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A Skeptical Look At The Carbon Tax

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Executive Summary

The year 2013 will see a major political debate over proposals for a carbon tax—a tax on emissions of greenhouse gases (GHGs), particularly carbon dioxide (CO_2). The justifications for the proposals include: (1) a desire to reduce emissions to prevent a rise in global temperatures; and (2) the hope that a carbon tax could substitute for other taxes and improve economic efficiency, while raising enormous sums for the government.

The carbon tax finds theoretical justification in economic theory, but it is a deeply flawed idea. Five sets of consideration militate against it—the five circles of Carbon Tax Hell:

1) A U.S. carbon tax will have only minuscule effect, if any, on global temperatures.

2) Economic projections that purport to show that the costs are manageable fail to identify specific and feasible energy technologies that will be deployed in place of carbon-based sources. They assume that technological and economic breakthroughs will occur.

3) While economic theory provides support for a carbon tax (it is called a Pigovian Tax), the theory is more complex than usually represented. Current proposals do not account for benefits that would accrue from higher atmospheric CO_2 levels. Nor do they reflect all the positive benefits of cheap energy that are not captured by the energy producers.

4) Predictions of climate change and assessments of the costs of carbon tax both rely on mathematical models. Modeling is an inexact art, and both sets of models have deep flaws. They do not provide an adequate basis for action.

5) A carbon tax will face many practical problems. It is supported by a "Bootleggers-and-Baptists" coalition of environmentalists, corporate profiteers, and government dependents which will shape its provisions in ways that undercut its beneficial effects and accentuate its harmful side. A carbon tax will reduce national GDP and inhibit job creation, will be regressive in its effects, and will damage energy-intensive industries and pressure them to leave the U.S. Judging by past experiences, the carbon tax will not substitute for other taxes or improve their efficiency, nor will it be implemented without political favoritism. It will not substitute for other regulations. On the international side, it will force the creation of complicated regime of taxes and subsidies to reflect the actions or inactions of other nations.

   Even strong proponents of a carbon tax admit that a system which does not include China will be unworkable, but official Chinese statements show that China is unlikely to agree to any carbon tax that significantly increases the cost of energy and inhibits its economic development.

Political discussion would be improved if the term "tax" were reserved for levies designed to meet the government's need for revenue, while imposing as little damage as possible on the economy. A carbon tax is not a tax in this sense; it is a tool of social engineering, imposed to meet the goals of central planners. If this tool fails to meet the planners' goal of a specific target for reducing CO_2 emissions, then other means will be deployed. Viewed from this perspective, the carbon tax enterprise suffers from the fatal conceit inherent in any belief that central planners can guide an economy.

Introduction

The year 2013 will see a major political debate over proposals to impose taxes on emissions of Greenhouse Gases (GHGs), notably carbon dioxide (CO_2): a policy usually called "a carbon tax."

The Obama Administration has signaled its intent to prioritize climate control early in its second term. The President mentioned climate change prominently in his Inaugural and State of the Union addresses, and John Kerry used his first speech as Secretary of State to highlight the issue. The President asserted a goal of putting the nation on a "path towards sustainable energy sources," a phrase that is code for discouraging use of carbon-dioxide-emitting fossil fuels and encouraging renewable sources, such as wind, solar, tidal, and geo-thermal. The term "sustainable" is also selective; conventional hydropower is renewable, but many environmentalists oppose dams and are trying to eliminate them, so large-scale construction of new ones is not part of the agenda. Nor is nuclear power an option, even though it does not emit CO_2, because it is also disliked by the environmental movement.

The task of shifting the nation to non-carbon fuels would be immense. The United States consumed 97.3 quadrillion BTUs of energy in 2011. Of this, 86 percent came from fossil fuels and an additional 8 percent from nuclear.[1]

The overall breakdown is:

U.S. ENERGY CONSUMPTION BY SOURCE

BIOMASS 2.9%
renewable
Heating, electricity, transportation

PETROLEUM 38.1%
nonrenewable
Transportation, manufacturing

HYDROPOWER 2.7%
renewable
Electricity

NATURAL GAS 22.9%
nonrenewable
Heating, manufacturing, electricity

GEOTHERMAL 0.3%
renewable
Heating, electricity

COAL 23.2%
nonrenewable
Electricity, manufacturing

WIND 0.1%
renewable
Electricity

URANIUM 8.1%
nonrenewable
Electricity

SOLAR & OTHER 0.1%
renewable
Light, heating, electricity,

PROPANE 1.7%
nonrenewable
Manufacturing, heating

(DOE, EIA, http://www.nm.nrcs.usda.gov/air-energy/Biomass.pdf)

A shift in fuels would require decades, as existing infrastructure was replaced and existing investments written off. Even if the shift proved technically possible, and this is questionable, it would be expensive. Capital cannot easily be moved from coal or oil production to wind or solar; the old infrastructure must be scrapped and new investments made.

The intractable realities of the importance of carbon-based fuels have led some to the idea of a tax on emissions of CO_2 and other GHGs. The theory is that this would encourage movement toward other energy sources without the distorting effects of blunt force regulatory commands or of absolute caps on emission levels.

Professional economists are open to a carbon tax because of its reliance on economic incentives. The environmentalist community is interested because a tax might dampen political resistance to regulatory measures. The carbon tax is also gaining traction as a possible substitute for other taxes and sources of revenue, regardless of its impact on GHG emissions.

Politicians were burned in the 1990s when Bill Clinton proposed an unpopular BTU tax, so they have been wary of proposing taxes on energy. In his State of the Union speech, Obama referred favorably to "market-based" control schemes, which some took as a signal that his antipathy to the carbon tax was waning, but on February 25, Treasury Secretary designate Jack Lew assured the Senate, "The administration has not proposed a carbon tax, nor is it planning to do so."[2]

However, neither Obama nor Lew ruled out support for carbon tax legislation proposed by others, and Senate Majority Leader Harry Reid endorsed the idea last summer, after a speech that blamed America's infrastructure ills on climate change. ("Runways are melting, trapping planes. Train tracks are bending, derailing subways. Highways are cracking, buckling and breaking open.")[3]

In February 2013, Senators Boxer (D-CA) and Sanders (I-VT) introduced a pair of bills that would impose a tax of $20 per ton on carbon emissions, rising at 5.6 percent per year for ten years to $34.50. The goal is an 80 percent reduction in CO_2 emissions, starting with a 20 percent reduction by 2025.

The Sanders-Boxer bills would use the receipts to weatherize a million homes, triple the $275 million annual energy budget of the Advanced Research Project Agency (ARPA-E), provide $500 billion for investments in green energy (excluding nuclear), invest in domestic energy-intensive industries to mitigate the impact of the tax, and spend $1 billion a year on worker training. It would also use 60 percent of the revenue to provide a monthly rebate to every legal U.S. resident. It would impose taxes on imports from nations that do not impose a similar tax. This money would go to fund projects protecting natural resources and wildlife and to help meet international commitments "to assist in global climate adaptation." The bills would also "end fossil fuel subsidies," extend green energy tax incentive programs, and devote $300 billion over ten years to reducing the U.S. deficit.[4]

An alternative carbon tax bill appeared on March 12, when a coalition of Democratic legislators led by Representative Henry Waxman (D-CA) and Senator Sheldon Whitehouse (D-RI) released a brief "discussion draft," with a solicitation for public comment on the proposal.[5]

The Department of the Treasury has tasked the National Academy of Sciences with performing a study of the impact of current tax code provisions on CO_2 emissions. The study "will outline principles and criteria for formulating climate-sensitive tax policy in the future" and "may evaluate the efficiency and effectiveness of different tax measures in reducing GHG emissions relative to other policy instruments."[6]

At an international level, the Green Investment Report delivered at the recent World Economic Forum called for trillions of dollars of investment in non-carbon energy and referred in passing to the possibility of financing some of this with carbon taxes.[7]

Republican leadership in the House opposes a carbon tax, and the Waxman-Whitehouse effort was met with a proposed anti-tax House Resolution.[8] But the party is not of one mind. The Energy and Enterprise Institute, created by former Congressman Robert Inglis (R-SC) and based at George Mason University's Center for Climate Change Communication, advocates "[a] revenue-neutral tax swap, accompanied by a phase-out of all energy subsidies."[9] It repeats a mantra commonly used to support a carbon tax: "Tax the bad; quit taxing the good." Another conservative-leaning institution, the American Enterprise Institute, held a series of meetings during 2012 to discuss, and possibly promote, a carbon tax.[10]

Given this constellation of forces, the issue will certainly be debated extensively during the next few months—and years.

Summary of Reasons to Reject the Carbon Tax: Five Circles of Carbon Tax Hell

The carbon tax is a serious proposal supported by some thoughtful people, so it deserves careful consideration. The tax is the subject of an extensive and often technical literature, but good presentations of the issues by experts who endorse the idea without sugarcoating it have been produced by Resources for the Future and the Brookings Institution.[11]

A problem in assessing it is that the term "carbon tax" has a chameleon-like quality, meaning something different in each of three different contexts. In the context of economic theory, the carbon tax is a way to deal with an imperfection in the energy market. In this world, CO_2 emissions cause harm for which the emitter does not pay. The purpose of the tax is to impose the full cost of his activities onto the user of carbon-based fuel, so as to force him to incorporate the cost of the harm into the price of the fuel. Once the level of harm and its costs are included in market prices, then the energy market will work properly.

