include environmental degradation as one of the “outstanding faults” of the economic system.

“The implementation of ambitious programs for social investment and redirection of the macroeconomy towards sustainability will be essential for preserving economic systems in the twenty-first century. It will, however, require a turn away from conventional macroeconomics.”

-- Harris, “Ecological Macroeconomics: Consumption, Investment, and Climate Change”, in Harris and Goodwin eds., *Twenty-First Century Macroeconomics: Responding to the Climate Challenge*, 2009.

# Mainstream, Ecological, and Biophysical Economics

- The basic premise of biophysical and ecological economics is that economic systems must adapt to biophysical realities, not the other way around.
- This is consistent with both Classical and Keynesian traditions, neither of which posits indefinite growth.
- It is only the “market fundamentalist” neoclassical approach that is inconsistent with observed physical reality, views everything through a market pricing lens, and dogmatically asserts that all limits can be overcome through technology and substitution.

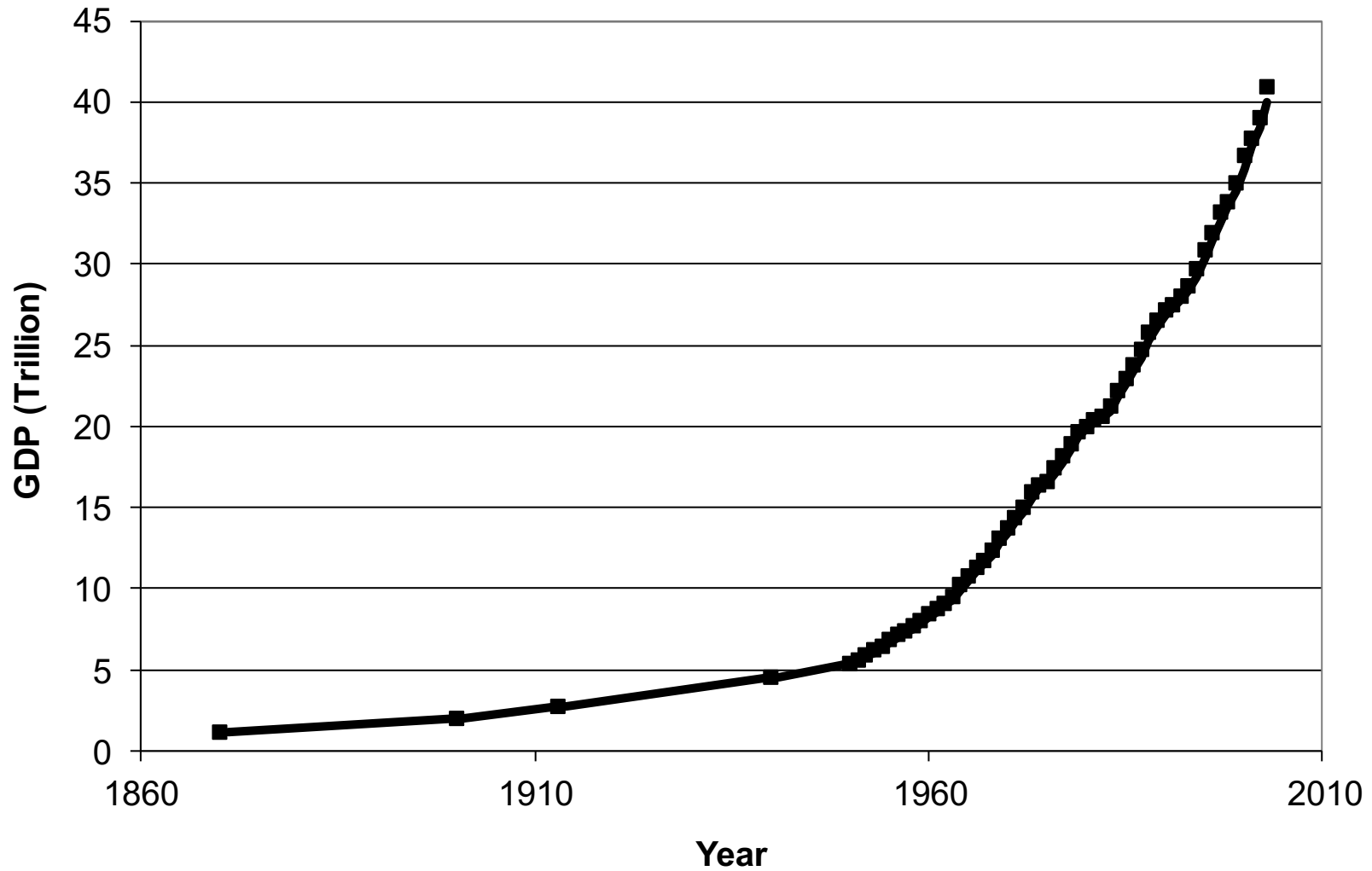
# Moving Past the “Neoclassical Synthesis”

- The “neoclassical synthesis” minimized Keynesian insights, accepting some Keynesian macroeconomics but locating the “foundations” of both micro and macro in mathematical market-based economics.
- This approach, coming to dominate the mainstream, along with the later and even more market-oriented “New Classical” view, has led many ecological/biophysical economists to view mainstream economics as wholly destructive.
- But there are rich traditions in economics that are compatible with biophysical realities, and that recognize weaknesses and limitations of markets along with their strengths.

