Cornwall Alliance
For The Stewardship Of Creation

The Cost of Good Intentions:
The Ethics and Economics of the War on Conventional Energy

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Executive Summary

The pastoral call requires shepherding a congregation through difficult circumstances, including challenges from the spiritual message and economic consequences of environmentalism. It is difficult to develop the knowledge and wisdom necessary to give biblical counsel on such issues, especially in light of complex scientific problems and intense policy debates. Yet the church must evaluate alarms raised about the environment and policies to address them. This paper is intended to assist ministry leaders, policy makers, regulators, and the public in understanding and applying biblical worldview, theology, and ethics, coupled with excellent science and economics, to promote a free, prosperous, and just society in a fruitful, beautiful, and safe environment.

The Introduction, "Thinking Biblically about the Environment," contrasts biblical guidance on the nature of environmental stewardship and the roles of government and the market with ideas that grow out of alternative worldviews like secularism and pantheism, and examines evangelical environmentalism.

Section One, "Stewardship, Markets, and Prosperity," explores the nature of environmental stewardship, how to count the cost of decisions about stewardship, and how to promote biblical stewardship in the political arena.

Section Two, "Regulation and Replacement of Conventional Energy Sources," examines claims that conventional fuels such as coal harm people, and the effects of proposed new regulations on human health and the economy. A technical Appendix (at the end of the paper) investigates whether additional restrictions on mercury emissions from coal-fired power plants are justified. (We focus on coal rather than oil or natural gas because it receives the most attention in current public debate.)

Section Three, "Economic Growth and Alternative Energy," discusses the relationship between prosperity and environmental quality. It explains the "environmental transition" and the role of prosperity in promoting environmental quality. It weighs the wisdom of pursuing "green jobs" and "alternative" or "renewable" energy, examining the impact of such policy on both the environment and human well-being.

The paper concludes with a call to honesty in place of the exaggeration of environmental hazards, and a call to caution in the use of coercive, regulatory means rather than more productive voluntary, market-based means, supplemented by tort action, to care for people and the planet on which we live.

This paper rests on foundations laid in four earlier Cornwall Alliance documents: *The Cornwall Declaration on Environmental Stewardship* (2000), *A Call to Truth, Prudence, and Protection of the Poor: An Evangelical Response to Global Warming* (2006); *The Cornwall Stewardship Agenda* (2008); and *A Renewed Call to Truth, Prudence, and Protection of the Poor: An Evangelical Examination of the Theology, Science, and Economics of Global Warming* (2010), all available at www.CornwallAlliance.org.

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Introduction: Thinking Biblically about the Environment

> Ron, a coal miner, approaches your church's diaconal ministry for help. "My unemployment insurance is running out," he says, "and I haven't been able to keep up payments on my house. Last month, the mine told us all that they don't think we'll be back for a while. I really need to get into a different line of work, but all I've done is work at the mine for 34 years. My wife and I are both stressed out about it and we've had a lot of fights lately. I don't know whether to blame the economy or the managers or myself."
>
> Single mother Diane, a member of your church you know to be struggling financially, speaks up in a Sunday school class to say that every time she looks at her electric bill, it gets higher. "Why do they raise the price when the economy's so bad already? It looks like the greed's out of control—aren't we supposed to look out for the poor instead of price-gouging them?"
>
> Lydia, a student at a Christian college who is home for Thanksgiving, is circulating a petition in the church. The petition, from a Christian organization, states that 1 in 6 babies born in the United States has a harmful level of mercury in its blood, and asks Congress to limit mercury emissions from power plants. She asks you to sign.

Pastoral care of a church requires shepherding a congregation through difficult circumstances, including medical problems, marital difficulties, job loss, and financial crises. It is no easy thing for a church leader to develop the knowledge and wisdom necessary to give biblical counsel on such a wide array of issues. On matters that involve scientific problems or intense policy debates, the investment of time and energy required to sort through the issues may seem immense. And yet, church members with family or work difficulties can be led astray, or be alienated by uninformed counsel. Church leaders want to provide spiritual assistance that goes deeper than generalized moral pronouncements and reassurances. Churches want to minister to the poor and hurting in a manner that extends beyond the giving of material aid, and answers the hard questions: "Why did I lose my job?" "Whose fault is it?" "Why can't I seem to make ends meet?"

Pastoral shepherding can also mean working to protect the church from threats that can materialize in the future, or that may be on the horizon (Proverbs 22:3). This includes the constant threat of temptation and sin in the individual's heart and in the family unit. In the broader social sphere, these may be threats of cultural decline, anti-Christian philosophies, political persecution, environmental degradation, or economic hardship.

The Challenge to the Churches

As part of its mission, then, the church must become competent to evaluate the alarms raised almost daily in the media about the environment, or the debates on policies that address those concerns. Teaching congregations about environmental issues means understanding God's role and man's role in sustaining and cultivating the creation (Genesis 1:28; 2:15). It means sorting out the genuine threats from the illusory ones, and considering the philosophies behind various approaches to environmental concerns (II Corinthians 10:5; I Thessalonians 5:21). And it means encouraging church members to act in biblical

wisdom to prevent harm from coming to the poor and weak (Psalm 82:3, 4; Proverbs 29:7; Jeremiah 22:3).

Some churches will refrain from teaching too specifically on these matters, as they might seem too "political" or "economic" and therefore beyond the theological and evangelistic mission of the church. Perhaps we should remember the broad reach of Christian theology:

> Theology, in all its departments, supplies the guiding principles by which to answer all the pragmatic problems of political economy. It tells us where true authority is to be found, and likewise what expressions of authority are usurpations. It tells us the nature of man, and hence of the chief subject and object of our political and economic deliberations and actions. It tells us right from wrong, not only in ends but also in means. And in so doing it tells us the proper reaches and bounds not only of coercion but also, by implication, of human liberty—i.e., of choice.[1]

Politics and economics are, in essence, the study of the choices people make, and the actions they take based on those choices. And so, when these broader social concerns have an impact on congregations and communities, requiring counseling or some other intervention, it is important that church leaders have a reasonable understanding of the choices that lead to suffering, or to prosperity. As Russell Kirk wrote so many years ago, "… the economic problem blends into the political problem, and the political problem into the ethical problem, and the ethical problem into the religious problem."[2]

It is our objective, with this briefing paper, to make that shepherding task a little easier. When confronted with a problem connected to the choices on energy and the environment made by individuals, businesses, or governments, church leaders should go beyond good intentions, and be well equipped to advise the hurting and confront the evils of this age.

Contrasting Foundations of Environmental Stewardship

As Christians have sought ways to minister to the suffering, and to apply biblical principles in all of faith and life, environmental stewardship has, quite rightly, become an important part of the discussion on a Christian worldview. This is a welcome change, because it is critical that Christians take seriously our responsibility to be good stewards of the world around us, and to exercise a careful and fruitful dominion over the creation entrusted to us.