In this formulation there is no preconception about the proper level of the tax or the final outcome of the competition between sources of energy. The tax is set by careful assessment of the costs of the harm caused by the emissions, and the level of use of carbon fuels is then determined by market prices.

In the context of tax theory and government finance, the carbon tax has a different function. It is a way to finance government and replace other levies. In this world, the goals are to maintain economic efficiency and tax equity, while, as in any tax system, plucking the most feathers from the geese that squawk the least.

The third context for the carbon tax is environmentalism. In this framework, CO_2 is a "pollutant" and emissions are bad. They should be reduced to the lowest possible level, and the carbon tax is one instrument to accomplish this. In this world, the limitations, caveats, and subtleties of the contexts of economic purity or tax policy do not apply. The reduction targets are not limited by any empirical estimate of the harm caused by CO_2 — or by any concern that the level of a tax might rise so far as to become economically destructive.

Rather than a simple path to a benign energy future, the carbon tax is the proverbial Garden Path, or the road to Hell that is paved with good intentions.

In public and political discussion, the distinctions between these three contexts tend to get blurred, and arguments applicable to tax or economic issues are often incorporated into the environmental debate, despite the fact that in this context the carbon tax of economic theory or tax analysis is fiction. Political realities will determine the size of the tax and the disposition of the revenues. Politicians will be sensitive to the costs imposed on voters, and interest groups will fight for exceptions or subsidies to mitigate the effects, with the actions of each unhinged from the theoretical efficiency of the tax.

Viewed in this perspective, the carbon tax is a bad idea that should be rejected. Rather than a simple path to a benign energy future, the carbon tax is the proverbial Garden Path, or the road to Hell that is paved with good intentions. In the course of its inevitable failure, it would cause serious economic damage to the United States at a time when the nation's economy is already under stress.

Carbon Tax Hell has five circles:

- The first consists of erroneous expectations about the ability of a carbon tax imposed in the United States to affect global temperatures. The assumption is made, usually tacitly, that of course a carbon tax would reduce future temperatures, and this would justify the costs and sacrifices involved. The proponents of the tax let people think this, but they do not attach a specific number to the predicted temperature reduction. In fact, the impact would be tiny.

As described below in connection with climate modeling, the projections of the Intergovernmental Panel on Climate Change (IPCC) about the effects of CO_2 on warming are highly suspect. However, even if the IPCC conclusions are taken as accurate, a drastic 83 percent reduction in CO_2 emissions from the United States over the next four decades would reduce global temperatures by 0.11°C, which is 4 percent of the IPCC's midrange warming estimate of 2.96°C over the next century.[12]

As discussed in later sections of this paper, the IPCC's models overstate the future impact of CO_2 on temperature, so the actual impact of U.S. action would be infinitesimal rather than just tiny.

- The second circle of hell consists of a lack of specificity about future sources of energy. The chart on page 3 shows current sources of energy in the United States. Advocates of a carbon tax lack any realistic chart showing energy sources in the future, after a carbon tax has produced some desired amount of reduction in CO_2 emissions, such as the 80 percent target of Sanders-Boxer. Nor do these projections show any path for getting to a new constellation of energy sources.

  In the absence of identification of specific technologies and their attainability, any discussion of significant CO_2 reduction becomes a variation on the story of *Peter Pan*. If we all believe real hard, Tinkerbell will appear in the form of an Energy Fairy.

- The third circle contains problems with the basic theories used to support the carbon tax. In economic theory, taxes on bad things are intended to compensate for the fact that some of the harms caused by the bads are not paid for by the producers. They spill over and land on others. Because the producers do not incur the full costs, the bads are over-produced.

  This theory is correct, but incomplete. It does not account for the complementary principle that many *benefits* of an activity or product are not captured by the producer. These, too, spill over to the advantage of others. Because the producers do not get all the benefits, they will produce less than they would if the costs and benefits were both concentrated in the hands of those responsible for the activity. A simple example is that when a homeowner paints his or her house, the whole neighborhood benefits, while letting the house go to ruin harms everyone. Housing developments deal with this issue by requiring each owner to maintain his property at his own expense, so that all pay and all benefit from the actions of the others.

  Discussions of a carbon tax focus on the negative spillovers, that is, on possible damage from CO_2 emissions. But the spillover benefits of energy are also immense and difficult to measure. As depicted in the chart on page 16, increased use of energy, and especially cheap energy which is largely carbon-based, is intertwined with the extraordinary increase in global wealth over the past two centuries. A policy focused only on the negative side presents an unbalanced picture.

Also, objective studies of the impact of an increase in CO_2 in the U.S. establish that there will be positive benefits from the increase. Imposing a carbon tax to reduce the emissions would forego these benefits as well. Again, accentuating the negative without referring to the positive distorts the picture.

- The fourth circle concerns mathematical modeling. Advocates of a carbon tax must rely on two rounds of models, an initial round of models for the climate system and a second round addressing the economic impacts of a carbon tax. Modeling is a highly uncertain business, full of opportunities for error. Scrutiny of the relevant existing climate and economic models finds major uncertainties in both sets. Betting the nation's economic future on them would be folly.

- The fifth circle of Carbon Tax Hell contains the political realities. Economist Bruce Yandle coined the term "Bootleggers and Baptists" to express a fundamental reality of public affairs: programs and policies are often supported by an alliance of "Baptists," whose support is based on moral fervor, and "Bootleggers," who smell profit. The term comes from the many contests over state laws forbidding liquor sales, which were supported both by those who opposed drinking and those who profited from selling illegal liquor.[13]

The tax will not be implemented in the politically aseptic world of academic modelers, but in the real world of intense political pressures. Its assumed purity will not survive the onslaught.

A carbon tax is supported by multiple sets of both Bootleggers and Baptists: idealistic environmentalists, crony capitalist subsidy-seekers, investment banks in quest of trading profits, government spenders who see a new source of revenue and power, and the recipients of the $280 million in foundation money that goes each year to the field of climate change/energy.

The tax will not be implemented in the politically aseptic world of academic modelers, but in the real world of intense political pressures. Its assumed purity will not survive the onslaught. The problem areas include:

- Its negative effect on GDP & jobs, especially over the long term;
- Its regressive nature;
- Its harm to energy-intensive industries, including their employees and regions of the country dependent on them to be economic drivers;
- The unlikelihood that it would increase the efficiency of taxation, trigger a repeal of other taxes, or be administered in neutral fashion;
- The unlikelihood that it would trigger reform of other regulations;
- The need for complex and improbable international arrangements and the unlikelihood that China, the most important source of CO_2 emissions, would join such a scheme.

> The provisions of the recent Sanders-Boxer legislation illustrate the pressures that exist in the political system. In that bill, the carbon tax is treated as a huge honey-pot for allocating money to powerful groups, including overseas interests.

These circles are explored in the balance of the paper.

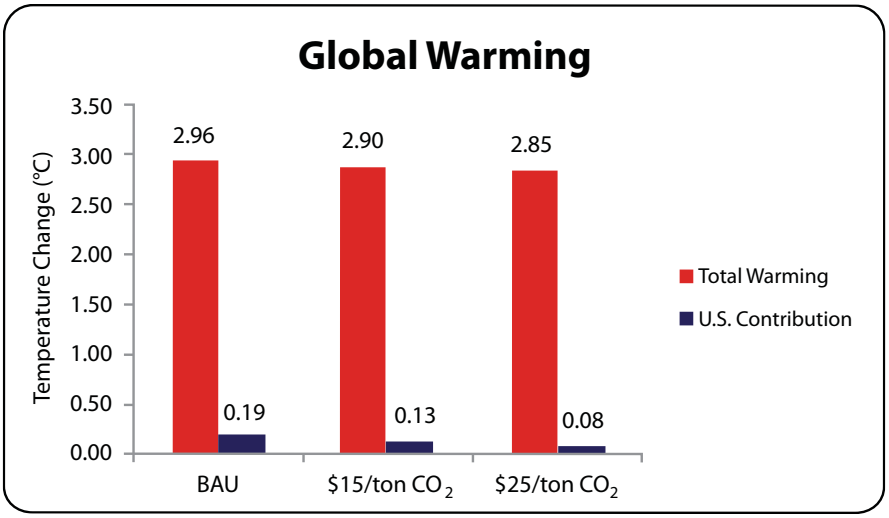
Circle One: Lack of Effect on Temperature

The central justification for a tax on GHGs is that it will meaningfully reduce those emissions and, by extension, their impact on global temperature. Charles (Chip) Knappenberger of the Cato Institute analyzed the impact of a carbon tax on future increases in temperature in "Climate Impacts of Waxman-Markey (the IPCC-based arithmetic of no gain)"[14] and "Carbon Tax: Climatically Useless."[15] For his analysis, Knappenberger accepted IPCC modeling about the effects of CO_2 on the environment. He also accepted as a goal the results sought in the 2009 Waxman-Markey bill, which aimed at an 83 percent reduction in carbon emissions.

Knappenberger's conclusion was that after the "monumental effort" that Waxman-Markey would require:

> Instead of 0.19°C of warming coming from the U.S. by the year 2100 (assuming the IPCC mid-range scenario), our contribution would have been reduced to 0.08°C—for a net "savings" of about 0.11°C of "global warming". . . . This amount is of virtually no environmental consequence . . . .[16]

The result is shown in the following table, which takes as a baseline the IPCC mid-range estimate of 2.96°C of warming and examines three scenarios for the U.S.: Business-as-usual, with no carbon tax; a $15/ton carbon tax; a $25/ton carbon tax.