# Making Macroeconomics Greener

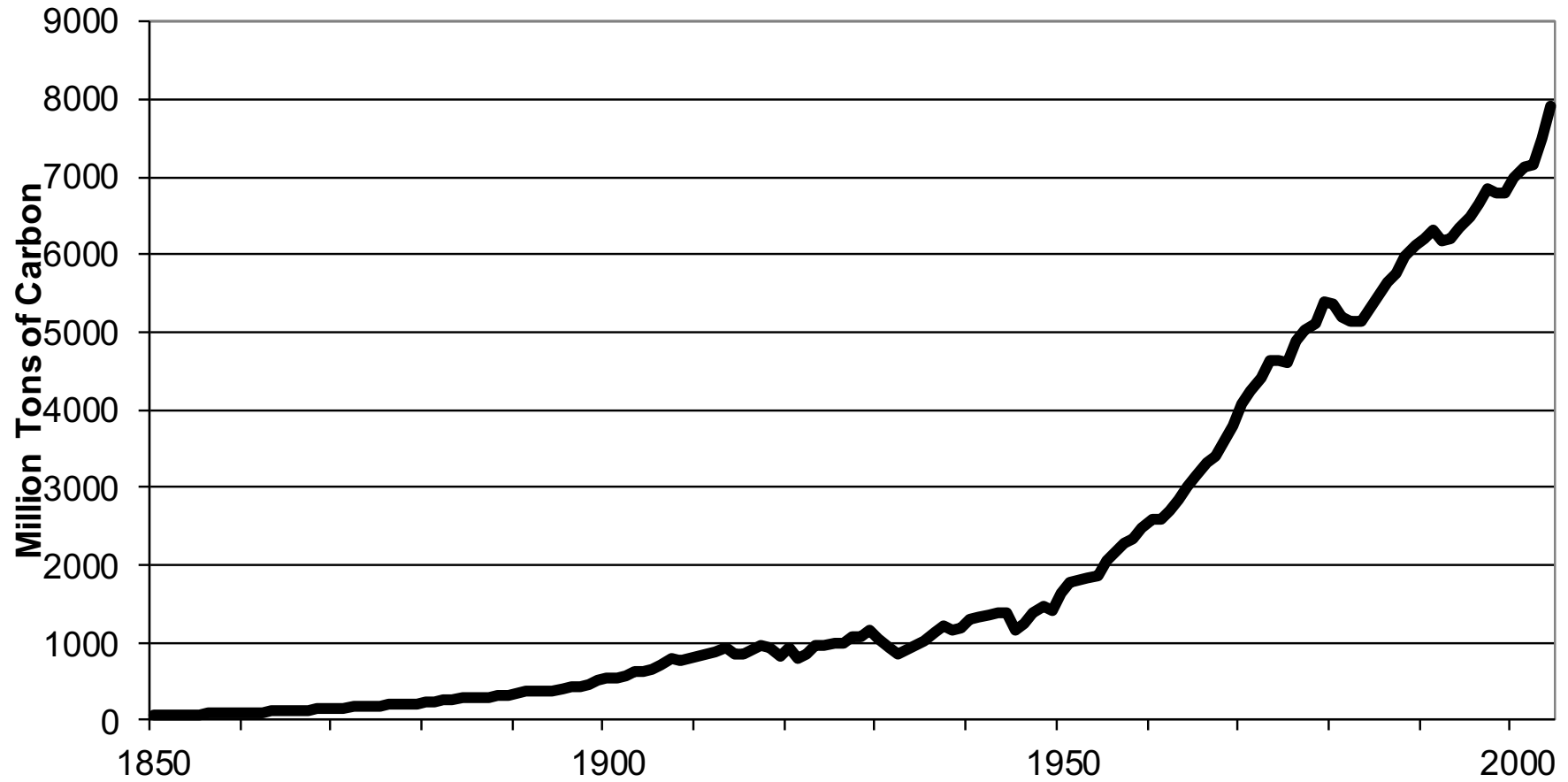
- Placing economic system in the context of social and environmental systems
- Alternatives to GDP for measuring well-being
- Limits to growth and macroeconomic scale
- Energy and carbon flows, throughput limits
- Differentiating ecologically damaging and ecologically sound forms of consumption, investment, government spending
- “Green Keynesianism”, decoupling, redefining consumption and well-being

# World GDP 1870-2003



Source: Maddison, *Historical Statistics for the World Economy*, 2008

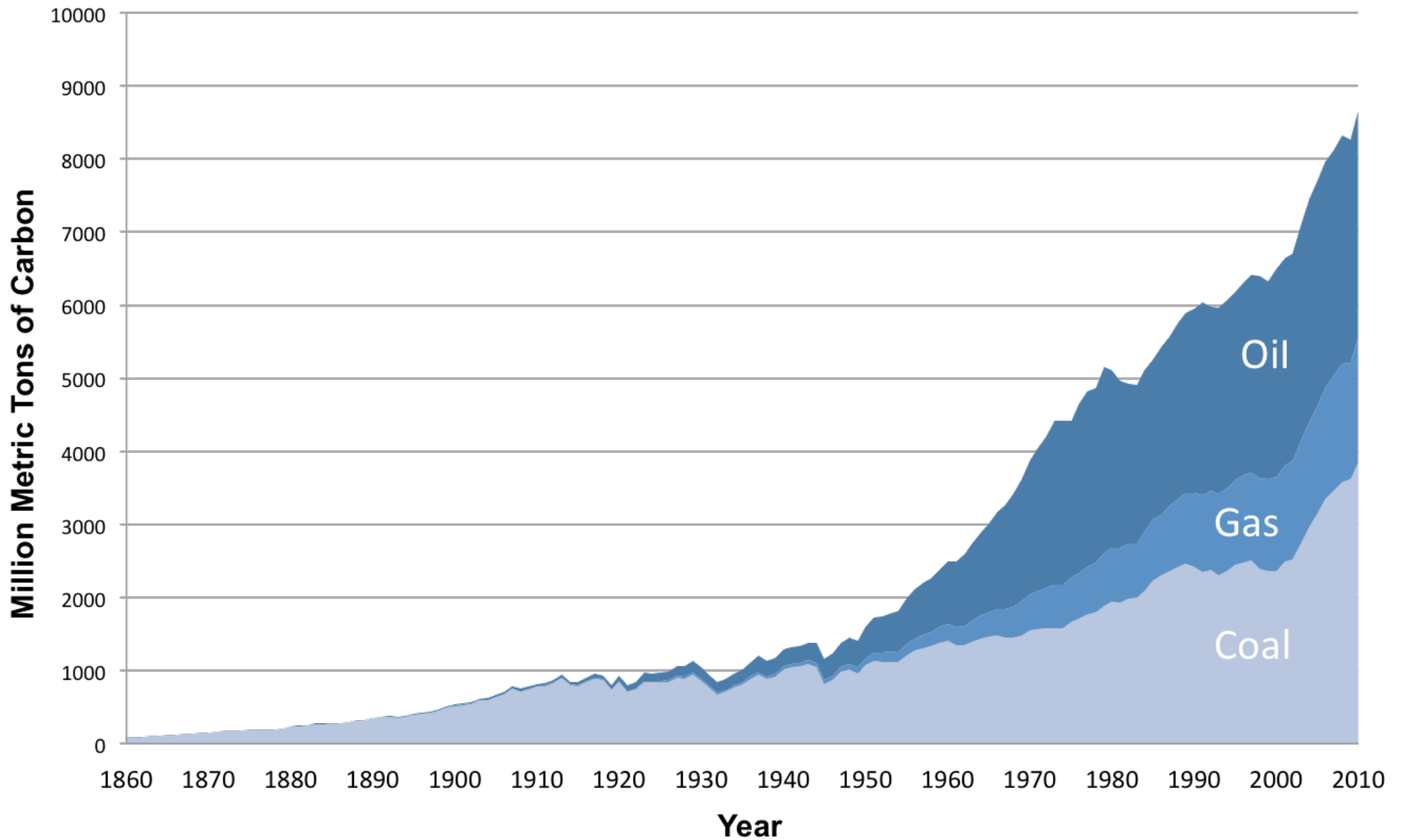
# Global Carbon Dioxide Emissions from Fossil Fuel Burning, 1850-2004