It is also important that Christians be able to think outside the usual political boxes. Christians have too often aligned themselves with one political group or another without thinking carefully about what should be unique about the Christian perspective. Along with the willingness to discard knee-jerk political loyalties in favor of distinctively Christian thought, the usual correlations between political leftism and theological liberalism have weakened. Until recently, those who advocated an expansive role for government in restricting environmental usage tended to be largely restricted to the more theologically liberal Protestant denominations.[3] Among conservative evangelicals, the understanding that sin affects those in government just as much as those in the private sector has led to a skepticism of the regulatory approach in the past. That is changing, as evangelicals in well-intentioned groups such as the Au Sable Institute, the Evangelical Environmental Network, Floresta, Flourish, and others have persuaded some

[1] Beisner (1990), pp. 19, 20.
[2] Kirk (1962), p. 6.
[3] See, for example, the denominational statements on the environment from the Presbyterian Church, USA (1996), the Episcopal Church, USA (2002), the United Methodist Church (2000), the Wesleyan Church (2002), the American Baptist Churches (1989), and the Evangelical Lutheran Church in America (1993). The Roman Catholic Church has produced statements in a similar vein [Paul (1989, 1991); United States Catholic Conference (1994)]. For criticism, see Terrell (2003).

theologically conservative evangelicals to address environmental problems with more government control over private and business life.

In addition, we are increasingly being asked to think of our task in terms of preserving a romanticized "natural state," rather than cultivating Earth for the enrichment of the creation. We are asked to think of prosperity and expansive families as, on balance, destructive to the planet rather than blessings from God.

Yet humans, as bearers of God's image, can creatively add to the abundance of the Earth. We are not only consumers, but producers as well. Where humans are allowed to flourish in God's created order, we see reduced hunger, longer lives, and increased enjoyment of the years given to us. At the same time, economic advancement allows people to afford the means not only to reduce pollution but also to clean up past pollution and alleviate its consequences.

In contrast, the new evangelical environmentalism often assumes a conflict between prosperity and environmental quality. Evangelical environmentalists, therefore, frequently advocate political constraints on consumption and production—constraints that often needlessly increase human suffering, or at least impose on others purportedly moral convictions that have no solid basis in Scripture (Colossians 2:8–23; Romans 14).[4] Regrettably, some evangelical environmentalists have adopted more than a few ideas from humanism,[5] and have downplayed some significant problems with both environmental science and the economics of political intervention.

The humanistic system of thought states that Earth and the people on it are the product of chance. The planet, in this view, is not designed by an intelligent Creator as a robust and self-regulating environment, but is subject to catastrophe as humans build civilization.[6] In the United States and Europe, humanism has taken the mantle of the post-modern progressive movement—with its attendant roots in socialism. This movement is highly suspicious of markets and decentralized order. Human beings are thought to be doomed by their individual self-interest to pursue ends that, while individually satisfying, are in the end collectively destructive. Without restraint collectively imposed by a select few, enlightened individuals, the planet would become inhospitable. Stewardship, then, is seen as an assemblage of restrictions on environmental use imposed by civil governments, in pursuit of goals determined by an educated and politically appointed elite. This "centralized stewardship" relies on two key assumptions. First, governing officials are assumed to be better able to determine the best outcomes for society than private persons, by virtue of their commanding view of the entire human society and enlightened perspective. Second, these governing individuals are assumed to be able to suppress their personal interests in search of a collective good.

Many Christians, and others, view these assumptions with skepticism. Humans have limited information, and officials who cannot know the actual costs and benefits of their decisions may do more harm than good. Even governing officials who are motivated to care about the people affected by their decisions are operating with insufficient information, but the Christian understanding of the fallen nature of man leads to further caution when entrusting any person with coercive power over another. In the Bible, one of the earliest examples of centralizing government was accompanied by a warning as to the excesses of civil

[4] See, e.g., Merritt (2010), Ball (2010), Sleeth (2006, 2010). Sleeth's 2010 *The Gospel According to the Earth* is critically reviewed at http://www.wanliss.com/2011/09/keeping-the-gospel-clear-in-the-face-of-green-twistsa-review-of-matthew-sleeths-the-gospel-according-to-the-earth/ and http://www.wanliss.com/2011/09/the-gospel-according-to-the-earth-by-j-matthew-sleeth-harperone-2010/.

[5] For criticism of the humanism within the new evangelical environmentalism, see Wanliss (2011) and Jones (2010).

[6] For a counter to this, see Cornwall Alliance (2010), p. 6: "It is difficult to imagine how God could have called 'very good' the habitat of humanity's vocation in a millennia-long drama if the whole thing were prone to collapse like a house of cards with the least disturbance—like a change in carbon dioxide from 0.027 to 0.039 *percent* of the atmosphere (the change generally believed to have occurred from pre-industrial times to the present)."

authority (I Samuel 8). For politicians, regulators, and other officials, the temptation to use power excessively and selfishly can lead to tragic outcomes, particularly for the poor and the weak (e.g., I Kings 21, Isaiah 1:21–23). The person who understands the necessity of limitations on governments will see stewardship as a process of decentralized, voluntary decision making on the part of property owners responding to localized and highly subjective information. "Decentralized stewardship" rejects the chimera of superior knowledge and higher motives on the part of a governing elite. It relies instead on the information provided organically as individuals from all social strata, countries, education and income levels, and belief systems freely interact. Unfortunately, when even well-intentioned governing elites employ regulatory controls, those regulations tend to become more detailed over time, gradually eroding the use of discretion in adaptively applying the rules to the varied situations that exist in our world and enterprises. Rules absolutely cannot anticipate, in accurate detail, all of the complexities of the environment and human enterprise. This is where regulatory control tends to fail.

Some Christians have come to the conclusion that consumption—even in the process of creating something good or enjoying the Earth God made—is inherently suspect. For example, in 2002, the Evangelical Environmental Network launched a "What Would Jesus Drive?" campaign. While trying to convince Christians that driving a vehicle with low gas mileage was immoral, the EEN advocated stricter government fuel-economy regulations—despite the fact that such regulations have historically resulted in lighter vehicles and, consequently, higher rates of death and serious injury in accidents.[7]

While contending against waste and poor stewardship, these well-meaning Christians have difficulty seeing that some of the policies they advocate are counterproductive. Policies intended to preserve or sustain the environment may be directed at exaggerated or non-existent hazards, or have costs so in excess of their benefits that they create a net harm to people and to the surrounding creation.

This paper will address some of these problems in three parts.

In Section One, "Stewardship, Markets, and Prosperity," we will look at the nature of stewardship. How are we to "count the cost" of our decisions about resources? How do the realities of the political sphere affect our ability to use the political process to promote stewardship?

In Section Two, "Regulation and Replacement of Conventional Energy Sources," we will examine the claims that conventional fuels such as coal are causing harm to unborn children and others. What has been the government's response, and what effects is it likely to have on human health and the economy? In that section, and in a more technical Appendix, we will investigate the controversial and technical question of whether additional restrictions on mercury emissions from coal-fired power plants are justified.

In Section Three, "Economic Growth and Alternative Energy," we will discuss the relationship between prosperity and environmental quality. Are they irreconcilably opposed? Or can prosperity produce environmental improvement? What about "green jobs" and alternative energy? Are they helpful to the economy and the environment?

We conclude with a call to honesty in place of the exaggeration of environmental hazards, and a call to caution in the use of political means to care for people and the planet on which we live.

Section One: Stewardship, Markets, and Prosperity

Good stewardship, over nature or anything else, requires weighing alternative uses of parts of creation. Humans, whether in positions of power or not, whether educated or not, have limited information about

[7] For a summary of some of the research on the Corporate Average Fuel Economy regulation, see Balis (2006).

what uses of environmental resources are best. In the context of a world of scarcity, any decision requires tradeoffs. For example, the decision to pump a barrel of oil out of the ground requires weighing the benefits of using that resource now against the costs—what economists call "opportunity costs"—of not having the barrel of oil in the future. Unfortunately for governing officials, benefits and costs are highly individualized and subjective—people have different priorities on satisfying present versus future needs, and they have different ideas about how a barrel of oil might be used.