Source: Knappenberger, "Carbon Tax: Climatically Useless," 2012

Knappenberger's work reveals two more important points to consider when evaluating the carbon tax debate. First, reducing U.S. emissions alone will have little effect on global emissions and global temperature trends. Despite rhetoric to the contrary, the IPCC's own models reveal the actions being considered would have "virtually no environmental consequence." Second, to obtain results that would have noticeable environmental consequences, a carbon tax substantially higher than $25 per ton is needed to further drive out fossil energy. Imposing a tax at those levels, however, would greatly increase the costs of the tax.

Furthermore, the assumptions used by Knappenberger may actually *overstate* the effect on temperature. For purposes of argument, he accepted the validity of IPCC models, even though he recognized that "There is growing evidence that actual global temperatures are not evolving the way projections indicate that they should."[17] (See also pages 16-21, *infra*.)

Knappenberger also looked at the projected impact if other nations copied the U.S., in "Climate Impacts of Waxman-Markey (Part II)—Global Sign-Up."[18] He concluded, as does any sensible observer, that no significant reduction of CO_2 emissions is possible unless China and India are enlisted in the effort. So, the bottom line is that the main opportunity presented by the carbon tax is for the U.S. to do itself great harm vis-à-vis other nations, while doing almost nothing for global temperatures.

Circle Two: Evasiveness About Future Energy Sources

Proposals to address climate change generally aim at reducing CO_2 emissions by some mandated amount: President Obama committed the U.S. to a 17 percent reduction by 2020, for Waxman-Markey the goal was 83 percent by 2050, and the more recent Sanders-Boxer bill aims at 80 percent by 2050. Waxman-Whitehouse does not contain a reductions target, but would start with a tax of between $15 and $35 per ton, which would increase at between 2 and 8 percent per year (after inflation), apparently forever, so the aim is to make any emissions prohibitively costly.

None of the proposals define a technological path for getting to the target. They seem to assume, like Mr. Micawber, that something will turn up and that a government mandate is sufficient to induce the transformation. But no discernible non-carbon path exists.

The lack of a technological basis undermines the credibility of any emissions-reduction goal and destroys the credence of estimates of the costs of attaining any goal. Support for legislation must be based on models of the projected costs of technologies that do not yet exist, or on assumed improvements in the efficiency of existing energy sources that have no empirical support.

The Energy Information Administration (EIA) has performed much of the analysis on which other studies depend, so its assumptions about future technologies are crucial to the accuracy of many other studies. In assessing the costs of Waxman-Markey, EIA assumed a series of conditions that are highly implausible. For instance:

> The . . . Basic Case represents an environment where key low-emissions technologies, including nuclear, fossil with CCS, and various renewables, are developed and deployed on a large scale in a timeframe consistent with the emissions reduction requirements . . . . without encountering any major obstacles.[19]

Any concerned citizen should pause over this language. Will nuclear energy be deployed "without encountering any major obstacles"? An avid and well-funded opposition has fought the expansion of nuclear energy to a dead stop. Will large-scale deployment of renewables be easy, despite the massive NIMBY problems of solar and wind and the well-deserved reputation of windmills as bird-slaughterers? Of course, the answer to both questions is a resounding, no. The EIA analysis goes on to detail other assumptions of equally dubious nature.

It also cautioned:

> As previously noted, the modeling horizon for this analysis ends in 2030. Unless substantial progress is made in identifying low- and no-carbon technologies outside of electricity generation, the [Waxman-Markey] emissions targets for the 2030-to-2050 period are likely to be very challenging as opportunities for further reductions in power sector emissions are exhausted and reductions in other sectors are thought to be more expensive.

The language here is opaque, but it seems to mean that EIA is making calculations about complicated economic and social developments 20 to 40 years in the future without being able to describe any actual technologies that would be used.

Nor is EIA alone in its lack of precision about technologies. Another econometric study of the costs Waxman-Markey uses elliptical language:

> R&D - Technology advances sufficient to achieve the Reference or Low Cost cases will only come with a much more effective commitment to R&D. The stimulus package and [the bill] almost exclusively address deployment of known technologies and large-scale demonstration of well-developed new technologies, and do not provide the level of support for the types of basic and applied research necessary to create the breakthroughs on which game-changing technologies can be built.[20]

Note the assumption buried in the quotation: commitment to R&D will produce breakthroughs. This is not how R&D works in the real world. Money is a necessary but not a sufficient condition. If the state of the science is conducive to rapid advance, then money can produce it, but if the fundamental insights are lacking, then it cannot.

EIA also provides estimates of the costs of different sources of energy.[21] However, these do not lend themselves to easy extrapolation to large-scale use because major energy transitions entail massive changes in basic infrastructure.

For example, coal for power generation is delivered primarily by railroad links between mines and generating plants. Natural gas is delivered by pipelines. A shift to natural gas involves writing off capital investment in railroads as well as mines, and adding new pipeline capacity to the new sources of natural gas in shale country. Furthermore, coal is easily stored in large piles at the mine head or the utility; natural gas must be stored in special vessels, caverns, and depleted fields and delivered on a just-in-time basis.

The Aspen Environmental Group projected that replacing current coal-fired plants with natural gas would cost $700 billion, assuming it could be done at all on any reasonable time scale. Furthermore, a shift from coal to gas would produce reductions in CO_2 emissions, but perhaps not as much as the public assumes. Burning natural gas produces about half the CO_2 of coal, but fugitive methane emissions must be captured, which raises the cost somewhat: the importance of this effect is a matter of dispute.

Baseload vs Peak Power. *A major complexity of operating an electric utility is that demand varies throughout the day/night cycle. The usual practice is for a utility to generate baseload power—the level that will be required at all times—by the cheapest method, which is often coal-fired. The power needed to meet peak demands is generated by other means, usually gas turbines, which can be turned on and off more easily than coal-fired furnaces. Increasingly, gas is being used for baseload power as well as peak power.*

Some experts contend that renewables will become more efficient and cheaper, and this will enable a smooth transition to non-carbon energies. Therefore, a carbon tax is good because it will force or speed the transition. This is akin to the argument often made by supporters of regulations that are called "technology forcing," because they require more than can be accomplished with existing technologies.

In the absence of solid knowledge about what is feasible, technology-forcing is a hope rather than a plan, because it cannot be counted on to work. For example, until a court stopped the practice, EPA persisted in penalizing gasoline refiners for failing to use required amounts of cellulosic ethanol, even though the product was not available. The agency's rationale was that the statute was "technology forcing," so the refiners were expected to squawk loudly enough to force someone to make it.[22] But the basic technologies and economics are still not available.

Also, the abstract nature of the assumption that technologies can or should be forced should cause unease, because many issues will arise in any shift to renewables, especially wind and solar. Robert Bryce notes, for example, that a megawatt of deliverable wind energy requires 870 cubic meters of concrete and 460 tons of steel; a gas-fired plant requires about three percent as much.[23] In comparing the emissions from these sources of electricity, the impact of the initial manufacturing should be accounted for, as should the rising concern over the capacity of windmills to kill birds, including endangered species.[24]

Solar has its own special needs, based on its requirements for space and sunshine, costs of gathering and transmission, and back-up for dark times. Also, current data on the costs per kilowatt hour of solar energy or wind energy that is fed into the existing carbon-fuel-based grid do not necessarily represent the costs if the grid were to rely much more heavily on these sources. To determine whether a total transition increases (or decreases) the costs would require an analysis of the complete system needed, not just the costs of an individual generating facility.

Improved storage must be at the core of any system that relies on renewable energy. However far down the cost curve wind and solar are pushed, the times when these technologies generate energy does not match the times when the most energy is demanded by consumers. Solar generation declines as residential use peaks in the early evening. Wind energy is highly variable, which puts immense strains on the management of the electricity grid — and raises the costs substantially. EIA puts the cost of wind energy at about 8 cents per kilowatt hour; a recent study finds that the costs added by the intermittency of wind boost that to about 15 cents.[25]

For these technologies to be reliable sources of baseline power would require cost and technological breakthroughs not only in generation, but in energy storage.[26] Engineers have been seeking improved storage methods for over a century, and it cannot be assumed that technological breakthroughs can be conjured by waving money like a magic wand.

Fossil fuels have large advantages in terms of storage. Natural gas can be stored in large tanks, as can petroleum. This is not usually at the point of use, but the tanks mediate the interface between production and demand. Coal can sit in piles at the point of use or at the mine head, the cheapest storage option of all.

A carbon-tax incentivized shift away from gasoline and diesel as the fuels of the auto and truck fleet would involve comparable demands on infrastructure. The U.S. transportation system is propelled by a complex web of pipelines, trucks, and storage tanks. Shifting significantly toward electric or natural gas vehicles would require a new retail infrastructure of charging stations, plus new investment at all levels of the electricity-generating system to meet the new demand.

If carbon tax advocates envision a transportation fleet powered by natural gas rather than petroleum, they must also recognize that, at present, the U.S. auto and truck fleet depends on 160,000 filling stations and thousands more private refueling stations. Shifting fuels is no small enterprise; there are at present only 1,000 refueling stations for compressed natural gas (CNG) vehicles, and building such a facility costs up to $1,000,000. Arithmetic shows that creating 100,000 CNG stations would cost up to $100 billion.[27] CNG is currently most useful for fleets of buses or delivery trucks that are fueled out of a central depot.