Source: Carbon Dioxide Information Analysis Center (CDIAC), <http://cdiac.ornl.gov/>

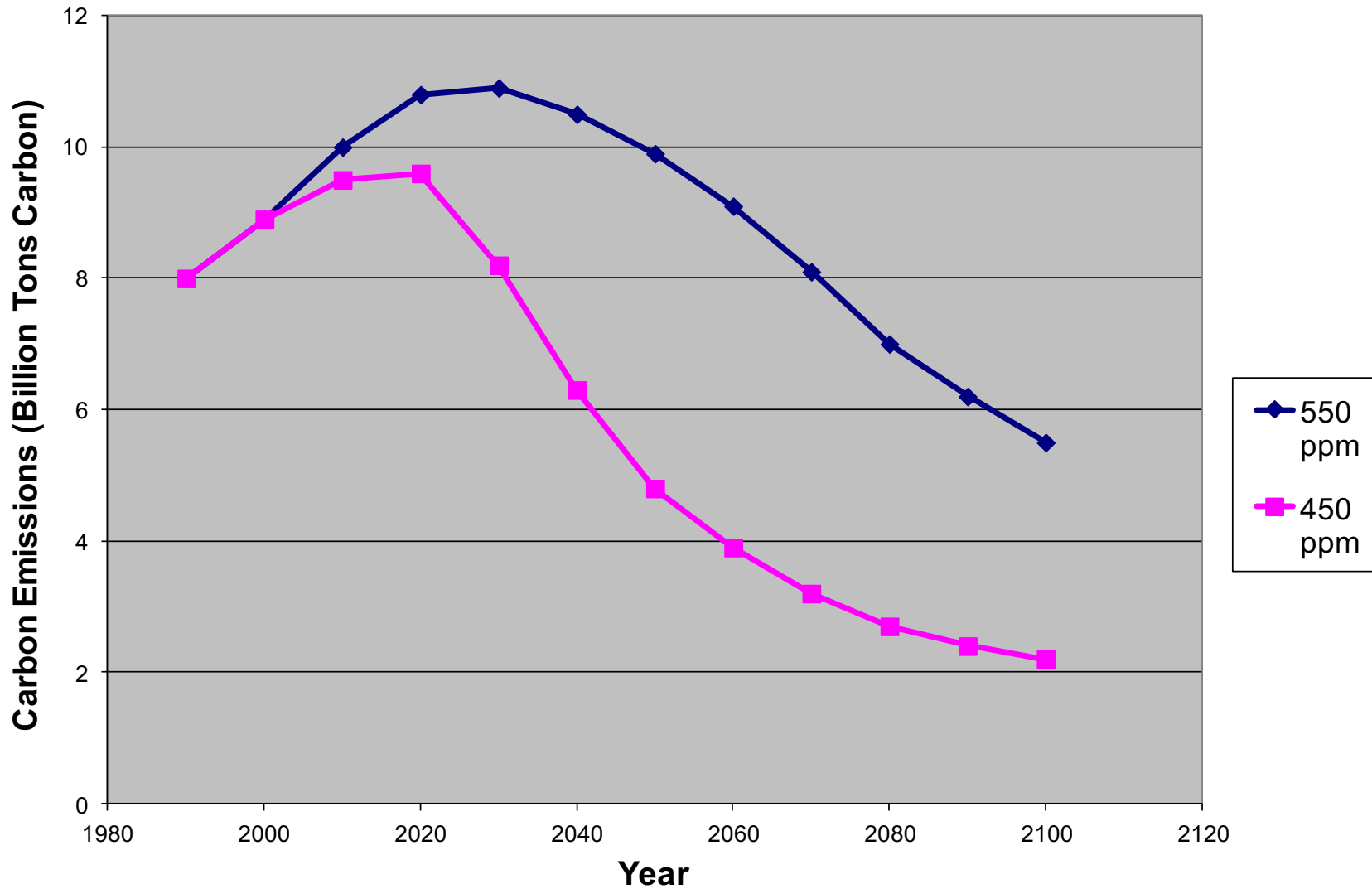


# Carbon Dioxide Emissions from Fossil Fuel Consumption, 1860-2010



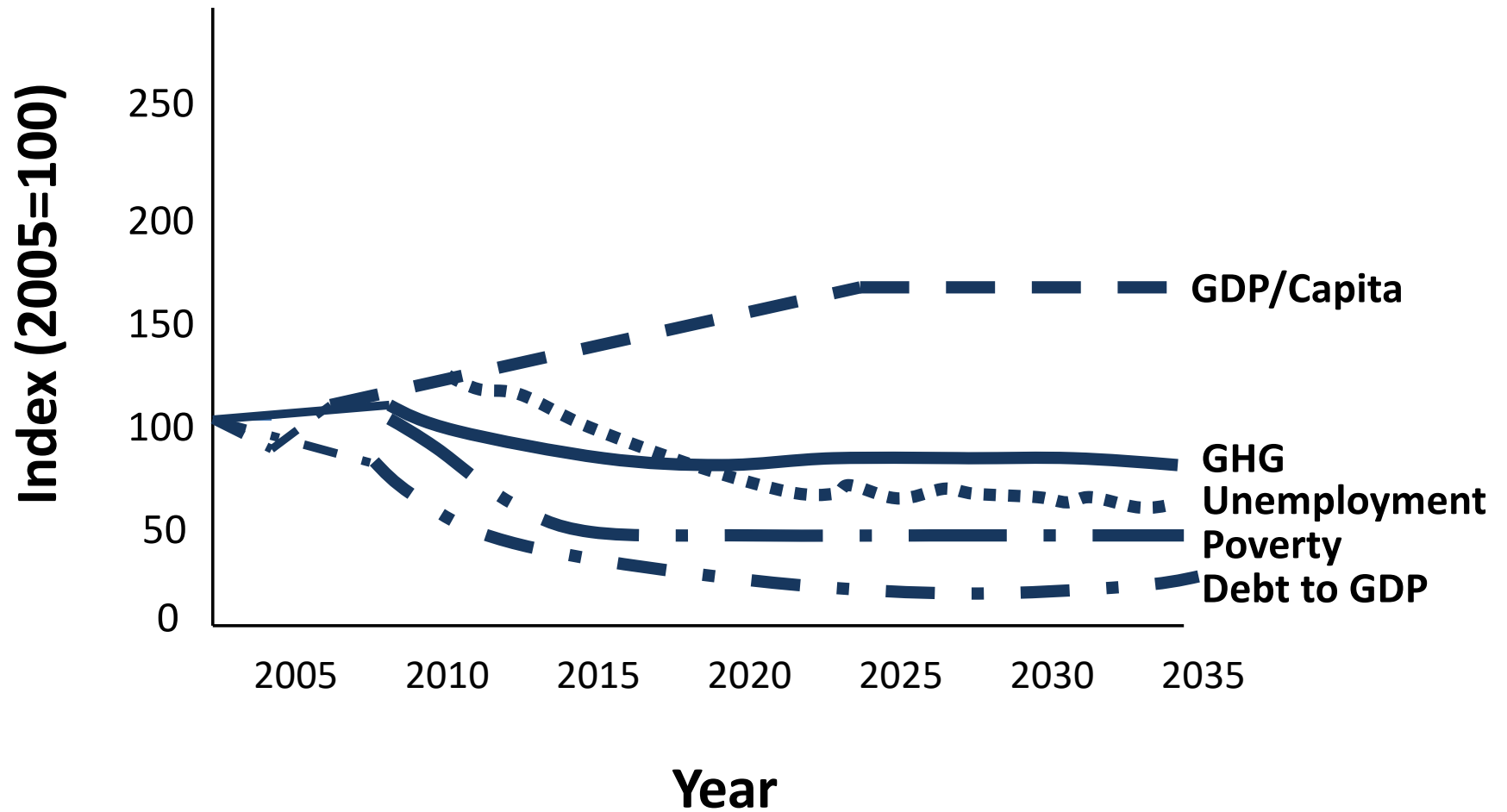
Source: Carbon Dioxide Information Analysis Center (CDIAC), <http://cdiac.ornl.gov/>