Counting the Cost

In a market, buyers and sellers reveal something of their own valuations as they negotiate over the use of a resource. Those who would like to use the resource now must be willing and able to compensate the sellers for their costs—which may include the forgone opportunity to enjoy the resource themselves, or the forgone opportunity to sell the resource to others who will use it differently, or the forgone opportunity to sell the resource to people in the future. The higher the value of those forgone opportunities, the higher the price the buyers must be willing and able to pay. If the buyers are willing, that provides evidence that the current uses of the resource are more valuable than the alternative or future uses of the resource. Sellers who own resources that are growing scarcer and are likely to be greatly missed later will require higher prices now, to compensate for the lost opportunity to sell the good later.

Prices, therefore, tell us something about the value of oil now versus oil later—or about the value of alternative uses of the oil. By trying to bypass the market's price information—as inevitably happens when government coercively intervenes in the economy—the modern evangelical environmentalist confronts the "socialist calculation problem." This problem occurs when a government planner tries to produce economic order without the necessary information about values and scarcity. That information emerges from market interactions among people freely choosing in light of their own preferences and opportunity costs, and is necessarily distorted by government interference in the economy.[8]

Property rights are an indispensable component of markets, and therefore indispensable to useful price information. One cannot voluntarily agree to exchange something over which he has no ownership or control, so meaningful prices cannot exist without property rights. Also, unowned assets such as forests or fisheries are subject to overuse and depredation, as no one in particular has the incentive or the right to conserve the resource and seek an optimal rate of use.[9]

Some evangelicals have argued that the mere fact that the creation has value should prompt us to seek its preservation, as we would preserve a classic work of art. Calvin DeWitt, one of the most widely respected leaders of evangelical environmentalism, writes, "When it comes to masterpieces created by human artists, respecters of Rembrandt keep and take care of Rembrandt's paintings; how much more so should respecters and worshippers of the Creator keep and take care of the Creator's works?"[10] Yet DeWitt here makes two mistakes.

[8] This problem was identified by the Austrian economist Ludwig von Mises in the 1920s. Mises argued that no rational economy would be possible without private property and prices. See Mises (1981 [1922], 1990 [1920]) and Anderson and Terrell (2003), pp. 572–575. Nobel Prize-winning economist Friedrich A. Hayek's approach, in "The Use of Knowledge in Society" (1945) is along similar lines.

[9] This problem, known as the "tragedy of the commons" is one reason that the absence of property rights has often been observed to lead to serious environmental problems. Government management of property is scarcely better, as the incentives of politicians and unelected bureaucrats are often incompatible with wise stewardship. For further elaboration on this point, see below, under "Environmental Stewardship vs. Political Clout."

[10] DeWitt (1994). "Preparing the Way for Action" [Electronic version]. *Perspectives in Science and Christian Faith* 46: 80–89.

First, reflecting the third of what physicist and ecologist Barry Commoner called the "Four Laws of Ecology," namely, that "Nature knows best,"[11] he assumes that the world as we find it, before transformation by human action, is optimal. That idea is inherent in the word *preservation*, which must not be confused with either *conservation* or *stewardship*. Some Christians may think it is a legitimate inference from God's observing, as Genesis 1:31 says, that "everything that he had made … was very good." But that way of thinking neglects two things: (1) Even as He initially created it, God did not intend the Earth to remain as it was. His instruction to Adam to cultivate and guard the Garden of Eden (Genesis 2:15) implies that even that idyllic habitat could be improved or, in the absence of human guarding, degraded. His instruction to Adam and Eve together, "Be fruitful and multiply and fill the earth and subdue it and have dominion over the fish of the sea and over the birds of the heavens and over every living thing that moves on the earth" (Genesis 1:28) implies that Earth outside the Garden was designed as a place for people to act out the image of God as His representatives, subduing and ruling it as its stewards. These commands were given even before mankind's fall into sin, and even in that pre-Fall state they implied that Earth, though "very good," was not what it was meant to be, that it could and should be improved. Was there something wrong, then, with God's creation? No. But its perfection was not final and unchangeable—not a terminal perfection. Rather, Earth was perfect as the arena for Adam and Eve and their descendants to exercise the stewardship to which God called them, a stewardship in which they would imitate God's own intelligent creativity, taking the rich and fruitful world God had made and making it even more so, to the glory of God and the good of humanity and the rest of life on Earth. (2) If the idea that "nature knows best" is mistaken in terms of unfallen creation, it is even more mistaken in light of mankind's Fall into sin and the curse God pronounced on it because of the Fall. After Adam and Eve had sinned, God said to Adam, "… cursed is the ground because of you; in pain you shall eat of it all the days of your life; thorns and thistles it shall bring forth for you …" (Genesis 3:17–18). Because of mankind's sin, God subjected the creation to "futility" and "the bondage to decay" so that "the whole creation has been groaning together" awaiting our redemption—and its own (Romans 8:19–22). Not only human sin, but also God's curse on the ground, mean that none of creation is normal in the sense of conforming to the norm; it is all abnormal, and the mandate God gave us to subdue and rule it, though not abrogated, is made more difficult by both our sin and God's curse.

Second, individuals can value resources differently in accordance with their individual goals. The natural environment has multiple good uses, not all of which are compatible with each other. Most of us would never dream of using a Rembrandt to patch a hole in a roof. We think it appropriate that Rembrandts stay carefully guarded and untouched in a museum or art collection. A Rembrandt, unlike many natural resources, has one clear and obvious use. But most of creation can fulfill multiple good purposes. Parts of nature have value to the individual according to how well they meet that individual's specific goals. While people can scarcely imagine a better use for a fine painting than display and contemplation, a tree is more versatile. It can be used for its aesthetic effect, standing preserved and untouched. It can be a means to the preservation of wildlife, even if the tree's aesthetic appeal is not particularly valuable. Or it can be cut down and used as a part of a house, a school, or a chair. It can be used for its fiber, to make paper or cardboard. All these are useful purposes, which may fulfill goals worthy of a Christian. The difficulty lies in deciding which goal to achieve with each piece of the created order. For this, information generated organically, in marketplaces, is indispensable. In any society in which we must coordinate our decisions with a large group of people, market prices can alert us to what is relatively scarce and what is relatively plentiful, what is highly desired by many and what many esteem to be of low value.

In other words, prices and profits provide a way to "count the cost" of an endeavor, which is a necessary part of wise decision making (Luke 14:28). In creating a product, what is the proper balance of quality, resource use, and the time taken in production? The values buyers place on quality and speed are reflected in the prices they are willing to pay for the product. In the same way, the values resource owners place on

[11] Commoner (1971).

their raw materials, their own time, and their tools are reflected in the prices of these ingredients of production. We might imagine a world in which these valuations were different, and wish that they fit our own valuations, but neither exhortations toward a "greener" lifestyle nor coercion by the state are likely to really improve our long-term well-being.

Some Christians have suggested that there is a problem in using *human* valuations of nature rather than *God's*. And yet this presents two serious problems.