The overarching point is that no understanding of the workings and costs of proposed massive shifts in energy sources can be attained unless realistic technological options are specified rather than assumed. As shown earlier, 86 percent of U.S. energy comes

from carbon-based sources. Anyone who asserts the feasibility of reducing emissions to any prescribed level via renewable energy sources should also explain what the chart would look like under this scenario, and should develop a realistic path of transition. The constraint of being specific about technologies highlights the huge obstacles to achieving any arbitrary goals. If the nation is to rely on wind and solar energy for its electricity, then the green energy advocates must lay out reasonable scenarios for getting to this state. They cannot assume that an energy fairy will appear.

Circle Three: Neglect of Benefits from Fossil Fuels and CO_2 Emissions

Proposals for a carbon tax invoke the common-sense observation that taxing something discourages it. Ergo, if we want lower CO_2 emissions, we should tax them.

This concept was given a theoretical economic structure by Alfred Pigou, one of the giants of economic intellectual history, so taxes intended to discourage "bads" are called Pigovian Taxes. The definition, per *Wikipedia*, is:

> A tax applied to a market activity that generates negative externalities. The tax is intended to correct the market outcome. In the presence of negative externalities, the social cost of a market activity is not covered by the private cost of the activity. In such a case, the market outcome is not efficient and may lead to over-consumption of the product. A Pigovian tax equal to the negative externality is thought to correct the market outcome back to efficiency.

As the economics profession (including Pigou himself) realizes, however, it is difficult to develop this theory into workable practical applications because of the uncertainties of assessing the extent of the negative externalities and the appropriate level of taxation.[28] Economist Bruce Yandle observed: "Put simply, [Pigou] did not believe the politicians could get the calculations right. Instead of making things better, the chances were just as good that things would be made worse."[29]

Economist Bruce Yandle observed: "Put simply, [Pigou] did not believe the politicians could get the calculations right. Instead of making things better, the chances were just as good that things would be made worse."

Furthermore, proper application of a Pigovian Tax requires recognition of positive externalities—the *benefits* that are not captured by the producers—and not just the negative externalities. Suppressing bad effects counts as benefit, but suppressing beneficent ones must be put on the other side of the ledger as a cost.

An obvious example is that proponents of the carbon tax assume that the level of CO_2 which existed a century or so ago is the optimum, and that the rise that has occurred since is a problem. In the history of the earth, the temperature and CO_2 levels have been higher and the results have been benign. It is distinctly possible that increasing CO_2 levels in the atmosphere would have positive effects on human and planetary welfare, not just negative impacts.

One report identified fifty-five discrete environmental benefits from higher levels of CO_2 — none of which are factored into the carbon tax debate.[30] Another example was identified by Indur Goklany, author of several thoughtful works on environmental policy. He pointed out that in the absence of fossil fuels, cropland would have to increase by 150 percent to meet current food demand. Because "conversion of habitat to cropland is already the greatest threat to biodiversity," reducing CO_2 emissions will come at a price in biodiversity.[31]

At a higher level of abstraction, another set of considerations exists. These are not really within the formal Pigovian analytic framework, because economists are picky about what they score as an externality or spillover. Nonetheless, whatever label is applied, one can see costs to the public that are not reflected in the conventional estimates of the impact of a carbon tax.

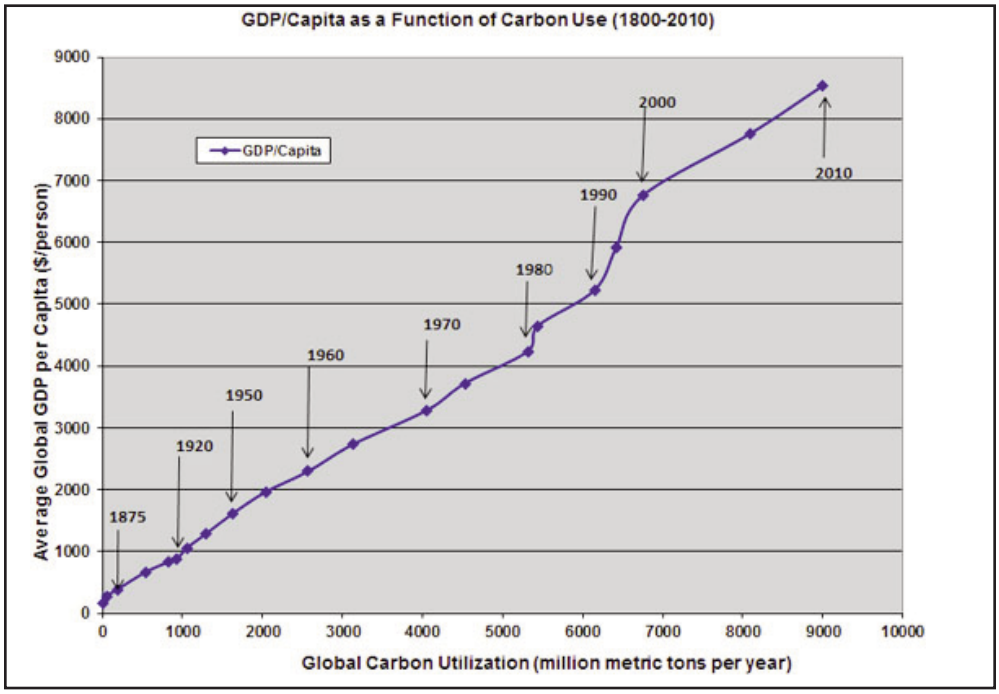
For one thing, the core of a competitive market economy is that producers do not capture all of the benefits of their activities. Consumers obtain massive benefits by paying less than the value *to them* of the goods and services they purchase. (That is, a consumer would be willing to pay a higher price if necessary, so he benefits from the difference between the actual price and this higher willingness-to-pay price, a difference called "consumer surplus.") When one considers the uses of energy, it is clear that energy is a source of substantial consumer surplus, and it is channeled into a multitude of other goods and services, ranging from food production to entertainment to medicine.

The impact of government appropriation of consumer surplus does not seem to be within the compass of Pigovian analysis, but to the extent that a carbon tax eliminates these surpluses, it will cost us heavily, in ways that are not commonly counted in assessing the wisdom or level of the tax.

The relationship between the advances in human well-being over the past two centuries and carbon use is illustrated in the chart, below, put together by Robert Zubrin. As he writes:

> The story that [this chart] tells is remarkable; it is, perhaps, one of the grandest stories ever told. It shows how, over the past two centuries, by using carbon in ever-increasing amounts, the human race has lifted itself out of hopeless poverty and misery to achieve a modicum of dignity and happiness. Look at that line reaching up, in direct proportion to global carbon use, from an average global income of $180 per person in 1800 to $2,200 in 1960 to $9,000 today; *that* is progress. [32]

Average global GDP per capita as a function of carbon use, 1800 to 2010. GDP in 2010 dollars.



Source: Zubrin, "Carbon Use and GDP," 2013

The simplistic mantra "tax the bad" does not begin to capture the complexities of the relationship between carbon emissions and good spillovers as well as bad.

The problem in identifying such relationships is that cheap energy opens up whole new possibilities and that it even restructures society.

The conclusion here is simple. Anyone who argues for a carbon tax on the basis of Pigovian theory cannot rig the analysis by assuming that CO_2 emissions and fossil fuels are simply "a bad" to be suppressed. Like most things in the world, they are mixed, with costs and benefits. The objective is to balance those, and in doing this, the costs of foregone benefits should be recognized.

Circle Four: Problems With Models

Supporting a carbon tax requires acceptance of two distinct sets of complex mathematical models.

The first consists of the climate models used to assess the effects of CO_2 and other greenhouse gases. Climate scientists agree that, according to physics, a doubling of the

level of CO_2 in the atmosphere will cause global temperature to rise by about 1°C. (This does *not* mean that continuing increases would have continuing effects; CO_2 absorbs only particular wavelengths of light, and the effects of an increase in its concentration have a ceiling.) The IPCC predictions that warming will exceed this baseline of one degree are based on models that purport to explain how an increase in CO_2 will affect other factors, such as clouds and water vapor.

If these models are incorrect, then the predictions of the level of warming are also incorrect, and, as described below, there is good reason to believe that the climate models overstate the warming effects, so the predictions of warming are overstated.

The second set of models consists of the economic models used to assess the impact of a carbon tax. Again, we have no direct data on the economic impact of a massive shift in the mix of sources of energy: and again, we must rely on models. If these models are incorrect, then so are the assumptions about economic affordability upon which policy is based. A familiar aphorism is that all models are wrong, but some are useful, so we cannot automatically ignore them, but we must be aware of the limitations, and be prepared to dig into the premises that are imported into the modeling enterprise.

Once again, there is good reason to believe that the economic models used in the climate change field lack a sufficient foundation in reality.

Modeling is an inexact endeavor.[33] Even for physical phenomena, the number of variables and their interactions can be mind-boggling. This is true of climate change science, which involves the interaction of hundreds of poorly understood and often unmeasured variables in the physical world.