# Carbon Stabilization Scenarios (450 and 550 ppm CO<sub>2</sub>)



Source: Adapted from *Climate Change 2001: The Scientific Basis*, <http://www.ipcc.ch/>

# A No-Growth Scenario for the Canadian Economy



*Even though projected GDP/capita stops growing in this macroeconomic model, well-being continues to increase, with declining unemployment, poverty, and debt, and improved environmental conditions.*

Source: Adapted from Peter Victor (2008) p.182

# Ecological Macroeconomics?

$$(1) Y = C + I + G + (X - M)$$

$$(2) Y = [C_g + C_s] + [I_{me} + I_{mc} + I_n + I_h] \\ + [G_g + G_{me} + G_{mc} + G_s + G_n + G_h] \\ + (X - M)$$

$C_g$  = consumption of material goods

$C_s$  = consumption of services

$I_{me}$  = investment in energy-intensive manufactured capital

$I_{mc}$  = investment in energy-conserving manufactured capital

$I_n$  = investment in natural capital

$I_h$  = investment in human capital

$G_g$  = government spending on goods

$G_s$  = government spending on services

$G_{me}$  = investment in energy-intensive manufactured capital

$G_{mc}$  = investment in energy-conserving manufactured capital

$G_n$  = government investment in natural capital

$G_h$  = government investment in human capital

$Y = \text{GDP}$      $(X-M) = \text{Exports minus imports}$

# Reformulation of Macro Balance Equation

$$(3) \quad Y = [C_g + I_{me} + G_g + G_{me}] \\ + [C_s + I_{mc} + I_n + I_h + G_s + G_{mc} + G_n + G_h] + (X - M)$$

To satisfy sustainability criteria, the terms in the first set of brackets should for the most part be stabilized or reduced over time, but the terms in the second set of brackets can be expanded.

GDP can grow over time, but throughput (input of materials and energy and output of wastes) will stay constant or decline.

(X-M) factor is trade – to avoid “leakage” international coordination of policies is needed.

# Examples of “Green” Macro Policy: U.S.

- \$787 billion dollar stimulus package included about \$71 billion for specifically “green” investments, plus \$20 billion in “green” tax incentives.
- Energy efficiency in Federal buildings and DoD facilities -- \$8.7 billion
- Smart-grid infrastructure investment -- \$11 billion
- Energy and conservation grants to state and local governments -- \$6.3 billion
- Weatherization assistance -- \$5 billion
- Energy efficiency and renewable energy research -- 2.5 billion
- Advanced battery manufacturing -- \$2 billion
- Loan guarantees for wind and solar projects -- \$6 billion
- Public transit and high-speed rail -- 17.7 billion
- Environmental cleanup -- \$14.6 billion
- Environmental research -- \$6.6 billion

Aggressive Federal policy action including “green” investments “probably averted what could have been called Great Depression 2.0 . . . without the government’s response, GDP in 2010 would be about 11.5% lower, payroll employment would be less by some 8 ½ million jobs, and the nation would now be experiencing deflation.” (Blinder and Zandi, “How the Great Recession was Brought to an End”, 2010).

# Examples of “Green” Macro Policy: Portugal

- Portugal government-led transition from fossil fuels towards renewable power, with the percentage of renewable supply in Portugal’s grid up from 17 percent in 2005 to 45 percent in 2010.
- \$22 billion investment in modernizing electrical grid and developing wind and hydropower facilities.
- Portugal will recoup some of its investment through European Union carbon credits, and will save about \$2.3 billion a year on avoided natural gas imports.

“Portugal Gives Itself a Clean-Energy Makeover,” *New York Times* August 10, 2010.

# What about Deficits and Debt?

- Krugman: “Suppose that government uses borrowed money to buy useful things like infrastructure. The true social cost will be very low, because the spending will put resources that would otherwise be unemployed to work [and allow private debtors to pay down their debt] ... the argument that debt can’t cure debt is just wrong.” (“Mr. Keynes and the Moderns”, 2011)
- Europe’s problems now arise from unwillingness to use European Central Bank to finance debt, allowing indebted players to recover. Instead, “austerity” policies make debt harder to manage and threaten major defaults and financial catastrophe.
- U.S. focus on debt reduction prevents further stimulus spending, threatens to derail weak recovery (like 1937).
- All based on what Keynes called “the Treasury view” or Herbert Hoover economics: balance the budget during recession.
- Instead, the government needs to borrow excess savings and put them to work.



# What about Limits to Growth?

- Ecological economists point out that we can't grow forever, and therefore can't rely on growth to pay down debt.
- But this is only true of "throughput" growth (energy and resources).
- We have lots of scope for growth in services, human capital, environmental infrastructure, renewable energy, etc.)
- Long term, we have to adapt to steady-state economy. But we don't need a steady-state with 10-15% unemployment!
- If we reach a point at which debt reduction becomes the main issue, we have lots of options: health care reform, carbon tax with partial per-capita rebate, tax the rich (eliminating Bush tax cuts eliminates more than half of deficit)

# Redefining Consumption

- Mainstream economists tell us that we need increased consumption to get the economy back on track.
- But increased social spending (e.g. on teachers, police, health care, infrastructure) poses a deficit threat and has to be cut back.
- So why is one kind of spending essential but the other one bad?
- Partly anti-government bias (e.g. Tea Party) but partly neo-classical economic theory that rejects Keynesian deficit spending
- With less goods consumption but more consumption of social services and improved environmental services, we might be better off and promote economic recovery: “growth” of a sort, increasing employment, but not traditional growth in energy- and resource-intensive goods.

