

# **ECOLOGICAL MACROECONOMICS: Responding to Climate Change**

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# Economic and Ecological Crises

- Economic growth under challenge – resumption of growth is sluggish after unprecedented financial crisis.
- Rising tide no longer lifts all ships-- Piketty's work indicates inherent and growing inequality of incomes and wealth.
- Urgency of responding to environmental crises, especially climate change, will have major macroeconomic implications.

# 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.”

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

# 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 market-based economics.
- This approach, along with the later and even more market-oriented “New Classical” view, have proved inadequate to respond to economic and environmental crises of the early twenty-first century.
- But there are rich traditions in economics that are compatible with ecological realities, and that recognize weaknesses and limitations of markets along with their strengths.

# Greening Macroeconomics

- Promoting transition to zero carbon emissions.
- Differentiating ecologically damaging and ecologically sound forms of consumption, investment, government spending.
- “Green Keynesianism” can use government-led investment to promote efficiency, renewables, repair and expand infrastructure.
- Net benefits: employment creation, taking advantage of low interest rates, if necessary using “green” taxes such as carbon tax with partial per-capita rebate to raise funds.

# 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.

# Examples of “Green” Macro Policy: China



- Wind turbine and solar panel manufacturing industries are world’s largest.
- China plans 150 GW of wind, 30 GW biomass, 20 GW solar, 300 GW hydro by 2020, for a total of over 30% of generation capacity.
- Renewable energy portfolio standards for major utilities: 8% capacity non-hydro renewables.
- Goal of reducing energy intensity 17% between 2010 and 2015.
- Recently announced goal of peak carbon emissions and 20% renewables by 2030.

# 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)
- A focus on debt reduction prevents further stimulus spending, threatens to derail weak recovery both in U.S. and Europe (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)

# Population Stabilization

- Ecological economists rightly point out that ever-growing population places excessive stress on planetary resources
- But population stabilization implies a larger cohort of elderly people, prompting concern about social services and health care costs.
- From a Keynesian perspective this is also employment-creating, and relatively environmentally sound provision of services

# 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, green infrastructure) poses a deficit threat.
- 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
- Less goods consumption but more consumption of social services and improved environmental services promotes economic recovery, increasing employment, but not traditional growth in energy- and resource-intensive goods.

# 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.
- [cf. Eric Kemp-Benedict’s Green/Brown Capital paper]



# 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)
- Germany has followed this path, which has had positive social effects and minimized unemployment impacts
- Requires more social provisioning (health care, education) and cultural shift away from goods consumption

# Reducing Inequality

- Financing public services and egalitarian forms of health, education, and social insurance.
- Education has long-term effect on improving opportunities and reducing inequality.
- These kinds of spending are relatively “green”, service and labor intensive rather than energy and materials intensive.

# Policies for Full Employment

- Major energy efficiency and renewables investment, partly public and partly incentivized private investment
- Large-scale building retrofit publicly financed but carried out by private contractors
- Increased hiring in public sector: teachers, police, transit and park workers, etc.
- Investment in public transit and infrastructure: Rebuilding infrastructure for water, transportation, etc.
- Financing health and education on equitable basis.