When uncertain physical models must also incorporate human behavior, as is the case for predicting the impact of a carbon tax, then the chances that they will be correct become vanishingly small. As an experienced financial modeler put it, "In physics, theories aim for a description of reality; in finance, at best, models can shoot only for a simplistic and very limited approximation to it. When we make a model involving human beings, we are trying to force the ugly stepsister's foot into Cinderella's pretty glass slipper. It doesn't fit without cutting off some of the essential parts."[34]

Edward S. Quade of the Rand Corporation, an expert on policy analysis, emphasized the importance of humility with a simple example:

> Suppose there is uncertainty about 10 factors and we make a best guess for all 10. If the probability that each best guess is right is 0.6 (a very high batting average for most best guesses), the probability that all 10 are right is about six-tenths of 1%. If we confined the analysis to this one case, we would be ignoring a set of possibilities that had something like a 99.4% probability of occurring.[35]

One can give the decision-maker an even better batting average, and the results will remain depressing. Assume that a preternatural 90 percent of all best guesses are correct, and the final decision will be right only a third of the time.

To assess the wisdom of the carbon tax as policy, in this spirit of humility about the limits of experts' ability to model, we must face the tremendous uncertainties surrounding scientific understanding of the climate.

It has become clear that many basic facts are in doubt. For example, while most experts agree that temperatures have risen over the past century, the magnitude of this rise is unclear. Recent assessments indicate that temperature sensors were located in hot zones, and no quality control over their siting was exercised. The effects of urban heat islands were not properly analyzed. High temperatures in some areas were improperly extrapolated to cooler areas. Ocean temperature measurements have been unsystematic and unreliable.

Furthermore, improved data from satellites indicates that no warming has occurred for sixteen years, contrary to the predictions of the models.

As satellite measurements accumulate accurate data, the modelers are getting some surprises. For example, the measured values of warming in the troposphere and on the surface "runs counter to our expectations," and "thus challenges the current state of our understanding."[36] Obviously, the expectations were determined by the climate change models. But models that fail to predict measured data lose credibility, especially as bases for decisions that will have huge impacts on human wealth and well-being.

An increasing number of experts now admit that natural variability is poorly understood and poorly reflected in the models that are the foundation of so much climate-change dread. Several thoughtful analyses identify the uncertainties and ambiguities that underlie the scare quotes of the climate change movement. See, for example, *Climate Change Reconsidered: Report of the Nongovernmental International Panel on Climate Change* (Heartland Institute, 2011); *Addendum: Climate Change Impacts in the United States* (Cato Institute, 2012); the continuing series of analyses on Allan Watts' *Watts Up With That*; or Norm Rogers, "Worse Than the Hockey Stick" (ClimateViews.com, 2009).[37] These document the extent to which predictions based on models have proven wrong.

A key is the phenomenon of feedback. A consensus exists on the basic physics of CO_2 – a doubling of CO_2 levels would result in an increase in temperature of about 1°C. But whether the actual temperature changes more or less than one degree depends on the workings of various feedback mechanisms, such as clouds and water vapor, and these are poorly understood.

MIT Professor Richard Lindzen has determined that for some crucial feedback mechanisms, conventional models have been wrong about the direction of the feedback effect. They assume that the warming effect of CO_2 is *intensified* by the feedback mechanism when the actual effect is a *dampening*.[38]

Environmental law Professor Jason Scott Johnston applied his forensic skills to climate change science in "Global Warming Advocacy Science: A Cross-Examination."[39] He found:

> [A] systematic tendency of the climate establishment to engage in a variety of stylized rhetorical techniques that seem to oversell what is actually known about climate change while concealing fundamental uncertainties and open questions regarding many of the key processes involved in climate change.

Professor Johnston's literature review found increasing support for Lindzen's point that the models attach the wrong sign to the direction of feedback effects: "While climate models all presume that such feedback effects are on balance strongly positive, more and more peer-edited scientific papers seem to suggest that feedback effects may be small or even negative."

The importance of this point about feedback cannot be overstated. *All* projections of harmful warming depend on feedback effects, particularly those involving water vapor and clouds, not just on CO_2.[40]

Professor Johnston commented that the formal scientific work on climate change may not mislead about the issue of feedback effects, but the scare stories in the conventional media are very much based on it. Whenever an activist climate scientist predicts some new disaster, he or she is assuming the existence of positive and dangerous positive feedback effects, despite the lack of any empirical basis for this assumption. As Johnston said, such tactics are "highly likely to lead to widespread public misperception about the role of feedbacks in future climate projections."

E.S. Quade could have predicted the problems with the climate models. He said, "modelers ordinarily come from the academic world, and so do their rewards."[41] He thought that a need for academic acceptability could skew models away from reality and encourage the modelers to ignore anything that did not fit into the equations.

Quade also knew that modelers do not ignore the needs and assumptions of their clients. He quoted literature going back to the 1950s to the effect that "'the cherished belief,' or 'adherence to the party line' has been called . . . 'the single, most important reason for the miscalculations made in foreseeing and preparing advances or changes in the strategic situation.'"[42]

The climate models are not the only sources of uncertainty and error in assessing a carbon tax. The economic models used to gauge its impact are also suspect.

Quade was writing about defense analysis in post-WWII strategic think tanks, but the principle remains constant. The piper-payer calls the tune, and this applies as much to contemporary climate modeling as it did to Cold War defense analysis.

The officials now running the U.S. government, along with many major U.S. foundations, have committed their reputations to the proposition that climate change is a real and serious problem, and modelers depend on these sources for funding. A modeler who contradicts this "cherished belief" will damage not only his or her own career, but will harm his university or Beltway contractor-employer, and his colleagues. The inevitable

result is that only the models supporting the funders' preferred outcomes will survive.

One need not even assume corruption on the part of the modelers because Darwinian selection over time will assure the outcome. Modelers who produce non-acceptable results will disappear from funding proposals and from tenure tracks. Then, of course, the unanimity of opinion will be used as evidence that "the science is settled" and that any heretics are "unsound."

Norman Rogers, a retired engineer and possessor of excellent technical credentials, made the point: "If it weren't for the scary predictions these scientists would be toiling in a poorly funded and obscure branch of academic science. . . . Organized science has relinquished its traditional role as an objective advisor to policy makers and has instead become a lobbyist for its own interests."[43]

The climate models are not the only sources of uncertainty and error in assessing a carbon tax. The economic models used to gauge its impact are also suspect.

Obviously, these suffer because they rely on data derived from suspect climate models. They also suffer from the problem discussed above: the lack of specific assumptions about energy technologies. Indeed, if a model starts from uncertain and erroneous assumptions about the underlying climate process, and continues by assuming away all technological realities, it is difficult to understand why one would bother to examine it in detail.

Even putting aside these issues of climate change science, the economic models have severe weaknesses. Some of these are general across the entire field of economic modeling. Emanuel Derman, a physicist who became a quantitative financial analyst, said, in 2005, even before the financial crisis:

> [E]conomists seem to have embraced formality and physics envy without the corresponding benefits of accuracy and predictability. In physics, Maxwell's theory allows you to predict the way an electron spins . . . . In economics, by contrast, there are no laws at all, only models, and you're immensely lucky if you can predict up from down.[44]

Robert Murphy, writing for the Institute for Energy Research, looked specifically at carbon tax models. He started with the observation:

> I am not aware of a single peer-reviewed economics article that challenges the basic case for a carbon tax . . . . [But] this consensus is unjustified because the case for a carbon tax is much weaker than most economists are probably aware.[45]

Murphy supported his point with an examination of the premier model, the Dynamic Integrated Model of Climate Change and the Economy (DICE), produced by Yale's William Nordhaus. Murphy said: "*[E]ach* critical step in Nordhaus's case relies on numerical estimates that are quite uncertain and to which the magnitude of the 'optimal' carbon tax may be very sensitive" [Emphasis in original]. He identified as key technical uncertainties the facts that the model might overstate future GHG atmospheric

concentrations, overstate the temperature increase from a given GHG concentration, or overstate the economic damages from a given temperature increase.

In addition, wrote Murphy, "Nordhaus's proposal and others like it are overly optimistic about the potency of government regulation and unduly pessimistic about a market economy's creative responses. Those who are calling for a carbon tax focus on market failure but ignore the possibility of government failure." The model contains simulations of many policies, and its "calculations show that the dangers of an overly ambitious or inefficiently structured policy can swamp the potential benefits of a perfectly calibrated and efficiently targeted one (that is, the optimal carbon tax scenario)."

Murphy concluded:

> [T]he steps in the argument—going from computer simulations to a specific, numerical tax on economic activity today—are riddled with uncertainties. Besides the theoretical difficulties, we cannot dismiss the likelihood that politicians will rely on politics—rather than pure science—to implement the recommended programs. . . . Given the large uncertainties at each major step of the case for reliance on a carbon tax, economists should reconsider their current support for such a policy.[46]

Murphy is surely right. Basing important policy decisions on the results of long cascades of best guesses, however carefully those guesses are considered, has a very high probability of ending in tears. Models may be an indispensable tool of policy analysis, but they must be used with great caution.

Circle Five: Political Pressures and Practical Problems

Even if all the theoretical models were to line up neatly to support the carbon tax, the pure and efficient tax of economic theory would not long survive in the real world. A final factor would doom its effectiveness as public policy—the political pressures it would generate.