# Redefining Labor

- Unemployment is clearly a social “bad”.
- But shorter work hours have historically been a social “good” and even according to standard theory more leisure represents a net gain in “utility”.
- If we are to exit the cycle of more consumption in order to promote more employment, we need work-sharing and shorter work weeks (Victor 2008, Schor 2010).
- Much of Europe has followed this path, which has had positive social effects and minimized unemployment impacts -- at least until the onset of “austerity”.
- Requires more social provisioning (health care, education) and cultural shift away from goods consumption.

# Redefining Capital

- Capital investment (“I”) is a crucial component of GDP and essential to recovery.
- But there is a critical distinction between energy-intensive and energy-conserving capital.
- Investment can also be in human capital (all forms of education and training) and natural capital (land reclamation, environmental protection and pollution control, etc.)
- All of these contribute to employment and recovery, so no need to concentrate on energy-intensive capital.

# A Better Approach

- Job creation through public investment in infrastructure, energy transition, health, education
- Reduce waste in health care with single payer or equivalent, eliminate tax cuts for rich
- Financial reform and re-regulation including equivalent of Glass-Steagall
- Continue reducing carbon emissions as economic growth resumes, based on carbon tax or equivalent
- Transition to high-employment, low-carbon economy

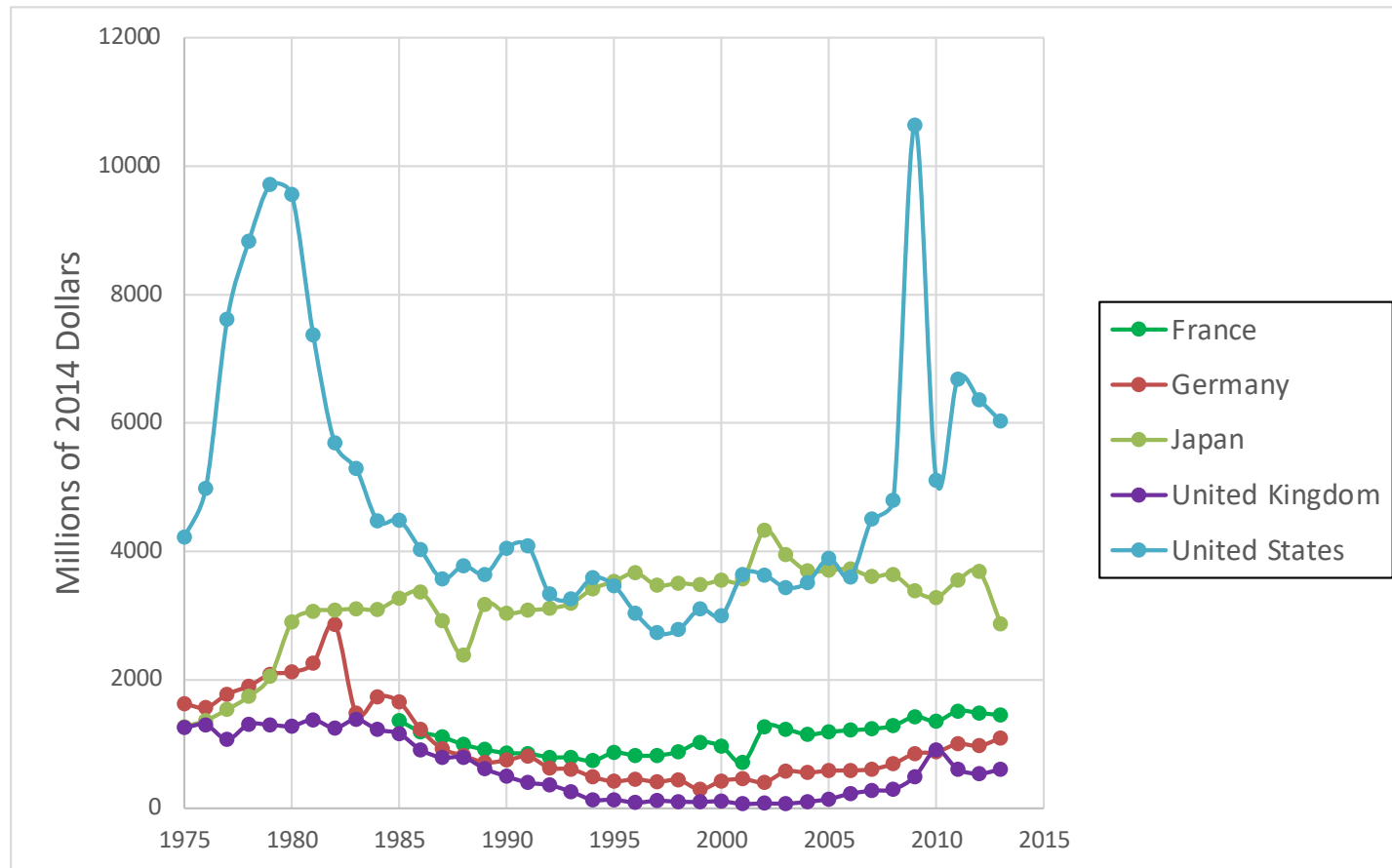
# Policies for Full Employment

- Increased hiring in public sector: teachers, police, transit and park workers, etc.
- Large-scale building retrofit publicly financed but carried out by private contractors
- Increased public R&D expenditures with accompanying higher education investment (“Sputnik” precedent)
- Major energy efficiency and renewables investment, partly public and partly incentivized private investment
- Investment in public transit and infrastructure

# Policies For Climate Stabilization

- Carbon tax or equivalent (cap & trade with auction) – must be  $\geq$  \$100/MT C (\$30/MT CO<sub>2</sub>) and rise over time.
- Recycle revenues of  $\geq$  \$150 billion for energy efficiency, renewables, progressive rebates.
- Public energy R&D investment (\$3-12 billion+).
- Infrastructure investment – hi-speed rail, public transit, green buildings.
- Efficiency standards for cars, machinery, buildings.
- Preferential credit or subsidy for energy efficiency investments.