First, while humans' valuations are expressed in terms of what one must give up in order to gain something else (even without markets), God, who can create *ex nihilo*, never has to choose in the context of scarcity. His choices, and His relative valuations, are therefore not directly comparable to the choices humans must make. Moral values are comparable for God and for us (e.g., faithfulness is valuable while infidelity is not), but economic valuations involving tradeoffs are not.

Second, if saying that God valued something in an economic sense were a sensible concept, there would still be the problem of determining what His valuations are. Steven Bouma-Prediger writes, "God's creatures are valuable not because of their usefulness to humans …. Rather, they are valuable to each other …. Most importantly, rocks and trees, birds, and animals are valuable simply because God made them."[12] Certainly it is true that these things have value. However, because choices are most often made among several things that have value, and not between a thing that has value and a thing that does not, some information is required to help us *prioritize*. The advocates of price-free stewardship have not been able to locate information that unambiguously informs us of the proper tradeoff between, e.g., red cockaded woodpeckers and paper, or how that tradeoff should change when circumstances change. Moral values will influence economic valuations—so that pornography, for example, should have a negative economic valuation to Christians—but comparisons among morally legitimate goods cannot be derived with any useful specificity from these moral values or appeal to whatever value God may place on them.[13]

Even the well-motivated person who wants to be a better steward of creation is unlikely to know how to do so. There is even less reason to expect that forcing our valuations on others via government policy would lead to an improvement in the well-being of all. In doing so, through regulation, taxes, or subsidies, the modern evangelical environmentalist falls afoul of the aforementioned socialist calculation problem. Market prices reflect billions of assessments of the value of different parts of a complex creation, and permit a more informed stewardship.[14] As Paul Heyne explained,

> We will almost certainly fail to achieve our objectives if we simply ask people to become "better stewards." No one knows what "stewardship of creation" implies for his or her own actions. Exhortations to change our life-styles just do not give us sufficient information.[15]

The tremendous complexity of the ecosystem and the economy ought to induce humility, rather than efforts to centralize control over these systems. E. Calvin Beisner has contended that environmentalist central planning constitutes pride. To claim that regulators—even well-intentioned regulators—can have sufficient knowledge to centrally steward the environment is to claim more information and intelligence than these resource-use planners can reasonably possess. Beisner wrote,

> Humility applied to environmental stewardship should lead us, in the light of the vast complexity of human society and the earth's ecosystems, to hesitate considerably at the notion that we know enough

[12] Bouma-Prediger (1998), p. 10. Also see Bouma-Prediger (2001), pp. 128, 142, 171.
[13] For further criticism, see Anderson and Terrell (2003), pp. 578–580.
[14] See Terrell (2003).
[15] Heyne (1993), p. 21.

> about them to manage them (as opposed to enforcing the rules of justice)—particularly that we are confident enough of our knowledge to assert our management preferences in place of the free choices of those who disagree with us.[16]

Francis Schaeffer and Udo Middelmann's book *Pollution and the Death of Man* (1970) was an early effort by prominent evangelical scholars to form a Christian perspective on resource use. In it, the authors mentioned an ugly Christian school building that had no trees around it. Was the land misused or not?

> It is always true that if you treat the land properly, you have to make two choices. The first is in the area of economics. It costs more money, at least at first, to treat the land well. For example, in the case of the school I have mentioned, all they had to do to improve the place was to plant trees to shield the building they built. But it costs money to plant trees, and somebody decided that instead of planting trees they would prefer to do something else with the money. Of course, the school needs money for its important work; but there is a time when planting trees is an important work.
>
> The second choice that is involved is that it usually takes longer to treat the land properly. These are the two factors that lead to the destruction of our environment: money and time—or to say it another way, greed and haste. The question is, or seems to be, are we going to have an immediate profit and an immediate saving of time, or are we going to do what we really should do as God's children?[17]

While recognizing that there are tradeoffs between planting trees and education (or to state it negatively, ugliness and ignorance), Schaeffer and Middelmann claimed to know that those tradeoffs were not being made appropriately. But there is an inescapable problem: How would one know what the proper tradeoffs are? How would Schaeffer and Middelmann know that the "somebody" who compared the benefits of planting trees, of a larger building, of higher teacher pay, of lower student tuition, or of any combination of those, made that decision wrongly? If prices of trees, salaries of teachers, and the like are not sufficient to make good stewardship decisions among morally legitimate goals, then what other information would these writers introduce?[18] Usually, in making decisions about resources under our control, we take into account our own priorities, our personal aesthetic sensibilities, preferences about appearances, our sense of the preferences of people we know well, and so on. However, in a world in which we must interact directly or indirectly with billions of other people in a complex economy, prices are indispensable.

Overall, Schaeffer's work may have added much to the evangelical Christian worldview, but these errors in his milder form of evangelical environmentalism have regrettably been expanded and compounded in modern churches. Modern evangelical environmentalism advocates "doing what we really should do" with respect to the environment, but then disregards vital sources of information that could help us find out what "what we really should do" is. In combination with alarmist science, this movement seeks to coercively impose centralized stewardship via regulation. There is a laudable emphasis on our moral obligations to be good stewards of God's Earth, but there are two problems: (1) a risk of treating some particular act or restraint as moral when it really has no moral significance (Colossians 2:8–23), and (2) a failure to recognize the importance of organic, exchange-derived information in determining what good stewardship looks like in practice.

[16] Beisner (1997), p. 28.
[17] Francis A. Schaeffer and Udo Middelmann, *Pollution and the Death of Man*, (Wheaton, IL: Crossway Books), 1992 [1970], pp. 81, 82.
[18] For elaboration on this criticism, see Anderson and Terrell (2003), pp. 575–577.

Good Intentions versus Good Stewardship

Confronted with the modern evangelical environmentalist's calls to preservation and frugality in consumption, therefore, the advocate of market-informed stewardship must ask, "How much should be preserved? How frugal should we be?" Good intentions and a sincere desire to see the development of a "green" prosperity are not enough. As economist P.J. Hill wrote,

> [I]n a modern, complex society, individuals simply do not have enough information to be good stewards of all the resources they use or affect. Good intentions cannot ensure that people manage resources appropriately or prevent environmental degradation. Given that much of what we see in the world is the unintended consequence of human interaction, simply reforming our intentions is an inadequate policy prescription.[19]

Good intentions, coupled with alarmist science and a readiness to discard information from markets, can lead to tragic results. The poorest and weakest of people on Earth are the most likely to suffer from ill-advised "green" policies that reduce prosperity. As the *Cornwall Declaration on Environmental Stewardship* states,

> Public policies to combat exaggerated risks can dangerously delay or reverse the economic development necessary to improve not only human life but also human stewardship of the environment. The poor, who are most often citizens of developing nations, are often forced to suffer longer in poverty with its attendant high rates of malnutrition, disease, and mortality; as a consequence, they are often the most injured by such misguided, though well-intended, policies.[20]

Ironically, many of these same policies can lead to further environmental degradation. Paul Heyne presented a wonderful example of how acting on good intentions, without price information, can actually lead to poor stewardship:

> Suppose that every inhabitant of Los Angeles was miraculously converted overnight to the worldview of St. Francis of Assisi. We would no doubt see major changes in the behavior of Los Angelenos; but I would not be at all confident that we would see a decline in air pollution caused by the automobile. Each newly-sanctified Los Angelino, eager now to bring benefits and blessings to all other beings, would still need his car to do so effectively, given the physical layout of the city and its environs, just as any current Los Angelena desirous of doing good finds her automobile a valuable asset for getting food to the hungry, drink to the thirsty, and clothing to the naked, for visiting those sick or in prison, and for earning income with which to do any of these things more effectively. Citizens of Los Angeles who make the "good steward's" choice and leave their cars at home end up getting less done, breathing more exhaust fumes, and dying earlier than those who refuse to behave like "good stewards." That looks like very bad stewardship.[21]

Environmental Stewardship vs. Political Clout

We are often tempted to look at public policy as the outcome of efforts by politicians to do what is best for their constituents, or at least to do what a majority of their constituents want. When policy seems to work against broader goals such as economic growth or environmental cleanliness, most people are inclined to make efforts to educate policymakers as to the inefficiency and damage caused by their policies. When the policies persist, it is tempting to think of the policymakers as incorrigible simpletons.