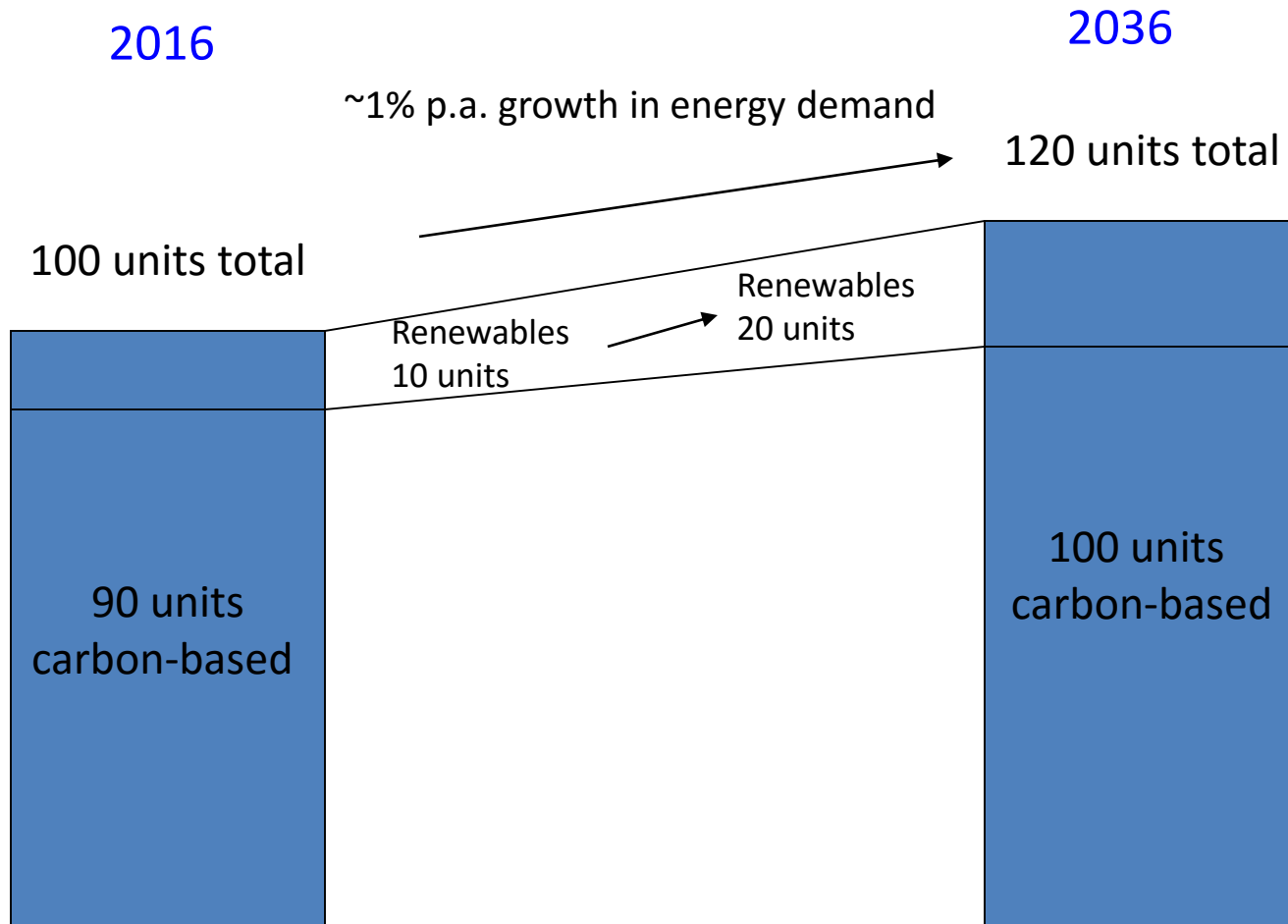
# Policies For Climate Stabilization

- 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.

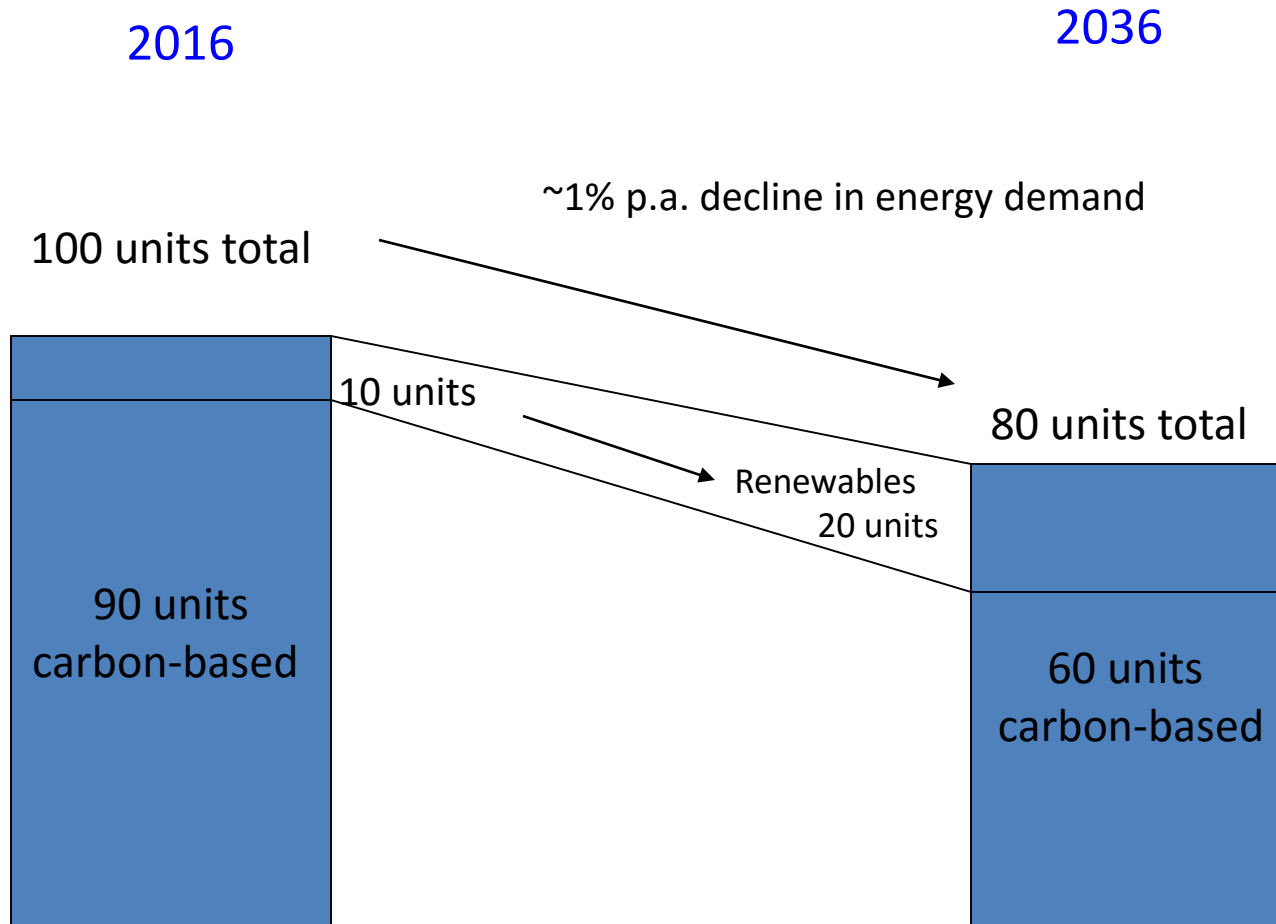
# Growth and Efficiency

<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 3%</b>	<b>Total -2%</b>	<b>Total -4%</b>
	<b>Net Change in Energy Use 1%</b>	<b>Net Change in Energy Use -1%</b>

# Business as Usual Scenario



# Services, Efficiency, & Renewables Scenario



Based on modest investment in services, efficiency, renewables, with no loss in employment (probably a gain)

# Moving Towards a Steady-State Economy

- Keynesian (and even Solow) growth models can be adapted to zero growth
- As indicated, there are many employment-creating macro policies that could be characterized as “green” growth
- But long-term adaptation to zero-growth, consumption limits, shorter work week, etc. is eventual goal



# 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 ecological limits to growth, including carbon limits but also water, land, forests, etc.