# Public Energy R&D Investment



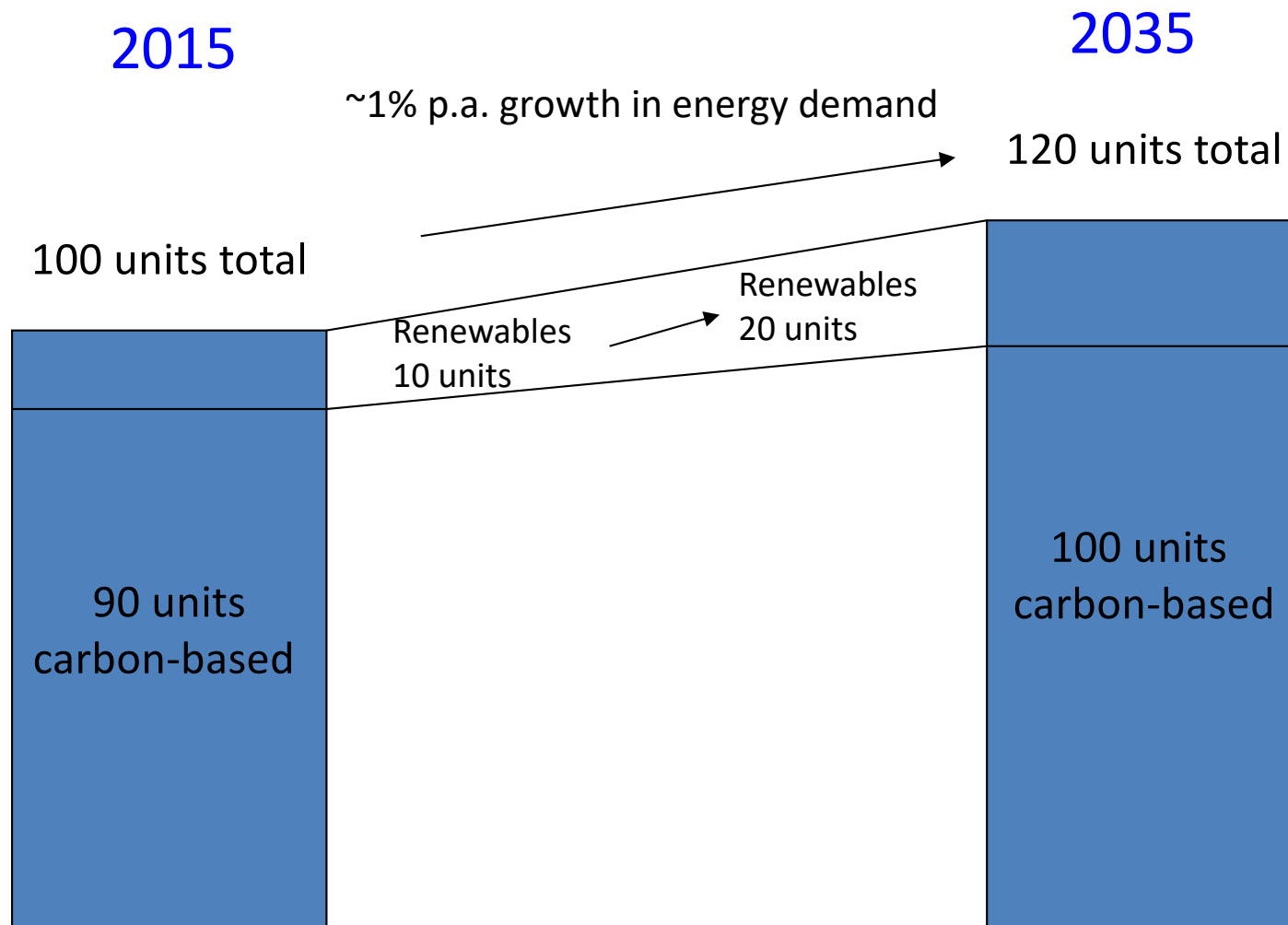
Source: International Energy Agency, 2014.



# A Hypothetical Example of Growth and Efficiency

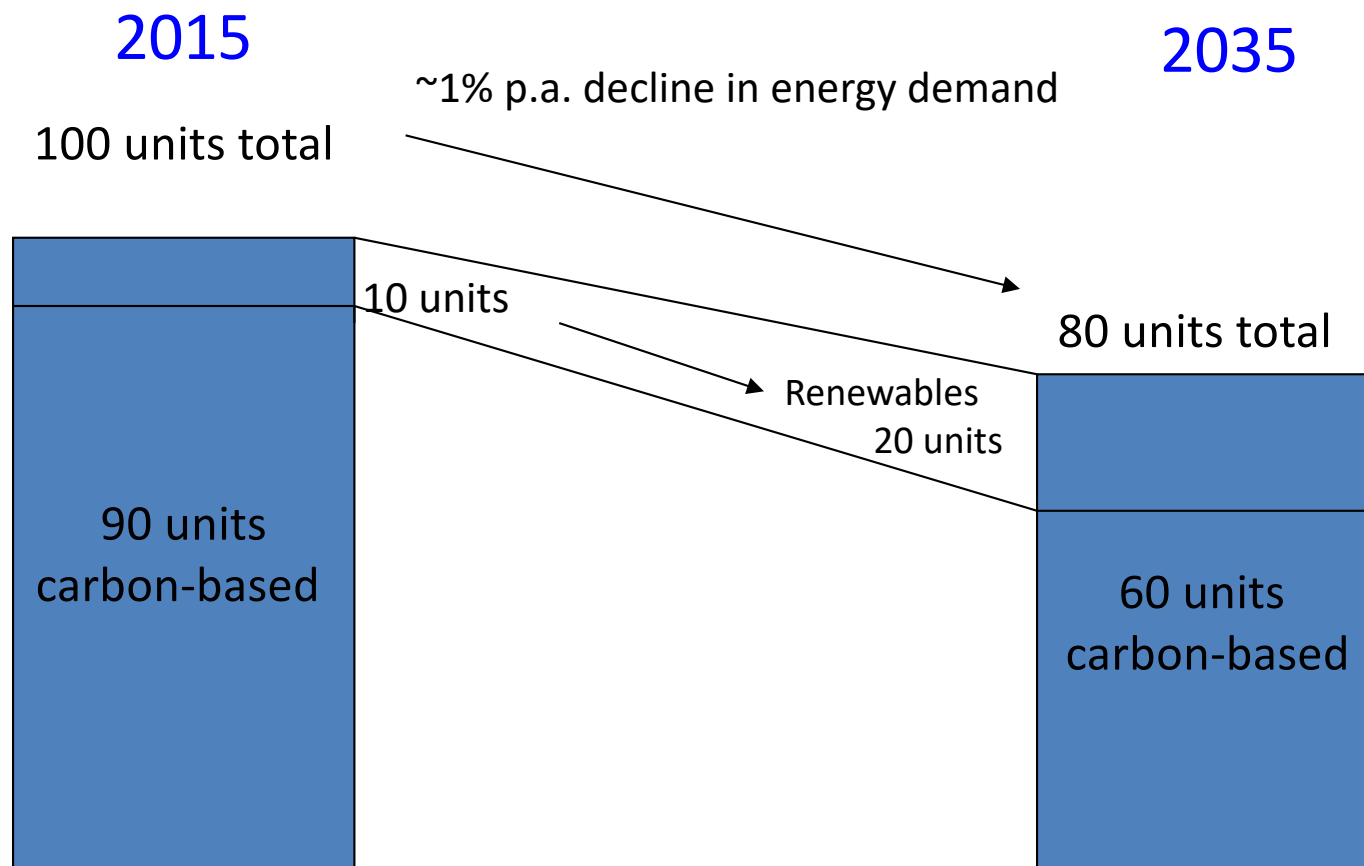
<b>Economic Growth</b>	<b>Energy Intensity Rate of Change (BAU)</b>	<b>Energy Intensity Rate of Change (HI-EFF)</b>
Population 1%	Shift to Services -1%	Shift to Services -2%
Per capita GDP 2%	Increased Efficiency -1%	Increased Efficiency -2%
<b>Total</b> <b>3%</b>	<b>Total</b> <b>-2%</b>	<b>Total</b> <b>-4%</b>
	<b>Net Change in Energy Use 1%</b>	<b>Net Change in Energy Use -1%</b>