[19] Hill (2000), p. 166.
[20] Acton Institute (2007), p. 9.
[21] Heyne (1993), pp. 20, 21.

And yet, there are good reasons to suppose that policymakers are quite intelligently accomplishing their goals.

The key is to understand that the real goals of policymakers are often at odds with economic progress and care for the environment. When faced with a choice between seeking the good of society and seeking re-election, politicians—as much sinners as the rest of us—are inclined to seek re-election. Unelected officials, or bureaucrats, are inclined to seek larger budgets for their agencies, even when the mission of the agency does not reflect the true needs of society.

While people often imagine that democracy creates a connection between what is good for society and what is good for elected officials, this happy ideal is often overwhelmed by three realities of the political sphere.

First, as we have already mentioned, there are the problems of policymakers' insufficient knowledge. In the absence of organic information emerging from voluntary, market-based exchanges, policymakers cannot know what the most desirable uses of resources truly are. The steady growth of regulations, mandates, subsidies, and trade barriers make the knowledge problem even worse.

Second, people are likely to make decisions with substantially less information when in the voting booth than when in a market setting. When an individual makes the decision to buy a product in a marketplace, he is, in effect, the only voter. There is a 100 percent chance that what he chooses will be what he gets. In an electoral setting, the impact of an individual voter is negligible. One vote is exceedingly unlikely to change the identity of the politician who takes office. Therefore, since people must expend time and resources to gain information before making a choice, they will rationally choose to expend those resources where doing so is more likely to result in a better outcome—or at least the outcome they consider better. It is not surprising, therefore, that individuals would choose to gather more information in a market setting where their "vote" makes a difference, than in a political setting where the individual expenditure on information is not likely to produce gains for the voter. Economists refer to this as "rational ignorance." Rational ignorance implies that policymakers are, relative to entrepreneurs in the marketplace, somewhat insulated from the consequences of socially damaging choices since voters are not as likely to monitor politicians.

Third, government officials can gain by using policies to create substantial benefits for a few of their constituents, while spreading the costs of those policies over a far larger group. If the costs are sufficiently dispersed, those bearing them will find it difficult to organize politically in opposition to the policies, and may not even notice the costs. While voters may be rationally ignorant with respect to most policies, policy decisions that have a disproportionate impact on a particular group of voters may attract the keen interest of that group. As a result, each of the few who stand to benefit greatly from a policy will invest considerable resources into getting politicians to adopt it, while each of the many who stand to lose only a little from it will invest little or nothing—even though the cumulative losses of the many might outweigh by thousands of times the cumulative gains of the few. Since the costs to the larger, disorganized group can exceed the benefits to the politically alert, well-organized group, "special-interest politics" can result in policies that are damaging to the economy and the environment.[22]

[22] To these three may be added three additional difficulties: (4) Elected officials have a short time horizon within which to operate. While a private firm's prospects for profits or losses in ten or twenty years may be reflected in today's stock prices, creating some incentive to consider long-term consequences of today's actions, politicians are keenly aware that unless the next election is won, they can enjoy no benefits at all from today's political decisions. This creates a political inclination to make decisions that create short-term, visible gains while concealing the costs or postponing the costs to a time after the election. (5) Rarely are politicians and unelected bureaucrats putting *their own* property or liberties at risk; rather, they are risking others', and so they lack the incentive of protecting their own property or liberty that would otherwise lead to greater diligence in comparing the costs and benefits of alternatives. (6) Because it is businesses that are least capable of prevailing in unhandicapped

When interest groups use politics as a means of limiting their competition in search of higher profits, this is called "rent-seeking." This often takes the form of some regulation that raises the costs of entering a particular occupation or industry. Usually, the regulation is surfaced with a veneer of public interest.[23] While an industry may ostensibly support the regulation for the benefit of disadvantaged consumers, for broad economic growth, or for the preservation of the environment, the monetary benefits to the industry itself not only suggest less altruistic motives but also fail to offset the monetary loss to the society as a whole.[24]

Environmental regulation is a popular avenue for rent-seeking behavior. By way of illustration, consider the following examples:

- In the early 1990s, the northern spotted owl was the focus of a controversial protective effort by the federal government, resulting in barriers to logging on millions of acres of federal forest land. Weyerhaeuser Corporation, a forest products company, employed wildlife biologists to search for spotted owls on federal land. While *some* of Weyerhaeuser's own land was put off limits by the regulations, a *Wall Street Journal* article at the time revealed that owl discoveries "have put more than *five million acres* of federal timberland in the Pacific Northwest out of loggers' reach—and driven lumber prices through the roof." While competitors searched for alternative sources of timber, Weyerhaeuser's "owl-driven profits enabled the company to earn $86.6 million in the first quarter, up 81% from a year earlier."[25]
- Oil and gas companies benefit from regulations that use global warming as a rationale for restrictions on coal—such as those imposed under the Kyoto Protocol. As coal loses market share, lower-carbon natural gas gains. When, in June of 1998, Shell Oil Corporation switched sides in the global warming debate and announced its conversion to "green" ideals, environmentalists cheered. Meanwhile, a Shell executive revealed that the company would be "promoting the development of the gas industry particularly in countries with large coal reserves such as India and China."[26] A group called "The Business Council for a Sustainable Energy Future," comprising gas, wind, and geothermal energy producers, lobbied hard for the reduction of emissions of greenhouse gases.
- The 1970 Clean Air Act imposed sulfur dioxide emissions restrictions on coal-fired power plants that made the burning of low-sulfur coal from the western United States preferable to using higher-sulfur coal from the east. Western coal mines and railroads that would transport the coal across the continent gained; eastern coal mines lost. Under the 1977 amendments to the Clean Air Act, expensive scrubbers had to be installed on *all* new coal-fired power plants, regardless of how clean the power plant already was. Eastern coal producers regained some ground. However, because the regulations made the construction of new facilities relatively expensive, older facilities stayed in service longer and produced an increase in sulfur dioxide emissions in some parts of the country.[27] Further amendments in 1990 set up emissions trading in sulfur dioxide, leading to a shift back to low-sulfur western coal. Western coal mines, and the railroads that transported that coal to the power plants in

competition that are the most likely to participate in rent seeking, it is those businesses that are most likely to spend large amounts of money lobbying politicians and donating to their campaigns. This creates an incentive for the politicians to serve the interests of less efficient users of resources rather than those of more efficient users. This is not the same as the special interest problem, for it goes beyond it to show explicitly that the consequence is not merely the favoring of one group or business over another, but the favoring of the less efficient over the more efficient.