Susan Dudley, former head of the Office of Management and Budget Office of Information and Regulatory Affairs (OIRA), is sympathetic to the concept of a "a globally-mirrored, revenue-neutral carbon tax" as the way to discourage GHG emissions.[47] She assesses the chances of enacting such a tax as zero, because "only a fraction of the political support for climate policy is driven by the supposed climate benefits; most of the impetus comes from the cost side, from groups who expect to be

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able to profit at the public expense." In other words, a carbon tax is supported by multiple sets of Bruce Yandle's Bootleggers and Baptists.

Powerful ideological motives are at work. To many in the green movement, cheap energy is an evil to be stamped out. At the extreme, humanity itself is regarded a parasitic cancer on Gaia, and that which limits humans is regarded as good. Even many who do not go this far still look askance at energy use. They want to see humans use less of it and lead more circumscribed lives, as a matter of philosophical conviction.

Because neither the Bootleggers nor the Baptists are interested in a simple, even-handed carbon tax system, the relationship between the quality of any final program and political support will be inverted. The simpler any proposed tax, the less support it will gather. The more complex the bill becomes, the greater will be its level of support, because complexity is inextricably bound up with opportunities for favoritism and special benefits.

Powerful economic forces are also at work. Global investment in renewable energy reached $257 billion in 2011, with $51 billion of it in the U.S.[48] Much of this is speculation that long-term government policy will make the investments profitable. The Federal government also spends massive amounts directly. From 1998 to 2009, the Federal budget for "climate change" rose from $4 billion per year to $7.5 billion, with total expenditures of about $60 billion. The stimulus bill of 2009 added between $26 and $36 billion, depending on who is counting. It appears that after that the annual amount dropped back to $10 billion, but the matter is unclear. Tax breaks add another $2 billion a year.[49]

One should add a category of "Baptist Bootleggers," too, because ideological interest does not preclude profit, and promoting "climate change" is a good business. The Federal budget for climate science is at least $2 billion per year. In addition, major foundations fund climate-related activities. According to the Environmental Grantmakers Association, in 2009 its member foundations allocated $280 million to the categories of "Climate/Atmosphere" and "Energy."[50] EGA covers only 62 percent of the foundation world, so the total is probably well over $400 million, *in one year* for climate change issues from foundations alone, not counting dues or litigation awards. A report from the National Committee for Responsive Philanthropy estimated that total foundation funding for environmental causes in 2009 was $1.3 billion, and that $10 billion was given out between 2000 and 2009.[51]

In 2011, Matt Ridley, author of the acclaimed book *The Rational Optimist*, said:

> [D]id you know that the collective annual budget of Greenpeace, WWF and Friends of the Earth was more than a billion dollars globally last year? People

> sometimes ask me what's the incentive for scientists to exaggerate climate change. But look at the sums of money available to those who do so, from the pressure groups, from governments and from big companies. . . . By contrast scientists and most mainstream journalists risk their careers if they take a skeptical line, so dogmatic is the consensus view. It is left to the blogosphere to keep the flame of heresy alive and do the investigative reporting the media has forgotten how to do.[52]

Norman Rogers followed his point about the incentives of big science, quoted earlier, with the observation: "The interests of big science happen to coincide with the ideological goals of the green movement. The resulting coalition has impressive political power."[53]

Rogers omitted the third leg of support: big business, which adds considerable heft to the potential support for a carbon tax. America (and China) battens on direct subsidies for green energy, regulations that favor one form of energy over another, and a host of other government actions triggered by climate change fears, right down to the elimination of incandescent light bulbs.

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The public reaction to the proposal of a BTU tax in 1993 illustrates the political forces that will soon be at work in this process. It generated powerful pushback against the fundamental concept that raising the price of energy is a good thing for the economy, as well as a tsunami of demands for special exemptions from numerous groups—farmers, energy-intensive industries, hydropower producers.[54] And since 1993, the environmental-group subsidy-seekers have grown much stronger, a development that will add to the level of horse-trading and *realpolitik*.

The proposed Sanders-Boxer legislation illustrates the scope of the ambitions of the Bootleggers and Baptists carbon-tax coalition. Sanders-Boxer calls for $500 billion in subsidies, plus transfers to foreign governments and private entities of money derived from tariffs, plus distribution of money from eliminating the so-called subsidies for fossil fuels. Were a carbon tax to pass, it would produce some unpleasant surprises for a number of adversely affected industries. It would produce even more surprises for the general public, which is not well informed about the issues, and which has been led to believe that such a tax would not have major impact. When people realize that the tax hampers economic growth and job creation, and damages American competitiveness and raises prices—all without actually affecting the climate—they would be seriously unhappy with those who misled them.

Effect on GDP and Jobs

Making energy more expensive and the economy less efficient will undermine economic performance and job creation. A carbon tax does that directly by increasing the cost of carbon-intensive fuels or indirectly by increasing the use of relatively more expensive forms of energy as consumers shift from fossil fuels to alternatives in response to the tax.

Costs could be considerable, especially if governments adopt extreme measures. As Robert Murphy observes, computer runs by William Nordhaus, creator of the DICE model, indicate that if CO_2 limits were capped at 1.5 times their pre-industrial level, then the loss of world economic output would be $27 trillion.[55] (Nordhaus offset this with an estimated $13 trillion in benefits from CO_2 reduction.) As Murphy says, "If the tax is set too high . . . Nordhaus's results demonstrate that the cure can be much worse than the disease."

A Congressional Budget Office (CBO) study of Waxman-Markey in 2009 concluded that the bill would cause U.S. GDP to be between 1.1 percent and 3.4 percent less in 2050 than it would be without the law.[56] CBO did not regard the reductions as serious, because it also calculated an average annual growth of 2.4 percent.

CBO's analysis suffers from the same defect as the EIA estimate mentioned earlier—the lack of specifics about sources of energy. CBO is estimating GDP ranges almost forty years from now, to the tenth of a percentage point, without knowing the underlying assumptions about the technology in use or how the economy may change by that time. The size and extent of the Internet/e-commerce sector was inconceivable in the early 1970s; no one can predict with certainty what new industries may evolve in the upcoming four decades.

Quade's caution about the interaction of best guesses is appropriate, but such analyses are not even best guesses; they are based on the hypothesis of "assume an energy technology fairy."

The real lesson to be drawn is that a carbon tax would impact the economy in many ways, leading to an uncertain result, but one which is unlikely to be positive. CBO's numbers may be dubious, but its list of incentive effects from Waxman-Markey is worth attention. (In theory, cap-and-trade is more restrictive than a carbon tax, and an analysis of its economic impact is not fully transferrable. However, the incentive effects are similar. Also, if a carbon tax program is implemented with a specific reduction target in view—such as the 80 percent reduction target in Sanders-Boxer—then the distinctions would become slight.)

CBO says that the incentive effects for Waxman-Markey would:

- Shift production, investment, and employment away from industries involved in the production of carbon-based energy and energy-intensive goods and services and toward industries involved in the development and production of alternative energy sources and non-energy-intensive goods and services;

- Reduce the productivity of existing capital and labor, which are currently geared to relatively inexpensive energy;
- Reduce domestic household income, thus tending to reduce domestic saving;
- Discourage investment by increasing the costs of producing capital goods, which is a relatively energy-intensive process;
- Reduce net inflows of capital from abroad (because lower productivity and higher production costs for capital goods in the United States would make it more attractive for investors to invest in other countries);
- Reduce the total supply of labor by raising the prices of consumer goods and thus reducing workers' real wages; and
- Interact with the distortions of economic behavior imposed by the existing tax system.

None of these effects would be good for U.S. Gross Domestic Product. CBO could also have included the terrible effect on the economy when investment decisions depend on the ability to influence governments and obtain special favors rather than on market forces.

Advocates of carbon taxes and other green proposals argue that these measures would create green jobs and whole industries. For the most part, these arguments are spurious. Regarding industries, Diana Furchtgott-Roth of the Hudson Institute wrote:

> Department of Energy grants and loan guarantees have been notoriously unsuccessful in attempts to make alternative energy profitable. Of the 33 energy loan guarantees made since 2009 under the Energy Department's programs, 30, or over 90 percent, have shown signs of trouble. 'Trouble' ranges from missed production goals to bankruptcy filings."[57]

She noted that "green jobs" is an equally nebulous category. Making a cardboard cup qualifies as green if it is stamped with a "save energy" logo.[58]

Rendering the energy sector of the economy less efficient is not a prescription for economic health. Were this a road to riches, we could forbid power equipment and require all work to be done by hand.

Regressive Nature of a Carbon Tax

Energy is an important component of the price of all kinds of industrial goods, services and transportation. Even the Internet is greatly affected by energy prices; power represents 40 percent of the operating cost of a typical large data center.

As William O'Keefe, CEO of the George C. Marshall institute noted in *The Wall Street Journal*, "[E]nergy is consumed to produce things that people value, and there are no near-term substitutes for fossil fuels. So a carbon tax would affect food prices, consumer goods, electricity, mobility, charitable works and more."[59]

The effect would not be small. Resources for the Future, a Washington think tank which is a strong supporter of the carbon tax, estimates:

> A tax of $25 per ton of CO_2 could add about 21 cents per gallon to the price of gasoline and about 25 cents per gallon to the price of diesel fuel. The price of natural gas could increase by about $1 per thousand cubic feet, the price of coal by about $40 per short ton, and the price of electricity by about 1.2 cents per kilowatt-hour.[60]

This would represent an increase in electricity costs of 10 to16 percent, depending on the area. Consumers would feel it, especially those at the lower end of the income scale. An analysis by the Heritage Foundation, using EIA data, found that a $25/ton carbon tax would raise the energy bill of a family of four by $500, excluding gasoline, and increase gasoline prices by $0.50/gallon. It would cut the family's income by $1,900 in 2016, and, if increased at 5 percent per year after inflation, would inflict losses averaging $1,400/year through 2035.[61]

Politically-based favoritism in the program would then lead to new cycles of tax-caused distortion, as other taxes would have to be increased to find the necessary revenue. Also, shielding large numbers of people from the impact of a carbon tax would undermine one of the major rationales for that tax—the need to incentivize people to reduce energy use. On this score alone, the carbon tax would quickly turn into a complex set of subsidies governed by elaborate regulations and filled with fraud and mistake.