# Business as Usual Scenario



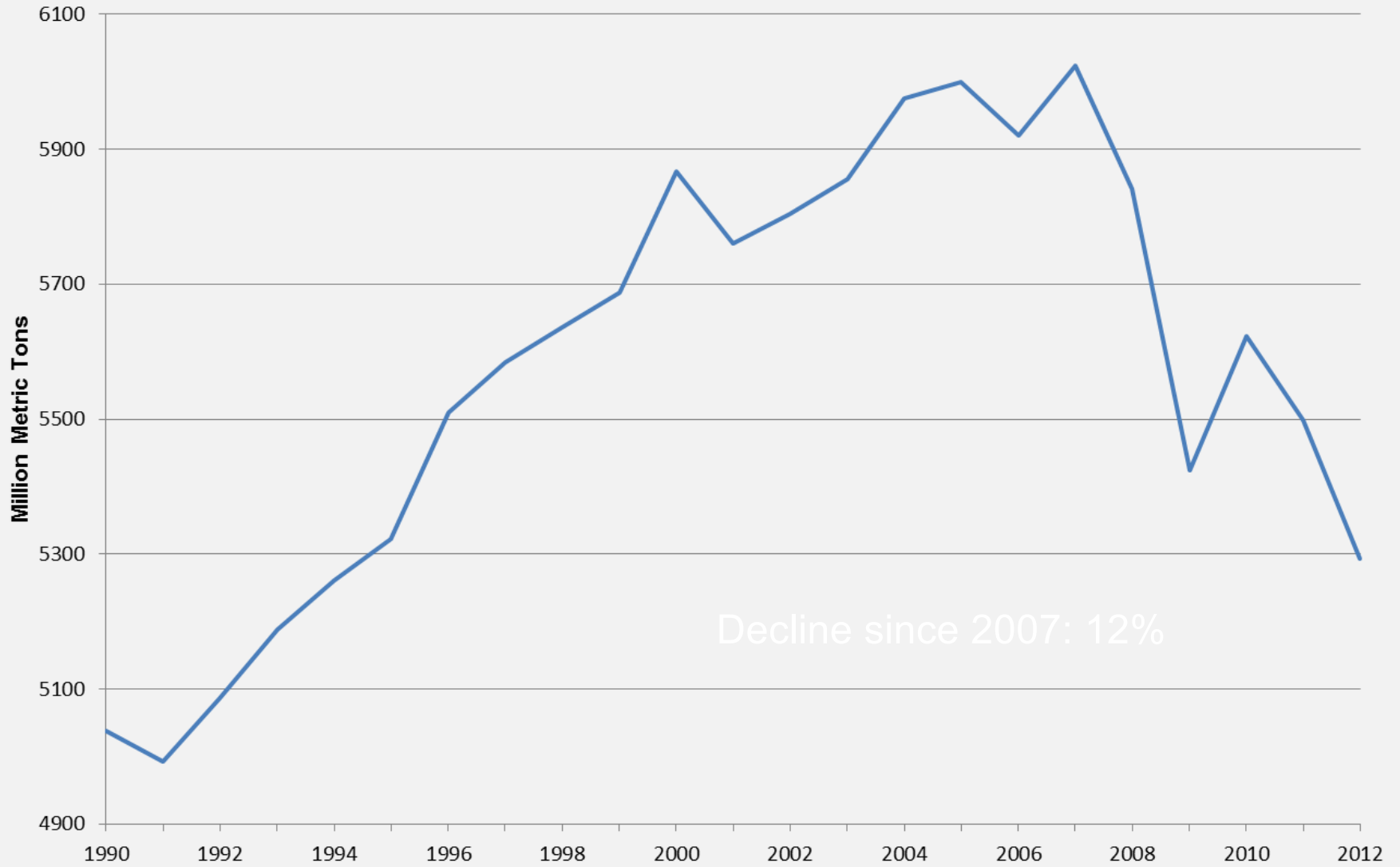
Continued reliance on fossil fuels, generating some employment, but increasing carbon pollution over time despite growth in renewables.

# Services, Efficiency, & Renewables Scenario



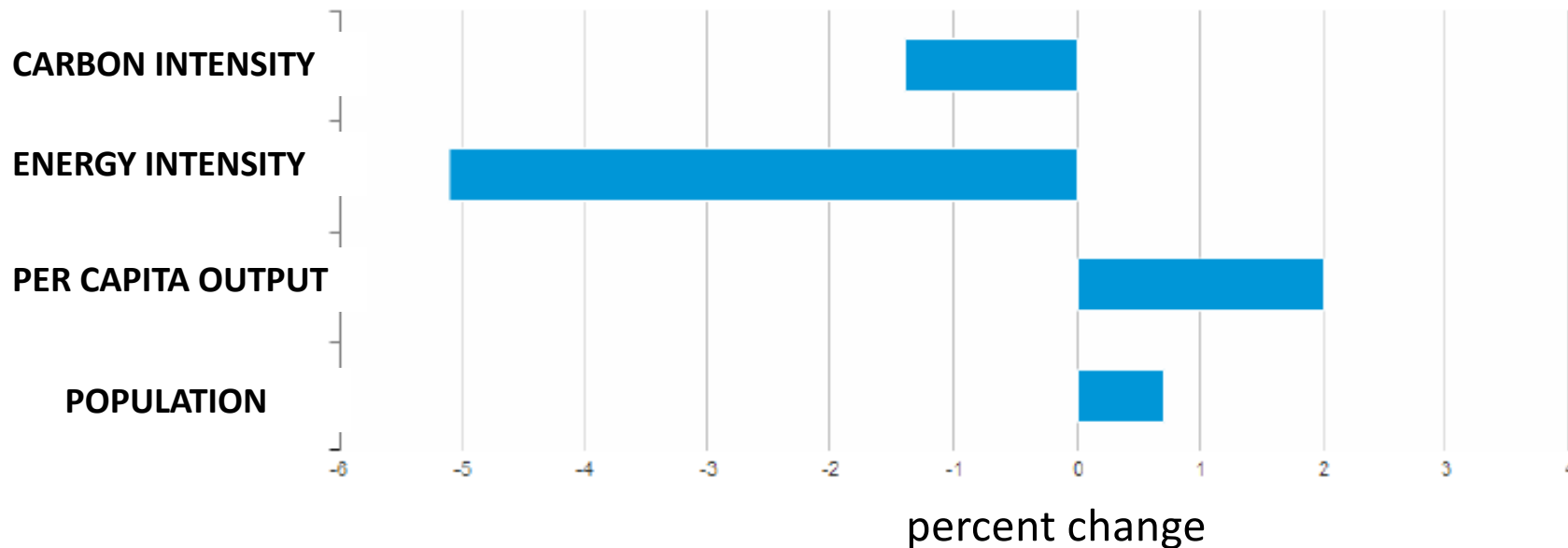
Investment in efficiency and renewables, with increased employment in “green” sectors. Much greater shift to renewables possible.