[23] We see in Acts 19:23–41 the account of a riot in Ephesus initiated by an organization of metalworkers, whose trade in idol-making was threatened by Paul's preaching. Dual motives appear in the text: a concern for the lost profits, and a "moral" concern for their goddess.

[24] Important works in the economics of rent-seeking include Stigler (1971), Buchanan and Tullock (1975), Peltzman (1976), Buchanan (1980), and McChesney (1997).

[25] *Wall Street Journal*, June 14, 1992, emphasis added.

[26] In Bruce Yandle (1999), p. 7.

[27] Adler (1996), pp. 28, 29.

the east, benefited tremendously. As economists pointed out in a recent study, the shift was dramatic. "Over the period 1990–2002, coal production from high-sulfur deposits in the Illinois Basin (Illinois, Indiana, and West Kentucky) declined by 42%, while low-sulfur coal production from the Powder River Basin (PRB) of Wyoming and Montana doubled and the number of utilities burning PRB coal more than tripled."[28]

- Rivals to Wal-Mart, such as supermarket chains Giant, Safeway and Supervalu, have used land-use regulations to block construction of new Wal-Mart stores. In some cases, the rivals have used consultants to work behind the scenes, enhancing the apparent size of any existing grassroots opposition and training union workers to use political means to shut down their competition.[29]
- When hazardous waste incinerators found that they were losing market share to cement kilns that burned hazardous waste as a side business (at lower cost), the incinerator industry funded local citizens' groups that sued cement kilns, alleging violations of environmental regulations. Internal memoranda released in court indicated that the incinerators had targeted cement kilns "most vulnerable" to additional regulation.[30]
- Philips, one of the world's largest light bulb manufacturers, began campaigning in 2006 to encourage governments around the world to ban traditional incandescent light bulbs by 2015.[31] GE, another major light bulb manufacturer, "spent $47 million in 2007 lobbying for an incandescent light bulb ban, cap-and-trade carbon regulations, and other government policies that would tilt the playing field in GE's favor. Its compact fluorescent and LED bulbs offer a higher profit margin."[32]

Many policies that are harmful to society in general generate political support, money, and votes. In order to get elected or hold on to political power, politicians often need to support policies that are morally questionable, cause economic problems, and lead to environmental damage.[33] The "knowledge problem" faced by regulators, the rational ignorance problem afflicting voters, and pressure applied to politicians by rent-seeking lobbyists all lead to policy outcomes that conflict with both economic growth and environmental improvement.

Section Two: Regulation and Replacement of Conventional Energy Sources

Conventional energy sources, such as coal and natural gas, provide the majority of the energy for the United States. These tend to be inexpensive sources of energy, and reserves of fuel are quite large (and not just for coal—estimates by the International Energy Agency suggest a quarter of a millennium's worth of natural gas[34]). Yet these energy sources are regarded by some as enemies of the environment and destructive to human health. Burning coal does generate undesirable emissions such as particulates and sulfur dioxide. Though advances over several decades in power generation technology have significantly reduced the quantities of these pollutants released into the atmosphere, advocates of renewable or "clean" energy argue that the costs of these energy sources still outweigh the benefits. Other Cornwall Alliance publications discuss carbon dioxide emissions and their alleged effects on Earth's climate.[35] In this section, we focus on the recent efforts to regulate power plants' mercury emissions, and the Maximum Achievable Control Technology (MACT) and Cross-State Air Pollution rules.

[28] Gerking and Hamilton (2010), p. 328.
[29] Zimmerman (2010).
[30] Terrell (2001), pp. 26–29.
[31] Carney (2008).
[32] Young (2011).
[33] Mark Brandly (2011) eloquently summarizes this point.
[34] Ridley (2011).
[35] Cornwall Alliance (2010); Cornwall Alliance (2006).

Mercury from Power Plants: What Is the Risk?

The Evangelical Environmental Network (EEN) recently issued a "factsheet" linking mercury emissions from US power plants to brain damage in unborn children. "One in six babies are born with harmful levels of mercury in their blood," the EEN states, "and coal-burning power plants are the largest source of domestic mercury production."[36] "Annually, 700,000 babies are born with harmful levels of mercury in their blood," the factsheet asserts. Saying that it is "well past time to stop gambling with the brains of unborn babies," the EEN links opposition to mercury emissions to a pro-life agenda.

The factsheet is in support of an EPA proposal to force the reduction of mercury emissions from US power plants from around 29 tons a year to about 5 tons a year through a modification of regulations based on the Clean Air Act. There are indications that the costs of accomplishing this reduction through the EPA's proposal would be extremely high, while generating insignificant reductions in the hazards from mercury (actually methylmercury, the substance humans ingest via fish consumption) exposure.

As the more technical discussion in the Appendix indicates,[37] the risk of exposure to methylmercury caused by mercury emissions from US electric utilities is probably far less than the EEN claims. It is so low that the proposed EPA rule is not likely to have any substantial positive impact on human health. In fact, the overall impact could be substantially negative, given the costs (discussed below). While the EPA's proposal for mercury is supposed to reduce emissions by about 24 tons a year, EPA's own estimates are that reducing emissions even by as almost twice as much (41 tons) "is unlikely to substantially affect total risk."[38]

A study by Willie Soon of Harvard argues,

> *The scientific literature to date strongly and overwhelmingly suggests that meaningful management of mercury is likely impossible*, because *even a total elimination of all industrial emissions*, especially those from U.S. coal-fired power plants, will almost certainly not be able to affect trace, or even high, levels of MeHg [methylmercury] that have been found in fish tissue over century-long time periods.[39]

Robert Ferguson, executive director of the Center for Science and Public Policy, summed up the problems with the kinds of claims being made about mercury risk:

> … [S]trong scientific evidence does suggest that most, if not all, of the trace amounts of methylmercury contained in ocean fish are *not connected* to the inorganic form of mercury emitted by power plants. That is because mercury is ubiquitous in our environment, the oceans alone containing tens of millions of tons of mercury—*deep ocean vents likely being the regions* for production of the methylmercury that ends up naturally and persistently over time in ocean fish.[40]

With the relationship between coal-fired power plants and methylmercury risk to average Americans (including the unborn) as uncertain as it appears to be, the risks of avoiding fish and of incurring significant costs from further regulation on power generation seem comparatively large.

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[36] Evangelical Environmental Network (2011), p. 2.
[37] The following discussion assumes and builds on conclusions reached in the more technical discussion in the Appendix. Readers doubtful of this discussion should read the Appendix carefully.
[38] Yeatman (2011c).
[39] Soon (2011), p. 5 (emphasis original).
[40] Ferguson (2004), p. 16 (emphasis original). For more on the question of where oceanic fish get their methylmercury, see Jaffe (2007). "No one really knows where ocean fish contract their mercury," says Jaffe. "And the little that is known suggests it does not come from human pollution." Ocean vents are a possible source.