Lower income families would be most affected because they spend a higher share of their income on energy. Furchgott-Roth wrote: "Data from Labor Department . . . show those in the lowest fifth of the income distribution spend an average of 24 percent of income on energy, compared to 10 percent of income for those in the middle fifth, and 4 percent of income for those in the top fifth."[62]

A study by the Congressional Research Service (CRS) concluded that a $15/ton carbon tax "would reduce after-tax income for taxpayers in the lowest income deciles by 3.4 percent, while taxpayers in the highest income deciles would see their income fall by 0.8 percent"[63]

One way to offset such a regressive tax would be to introduce measures to reimburse lower income families for the costs. CRS discusses the possibility of rebates to payers and or recipients of social security, or rebates on income taxes. Still, "the approaches that yield the largest overall benefit often impose disproportionate costs on lower-income households."[64]

Robert Murphy describes the detailed special benefits necessary for a Canadian proposal for a carbon tax to muster political support. They included not just rate reductions, but special credits and deductions.[65] The number and variety of these special benefits contained in Sanders-Boxer confirm his assessment of the political forces at work: subsidies to weatherize a million homes; $500 billion for investments in green energy and $1 billion/year on worker training; a monthly rebate check to every legal U.S. resident; taxes on imports from nations that do not impose a similar tax, with the money channeled to projects to protect natural resources and wildlife (i.e., to environmental groups).

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Effect on Energy-Intensive Manufacturing

The Industrial Energy Consumers of America is a trade association of companies that are energy intensive and trade exposed, such as chemicals, plastics, fertilizer, steel, aluminum, paper, cement and glass. It estimates that a $15/metric ton carbon tax would raise manufacturing costs by $17 billion/year, and a $50 tax by $56 billion.[66]

The National Association of Manufacturers (NAM), relying on a study by the economic consulting firm NERA, concluded that as a result of a carbon tax "manufacturing output in energy-intensive sectors could drop by as much as 15.0 percent and in non-energy-intensive sectors by as much as 7.7 percent."[67]

Obviously, immense pressure will be exerted to alleviate the stress on these industries. Reponses suggested include exemptions from the tax, output-based rebates, or adjustments at international borders. All of these raise serious difficulties. Who would get exempted and by how much? How would the nation reconcile the goal of the law—reduce emissions—with the reality of exempting those with high emissions and the inevitable undercutting of emissions goals? What about competitive effects? Where is the line between who is exempted and who is not? What about firms that already reduced emissions—are they to be penalized and their competitors rewarded?

In essence, it appears that a carbon tax scheme would simply add another tax system —one that would rapidly grow in complexity and add another layer of distortion and administrative costs.

On the other hand, if nothing were done to help energy-intensive industries, they would leave the U.S. for more friendly nations as quickly as possible. The result would be a lose-lose situation: the U.S. would lose jobs and investment, but the emissions

would still take place, only somewhere else. But because climate change is a world issue, shifting emissions from one place to another is pointless.

In those parts of the country where a manufacturing renaissance is underway, "much of the momentum behind the revival comes from the rise of America as a global energy powerhouse, producing record amounts of oil and natural gas and in the process driving down one of the chief costs of manufacturing production, namely power."[68] Aborting this promising development by raising energy costs by an unknown percentage would be folly.

Implementation and Interaction with Other Taxes

A selling point for a carbon tax is that it could, in principle, substitute for existing taxes. Some experts believe a carbon tax would be less distorting of economic activity than are the other taxes, so substitution would create a gain in efficiency without regard to any benefits from countering climate change.[69]

The accuracy of this conclusion is far from clear. The carbon tax is cited as a possible substitute for payroll taxes, personal income taxes, or corporate income taxes. Each of these creates its own set of economic incentives and has been doing so for decades. It is far from clear how a new tax on a part of a single input (energy) into all activity would affect overall efficiency, nor how this would interact with dropping existing taxes. Even if initial conditions were set so as to do minimal harm, the continuing assaults of Bootleggers and Baptists would produce serious dysfunctions over time.

A potential problem called Tax Interaction Effects (TIE) is a subject of cantankerous debate among economists, and a carbon tax could amplify, rather than reduce, tax-caused distortions in the economy. The arguments on TIE are complex, but in a paper for the Energy Research Institute, Robert Murphy summed them up:

> Contrary to the claims . . . of the proponents of a revenue-neutral carbon tax swap, a carbon tax is likely *more distortionary* than a generic tax on labor or capital. A carbon tax is effectively a tax on *certain forms* of energy, and is therefore a tax on a *smaller but sizeable fraction* of inputs used in virtually all production processes. A new carbon tax, even if its revenues were used to perfectly offset existing taxes on labor, would likely introduce more distortions. This effect is stronger, the greater the original distortions in the tax code.[70] [Emphasis in original.]

As a matter of political reality, a distortion-free tax is improbable. As noted, the regressive nature of the carbon tax would create pressures to cushion lower-income groups from its impact, and revenues for this would have to come from somewhere. Similarly, if energy-intensive industries are to be shielded from the consequences of a carbon tax, the lost revenues would have to be made up from some other source, and pure political power would distort the tax. Anyone who thinks the carbon tax could remain free of favoritism needs to examine the income tax.

In any case, the idea that a carbon tax would substitute for existing taxes seems improbable, given the current Federal deficits and hunger for revenue. Many carbon tax proponents favor it precisely because it would augment existing taxes and provide additional revenues. As a Heritage Foundation paper said, "Ideas on how to use the revenue already include income transfers, paying for defense spending cuts, reducing the deficit, transferring money to developing countries to adapt to climate change and the list goes on."[71]

California represents what happens in the real world. It has a system for auctioning emissions permits. The revenues are earmarked for building a high-speed rail from Bakersfield to Fresno, which have been characterized as "two places people love to leave but don't want to arrive."[72]

In Europe, "Special interests and industry players have pressured European law makers into giving companies their emission credits for free. These favors have been handed out more or less arbitrarily and have saturated the market, predictably dragging down the price of carbon permits and largely eliminating incentive for companies to cut emissions . . . ."[73]

In reality, the dynamic of the interaction between concern over climate change and the carbon tax is the reverse of what is generally assumed. Politicians are not reluctantly considering a carbon tax because of concern about climate change. They are expressing concern about climate change because they need a justification for a major new tax, and the straightforward explanation that "the government wants more money" is running into resistance.

An article in *Der Spiegel* said: "the flagship project of Europe's climate policy settled deeper into a lifeless coma." The article explained that "When the ETS was developed, credits were supposed to be based on expected growth patterns, but no mechanism was built in to compensate for the possibility of economic fluctuations." As a result, prices are low and the governments are considering rigging the market by withdrawing 900 million carbon allowances.[74]

Effective in July 2012, Australia imposed a $A23/tonne on CO_2, applied to the 294 largest emitters and covering about 60 percent of emissions. The system will convert to an emissions-trading system in three years, and is of considerable complexity.[75] Half the revenue will go to households, via income tax reductions, direct payments, pension increases, and various special programs—an average weekly benefit of $A10.10 per household.

The program also includes $A9.2 billion for "emissions-intensive trade-exposed industries," an energy security fund to give emission permits and unspecified cash payments to coal-based generators, $A1.2 billion to manufacturing industries, $A300 million to

the steel industry, $A1.3 billion for a coal-sector jobs package, $A13 billion for clean energy projects, and other incentives for farmers, foresters, and land-owners.

Japan imposed a carbon tax in 2012. It expects to collect ¥39.1 billion in 2012 and ¥262.3 billion starting in 2016. The money will go to domestic low-carbon innovative industries, namely, lithium-ion batteries, energy saving equipment for small and medium enterprises, and "introduction of Green New Deal Funds in accord with local characteristics."[76]

In the United States, current pressures on the federal budget and concern about the deficit also enhance the appeal a major new source of revenue for the political class. Given these pressures, the carbon tax looks like manna from Heaven. It would be hidden, imposed at the level of the producer, so it would be incorporated into the price of goods and services, opaque to the consumer. And it provides politicians with a convincing story: "we hate to do this, but given the possibility of climate change, we have no choice."

Furthermore, once imposed, a carbon tax could be raised periodically. European VATs have steadily crept up, and it is naïve to think that the level of the carbon tax will be dictated by Pigovian Tax theory rather than government revenue desires.

In 2003, economists Bruce Yandle and Cristina Ciocirlan analyzed European green taxes ostensibly directed at improving environmental quality. Their "robust findings" were that the programs were that the programs seemed to be more about generating revenue than protecting human health.[77]

In reality, the dynamic of the interaction between concern over climate change and the carbon tax is the reverse of what is generally assumed. Politicians are not reluctantly considering a carbon tax because of concern about climate change. They are expressing concern about climate change because they need a justification for a major new tax, and the straightforward explanation that "the government wants more money" is running into resistance.