## US CO<sub>2</sub> Emissions 1990-2012



Source: US Department of Energy, 2013  
Accessed at: <http://www.eia.doe.gov>

## PERCENT CHANGES IN EMISSIONS DRIVERS, 2012

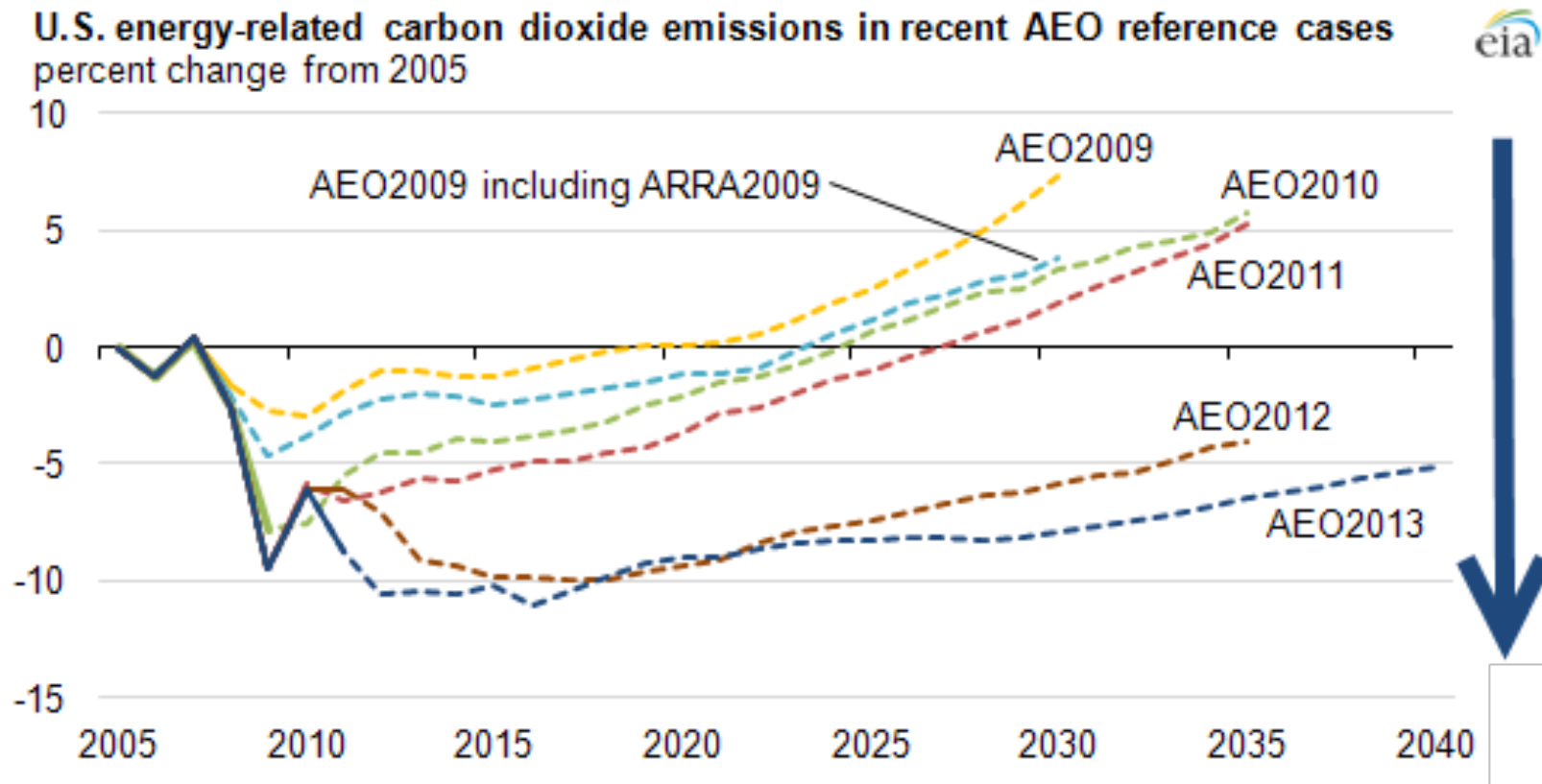


 Source: U.S. Energy Information Administration, Monthly Energy Review (September 2013), Tables 12.1 and 1.1. Population growth for 2012, Census Bureau as of October 17, 2013. GDP, Bureau of Economic Analysis, as of July 31, 2013.

Although 2012 was unusual, it shows the pattern of declining emissions: growth in population and per capita output were outweighed by decreases in energy intensity (energy use per dollar of GDP) and carbon intensity (carbon emissions per unit of energy use).

Reduction in population growth rates and in GDP growth rates could accentuate this trend, and will be necessary to meet carbon targets, but there is a lot of scope for energy and carbon intensity reduction.

# A good trend, but needs continuing....



**Source:** U.S. Energy Information Administration, Annual Energy Outlooks 2009 - 2013  
ARRA2009 denotes the American Recovery and Reinvestment Act of 2009.

# Progress?

Reasons for downward shift in AEO projections include:

- Impact of ARRA 2009 (efficiency, renewables)
- Downward revisions in the economic growth outlook, which dampens energy demand growth.
- Updated fuel economy standards, increased penetration of alternative fuels, lower growth in vehicle miles traveled.
- Slower growth in electricity demand and increased use of low-carbon fuels for generation.
- Shift from coal to natural gas.

But do not include:

- Major investments in energy efficiency
- Accelerated shift to solar and wind energy

So much greater reductions should be possible....

# Macroeconomics for the 21<sup>st</sup> Century

- Promote employment, equity, well-being, including investment in health, education, community.
- Reduce per capita consumption in physical terms, cultural shift away from GDP/consumption as measure of success.
- Drastically reduce carbon emissions, lower other forms of pollution.
- Use “green” Keynesian policies and invest in green technology.
- Adapt to limits to growth and (eventually) steady-state economy.