The alarmism evident in some of the evangelical literature on mercury is often based on hair-trigger "fish advisories" issued by government agencies. The same EEN fact sheet displays a map indicating that mercury advisories exist in every state (as of 2008). For those who are unaware of the actual risks behind the advisories, it is easy to overestimate the danger. Overall, the risk, even in freshwater fish, seems to be quite low.[41]

MACT, Cross-State Air Pollution, and Employment

The scientific basis for reducing mercury emissions from US power plants is speculative at best. But what of the costs? When governments regulate air pollution, they often do so in ways that are needlessly costly. While environmental damages were once dealt with predominantly through lawsuits filed by the individuals or groups harmed, the trend for several decades has been to deal with pollution through legal restrictions, sometimes specifying a limit on the amount of the pollutant that may be emitted, and sometimes even specifying the particular method that must be used to reduce the pollution. This type of regulation may require "reasonably available control technology" or "maximum achievable control technology" (MACT).[42] For major stationary sources of 189 chemicals, the 1990 Clean Air Act requires MACT, without regard for the size of the affected population or the existing levels of pollution in the area.[43] The proposed mercury rule is a MACT regulation, often called the "Utility MACT."

MACT is a technology-based standard. That is, the EPA requires certain technologies that must be used to reduce emissions, rather than giving the industry the flexibility to choose which technology most efficiently meets a given emissions standard. For that reason, MACT tends to be a more expensive way of reducing emissions.

Imposing the Utility MACT and Cross-State Air Pollution Rule (a.k.a. Clean Air Transport or Clean Air Interstate Rule) could force electricity costs to increase substantially for many families. According to a study by National Economic Research Associates (NERA), their combined impact would be to increase electricity costs while inducing the closing of some 48 gigawatts of installed generating capacity of coal power—enough to power about seven New York Cities. NERA projects an increase in national average retail electricity prices of about 11.5 percent by 2016. Some regions would see even higher increases. For the mid-Atlantic, electricity is predicted to become 17.1 percent more expensive. For Michigan and Wisconsin, prices are expected to rise around 21 percent, and for southern Illinois and eastern Missouri, around 23 percent. Kentucky and Tennessee are projected to see increases of 23.5 percent. Natural gas prices also would be higher than otherwise as electric utilities shift from coal to natural gas, driving up demand. NERA projects increases in natural gas prices of 17 to 18 percent by about 2015. This not only affects households directly as they pay more in utility bills. Any product that requires electricity to produce could become more expensive.[44]

While MACT regulations can result in some people being employed to build and install the technology, industries subjected to MACT regulations can face job losses and reduced overall productivity. In addition, just as households will struggle with higher energy prices, many firms will see their financial

[41] As Heuss (2003) points out,

> Advisories are meant to be protective in nature so even one sample above the triggering level (which varies from state to state) is enough to consider an advisory. There are several different kinds of advisories that range from restricted consumption of some types of fish for sensitive sub-populations to commercial fishing bans. Because of the wide range of types of advisories, statistics on the number of advisories or even the fraction of water covered by advisories are not particularly helpful in estimating the extent of mercury contamination. (p. 6)

[42] The EPA has defined MACT as the emissions attained by the average of the best-performing 12 percent of emissions sources. See Field and Field (2009), p. 342.

[43] Portney (1990), also Field and Field (2009), p. 305.

[44] NERA Economic Consulting (2011).

situation worsen, and reducing employment will be among the means they use to adjust. The EPA projects some job gains from complying with the new regulations. However, the NERA study found that the U.S. labor market from 2013 to 2020 can be expected to see a net *loss* of 1.44 million job-years (1.88 million lost, partially offset by 0.45 million gained). Most of that impact, NERA projects, would be felt up front, from about 2013 to about 2015.[45]

The EPA seems unwilling to consider the full impact of its regulations. Its optimistic cost-benefit analysis on MACT and Cross-State Air Pollution rules appear to be characteristic of the its assessments of its own regulations.[46]

The reliability of the electric grid could also be reduced, leading to brownouts and blackouts during periods of high demand. The unrealistic timeline for compliance with the new regulation could force retirement of generating capacity without replacements sufficient to ensure a constant flow of power.[47] With regard to the possible effects of the new regulation on the reliability of the grid, the head of the Federal Energy Regulatory Commission, Philip D. Moeller, wrote that "[FERC] believes that the [EPA's reliability analysis] does not consider certain reliability issues."[48] Moeller argued that while the EPA was considering aggregate electricity generation, it did not take into account problems of transmission. Even if electricity generation remains adequate in total, the transmission network could be unable to fill gaps left when local generating facilities are forced into retirement by the new EPA rules.

More pointed are the comments of PJM Interconnection, LLC, a company that is responsible for the reliability of the electric grid for 13 states and the District of Columbia. The company has contended that the proposed Utility MACT rule puts the grid at risk of increased reliability problems unless the EPA is more reasonable about the time it allows to comply with the new regulation. PJM also argues that the EPA's forecasts of how many generating facilities will shut down as a result of the new regulation are unrealistically low. The EPA's predictions, PJM says, do not take into account the fact that electricity production in the United States occurs in a predominantly market-based environment, rather than a centrally planned market.[49] When environmental regulations drive up the cost of producing electricity, less electricity will be produced. Overall, PJM projects that the volume of lost generating capacity resulting from the Utility MACT rule could be over ten times what the EPA has estimated, over a timeline in which it will be difficult to adjust.[50] The problems PJM faces in its electricity market are likely to be paralleled in other parts of the country.[51]

The Cross-State Air Pollution Rule creates more risks for lost generating capacity, but with a special harshness for the state of Texas. The rule originally was proposed in July 2010, and was finalized in July,

[45] NERA Economic Consulting (2011).
[46] See Vaughn (2011).
[47] The production and distribution of electric power is complex, and problems extend beyond the simple reduction of capacity that could result from costly environmental regulations. Even a power grid that has sufficient generating capacity can become unreliable if a generating facility that was responsible for "jump-starting" a local area of the grid shuts down due to regulatory costs.
[48] Moeller (2011).
[49] PJM Interconnection (2011), p. 15.
[50] PJM Interconnection (2011), p. 19.
[51] Thomas Fanning, president and CEO of the Southern Company, testified before the House Energy and Commerce Subcommittee on Energy and Power on April 15, 2011 as follows: "EPA has proposed Utility MACT rules under timelines that we believe will put the reliability and affordability of our nation's power system at risk. EPA's proposal will impact plants that are responsible for nearly 50 percent of total electricity generation in the United States. It imposes a three-year timeline for compliance, at a time when the industry is laboring to comply with a myriad of other EPA mandates. The result will be to reduce reserve margins—generating capacity that is available during times of high demand or plant outages—and to cause costs to soar. Lower reserve margins place customers at a risk for experiencing significant interruptions in electric service, and costs increases will ultimately be reflected in service rates, which will rise rapidly as utilities press ahead with retrofitting and projects to replace lost generating capacity due to plant retirements." See Fanning (2011), p. 1.