Because of these inverted incentives, the increasing uncertainty about the validity of climate change panic will cause the level of rhetoric to become more rather than less shrill. The goal of its advocates seems to be to get a carbon tax in place before public awareness of the scientific and economic uncertainties behind it catches up.

Regulatory Relief

Another argument that can be made for the carbon tax is that it could replace the current patchwork of existing regulations of CO_2, which would promote a more stable environment for investment decisions. The argument has some logic behind it, because economic incentives are almost always superior to command-and-control regulation. Substituting incentives for regulation could hardly avoid improving economic function.

Like the assumption that the carbon tax will replace other taxes, the hope that it will replace regulations is not likely to be fulfilled. The advocates of the carbon tax have no

intention of allowing substitutions. The Waxman-Markey cap-and-trade bill in 2009 contained 700 pages of regulatory standards before it got to its supposed purpose, and its sponsors made clear that they regarded it as an addition to regulation, not a substitute.[78] No such possibility was mentioned in connection with the introduction of Sanders-Boxer, either.

The EPA's regulatory agenda reflects the agency's continuing, aggressive pursuit of regulations directed at reducing CO_2. Nor are environmental groups proposing that carbon taxes replace regulation. The idea is a non-starter.

International Involvements

Energy is traded on a world market. Prices are the same all over, with allowances for the costs of transportation. This facilitates rational investment decisions, because industries can assess their costs of energy and trade them off against transportation costs or other location-based factors.

Proponents of a carbon tax do not deny the need to bring most of the world, especially China and India, into the system. They assume that this can be done. In their view, these nations will see that their self-interests lie in reducing emissions, so as to prevent climate change, and that the U.S. and Europe can develop packages of aid and technology transfers that will encourage them.

Indeed, the movement in favor of imposing a carbon tax has worldwide support. *Wikipedia*'s list of current carbon taxes includes: South Africa, China, India, Japan, South Korea, Taiwan, Australia, New Zealand, Europe (the EU, plus Denmark, Finland, Germany, Ireland, Italy, the Netherlands, Norway, Slovenia, Sweden, Switzerland, and the UK), Costa Rica, Canada, and parts of the United States (Boulder, CO; California; Montgomery County, MD)

However, no uniformity exists. Many of the taxes, such as the South African tax on motor vehicles, look like pure revenue measures dressed up in the garb of environmentalism. Some look like vaporware; as considered below, China has no serious carbon tax initiative underway, despite its presence on the list. All of the schemes are loaded with complexities and details, as illustrated by the earlier discussion of Australia.

This lack of uniformity will inevitably persist. Other nations will place their carbon taxes at different levels and will marble their programs with subsidies and exemptions that reflect the balance of local political forces, as will the United States.

A system of varying carbon taxes will require international negotiations over compensating tariffs so that nations that do not control carbon would not obtain a cost advantage over those which do. Otherwise, there would be leakage, as Americans responded to the incentives to buy energy-intensive goods from overseas, non-tax jurisdictions. This will exacerbate the existing complexities of international trade, as damaged competitors demand compensating tariffs, which might not be legal under world trade rules.[79]

The big question mark is China, since all agree that a tax system which omits China would be unwise. Supporters of the carbon tax refer to proposals from the Ministry of Finance, and then extrapolate this into a supposed Chinese commitment.

This conclusion has little basis. There is a vague news story from 2010 about a carbon tax suggestion made by the MOF—and an even vaguer one from 2013.[80] Neither is backed by an official document available in English, and the Chinese government makes its important policy documents available in translation. The *Washington Post* pieced together some possibilities from past Chinese news stories and statements, but at the moment all is speculation.[81] In more authoritative releases, China has also stated an intent to experiment with emissions pricing mechanisms in a few cities, but this is a long way from a Pigovian carbon tax proposal, and appears to be addressed primarily at China's serious air pollution problem.

Official Chinese policy is at odds with any approach that would make energy expensive. The nation has published a series of planning papers on climate change, most recently in 2012 by the National Development and Reform Commission, which has the responsibility for energy and climate change issues.[82] It contains many details about specific projects and initiatives, but is scant on estimates of emissions and their reduction. It expresses a desire to reduce CO_2 emissions per unit of GDP and to increase energy from non-fossil fuel sources from 8.1 percent of total energy consumption in 2011to 11.4 percent within five years.[83]

The 2012 plan does not mention a carbon tax, nor did the 2011 plan, *China's Policies and Actions for Addressing Climate Change*, released by the highest level of the Chinese government, the State Council.[84] The plans do express an interest in exploring market mechanisms on a trial basis.

China's basic position is that the developed world released the CO_2, so the developed world should bear the costs of fixing any problems. As the 2011 policy paper stated:

> Second, China sticks to the principle of "common but differentiated responsibilities." Developed countries should be responsible for their accumulative emissions during their 200-odd years of industrialization, which is the main reason for the current global warming, and they should naturally take the lead in shouldering the historical responsibilities to substantially reduce emissions. . . . developed countries should, on the one hand, take the lead in reducing emissions substantially, and, on the other, provide financial support and transfer technologies to developing countries. The developing countries, while developing their economies and fighting poverty, should actively adopt measures to adapt to and mitigate climate change in accordance with their actual situations.
>
> Third, China holds fast to the principle of sustainable development. The present development should not compromise the development capacity of future generations. Instead, it is necessary to take into overall consideration economic development, poverty alleviation and climate protection within the framework of sustainable development, actively promote green and low-carbon development,

and strive for a win-win situation in both socio-economic development and response to climate change.

Fourth, China upholds a packaged arrangement of mitigation of and adaption to climate change, and fund and technology supply [sic]. Mitigating and adapting to climate change are two integral components in addressing climate change, and they should be accorded with equal attention. **Mitigation of climate change is a long and arduous challenge, while adaptation to it is a more present and imminent task for developing countries.** Funding and technologies are essential for the realization of mitigation of and adaptation to climate change, and financial support, technology transfer and capacity building support provided by developed countries are the fundamental guarantees for developing countries to effectively cope with climate change.[emphasis added]

These statements do not support a conclusion that China will consider imposing any carbon tax which significantly raises the price of energy and retards its development. Furthermore, one should look at the Chinese endorsements of the importance of addressing the climate change issue with a skeptical eye. Experts in China can see clearly the problems with the models predicting serious warming. Given the political strength of the climate change movement in the West, the Chinese government has strong incentives to pay attention to the issue, to cooperate to some degree, and to give the appearance of cooperation to an even greater degree. China will be happy to sell us solar panels and to encourage us to raise costs for our industries, but in the end it will not join the U.S. in jumping off the energy cliff. Meanwhile, it can continue to build up its economy and extract payments for actions to reduce CO_2 emissions.

To the extent that China regards the U.S. as a rival, it can follow the maxim attributed to Napoleon Bonaparte: "Never interfere with the enemy when he is in the process of destroying himself."

Conclusion

Considering this array of problems, it is clear that the term carbon tax is misleading. Political dialogue would be improved if the term "tax" were reserved for levies imposed to meet the government's need for revenues. Obviously, these should interfere as little as possible with the workings of the economy.

President Grover Cleveland made the point in 1893 when he scorned the Republicans' use of the tariff as a tool of favoritism and industrial policy:

> When we proclaim that the necessity for revenue to support the Government furnishes the only justification for taxing the people, we announce a truth so plain that its denial would seem to indicate the extent to which judgment may be influenced by familiarity with perversions of the taxing power.[85]

A carbon tax is not a tax in this sense; it is a tool for social engineering, imposed to meet the goals of central planners. If this tool fails to meet the planners' goal of a targeted reduction in carbon emissions, then other means will be deployed, such as even more direct regulation, more subsidies for Bootleggers, cap-and-trade, or continuing increases in the tax.

The proposed carbon tax does not even qualify as a Pigovian tax. In economic theory, such taxes are designed to offset negative spillovers. The carbon tax is not based on any decent estimate of the magnitude of these spillovers and does not take account of positive downstream benefits of cheap energy. In the absence of serious estimates, it loses its intellectual fig-leaf.

When viewed as an instrument of central planning, the defects of the carbon tax become even more apparent. It would cause massive gaming of the system, as in the stories from the Soviet Union about the manner in which quotas were gamed. And the enterprise suffers from the fatal conceit that central planners can and should guide an economy.[86]

Richard Lindzen said:

> Future generations will wonder in bemused amazement that the early 21st century's developed world went into hysterical panic over a globally averaged temperature increase of a few tenths of a degree, and, on the basis of gross exaggerations of highly uncertain computer projections combined into implausible chains of inference, proceeded to contemplate a roll-back of the industrial age.[87]

The situation is even worse than Lindzen contemplated, because he was focusing on the question marks surrounding the climate science and its models. When the added uncertainties and errors inherent in the economic analyses are added in, the irrationality of the policy response is even more obvious.

Lindzen also erred in another respect. Forces of greed and ideology are always at work in human affairs, and it is not surprising that some would contemplate rolling back the successes of the Industrial Age out of their own convictions or for their own profit. Considering the powerful combinations of Bootleggers and Baptists at work to whip up concern, the power of the assault is not really amazing.

The real question is whether our democratic republic is vigorous enough to compel a return to rationality and to recommit to the continuing betterment of humanity's lot by pursuing cheap energy.

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