2011.[52] There are two phases of compliance for sulfur dioxide (SO_2), which is a pollutant produced by the burning of coal. The first phase begins January 1, 2012, and the second begins January 1, 2014. The trouble for the electricity generating industry, apart from the significant cost of the rule itself, is that it takes several years (including time required to prepare necessary environmental impact reports and obtain construction permits) to get a scrubber built and operating. Coal-fired power plants that began plans for the installation of scrubbers when the rule was originally proposed would have faced extremely tight permitting, design, and construction schedules, as there are only 18 months between the proposal and the first phase of compliance. Texas faces a nearly impossible schedule, however. The state was exempted from the regulation in the original proposal because of a lack of evidence that the state contributed to downwind pollution. When the final rule was issued a year later, the agency stated that Texas does contribute to downwind pollution and was subject to the rule, under a special regulatory regime set up just for Texas. Thus the state's power plants have about six months to make expensive modifications that should take several years. While the EPA says that compliance is as simple as switching to low-sulfur coal, Texas legislators from both sides of the aisle have argued that this cannot be done at reasonable cost.[53]

The anti-mercury and air transport regulations on their way in the next few months are likely to create significant costs for American households and businesses. While the EEN claims that "[t]he proposed mercury regulation protects the unborn, creates jobs, doesn't reduce electricity reliability, and produces real dollar savings in health benefits,"[54] the evidence suggests otherwise. For mercury reductions, at least, the projected benefits are based on unrealistic estimates of human hazard from fish consumption, and do not justify the burdens of the regulations. When we consider that the dollar costs of regulations translate into human death and suffering from reduced incomes (see below), it is possible that these regulations could kill more people than are being saved. This has been observed with other EPA regulations.

Though the path by which regulation costs lives is not always easy to see, it is nonetheless real. Disposable income is used partially to increase personal health and safety. To the extent that regulation reduces disposable income, it damages health. In developing nations, higher incomes may be used to purchase adequate food and clean water, obtain medical care, and perhaps provide for an education that allows the individual to avoid dangerous employment. In industrialized nations, higher incomes mean that people can buy safer cars, choose more healthful foods, move away from crime-ridden neighborhoods, and install smoke detectors in their homes. When an EPA regulation diverts resources from the pockets of individuals, there is less money available for individuals to take any one of thousands of steps to extend and better their lives. And these regulations are not trivial in their costs. Supreme Court Justice Stephen Breyer pointed out that in one Superfund case in which he ruled, a reasonable cleanup effort at a polluted site could have made it safe enough for children to eat the dirt 70 days out of the year. The EPA, however, saw fit to spend an additional $9.3 million to clean the site thoroughly enough for children to eat the dirt 245 days a year. The site was not a school, park, or playground, but a swamp. No children lived nearby.[55] In how many ways might $9.3 million have been used to save lives or improve health elsewhere?[56]

Economists have estimated the relationship between a decline in income and the loss of life that will result. One study indicates that a life is lost, on average, for an income decline of $10 million to $15

[52] See www.epa.gov/airtransport/.
[53] See Yeatman (2011b). Yeatman speculates that Texas' lawsuit against the EPA as well as other conflicts between the state and the EPA may have contributed to the EPA's unreasonable timeline.
[54] Hescox (2011).
[55] Viscusi, Harrington, and Vernon (2005), p. 777.
[56] The average EPA regulation costs $7,600,000 per additional *year* of life preserved (i.e., $76 million per ten years of life saved). See Tengs et al (1995). The law does not tell the EPA how clean a Superfund site must be. That discretionary power given to the EPA, along with the lack of incentive to consider costs and benefits, means that in some cases, the EPA "over-cleans" a site, and in other cases "under-cleans."

million.[57] Another approach indicates that it takes a $17 million income decline to result in one lost life.[58] Systems engineer Ralph Keeney commented on still another study:

> Regulatory costs are paid by individuals, which leaves them with less disposable income. Since individuals on average use additional income to make their lives safer and healthier, the regulatory costs lead to higher mortality risks and fatalities. Based on data from the National Longitudinal Mortality Study relating income to the risk of dying, approximately each $5 million of regulatory cost induces a fatality if costs are borne equally among the public. If costs are borne proportional to income, approximately $11.5 million in regulatory costs induces a fatality.[59]

This means that some regulations may cost more lives through reduced income than they save by avoiding the risk they regulate against.[60] In a way, the regulation backs us away from one risk into another risk that may be far larger. For example, the 1990 EPA regulation placing a hazardous waste designation on wood-preserving chemicals costs three lives for every one it saves.[61]

Collectively, government regulations impose an enormous cost on the U.S. economy. As with the link between income reductions and mortality, it is difficult to calculate these costs in a scientifically objective way. However, one study indicated that "… in 2008, U.S. federal government regulations of all types—economic, health, safety, and environmental—cost an estimated $1.75 trillion, an amount equal to 14 percent of U.S. national income,"[62] or about $5,800 per person. Even at $17 million per life—the highest estimate among those above—this would mean the regulations cause a gross excess of nearly 103,000 deaths per year merely from their financial costs. Do the regulations prevent as many deaths, or more? Since so many address badly exaggerated risks, and at a regulatory cost per life-year saved of $7.6 million,[63] that seems unlikely.

Regulatory and paperwork costs can cripple businesses, especially small ones. This is because regulatory compliance entails some fixed costs that do not increase when the business gets larger, so that relative to the size of the firm, larger firms are not hit as hard. Environmental regulation is a large part of that cost. A 2005 study by Crain found that "compliance with environmental regulations cost 364 percent more in small firms than in large firms."[64] The overall cost of environmental regulation can be damaging to firms of all sizes, of course, but larger firms may see the regulation as a way to put their smaller competition at a disadvantage. One Small Business Administration study found that, in 2008, the total cost of environmental regulations was $281 billion (in 2009 dollars).[65] Crain and Crain point out that the cost of regulation is highest, per employee, for such businesses as "utilities, mining (including coal, oil and gas extraction), and transportation and warehousing concerns …."[66] These firms paid about $14,992 per employee in 2008, higher than any other sector.[67]

"Regulatory agencies should be cognizant of the harm that is done when they fail to take costs into account," writes economist Kip Viscusi. "The concern of economists with cost is not a professional bias,

[57] Lutter and Morrall (1994).
[58] Lutter, Morrall, and Viscusi (1999).
[59] Keeney (1997).
[60] Green (1998) applies this reasoning to the Kyoto Protocol.
[61] Viscusi (2005), p. 741.
[62] Crain and Crain (2010), p. 6.
[63] Tengs, et al. (1995).
[64] Crain (2005), p. 6.
[65] Crain and Crain (2010), p. 48.
[66] Crain and Crain (2010), p. 52.
[67] Other sectors included manufacturing ($14,070 per employee), services ($7,235), trade ($5,289), and health care ($4,221). See Crain and Crain (2010), p. 51.

but ultimately has a link to individual welfare. Such links in turn involve our health and are just as real as the concerns that motivate the government regulations."[68]

Unlike many taxes, the full cost of environmental regulation is not stated clearly in a pay stub or tax form. Many people may not perceive the connection between their reduced living standards, their health problems, and the regulation that caused them. But in some cases, the environmental regulation can lead to job losses that are obviously damaging, both to a local area and to the economy as a whole.

For example, in January of 2011, the EPA vetoed a Clean Water Act permit granted by the U.S. Army Corps of Engineers to a coal mining company for the Spruce No. 1 Mine in Logan County, West Virginia, where per capita income in 2010 was just over $14,000—less than half the average income in the state, and barely a third of the average in the nation. This was the first time the EPA had used this power since the Clean Water Act was passed in 1972. About 250 jobs, which would have paid an average of $62,000, are being lost as a result of this action, amounting to a gross loss of $15.5 million in income to that already poor locale. The EPA cited impacts on insects, salamanders, fish, birds, and other animals as justification for the veto, but the EPA's support for its claims has been extremely weak. For example, the salamanders in question are not unique to the area to be mined, and the environmental impact statement indicated that there were actually no fish in the project area.[69] In its efforts to stop "mountaintop removal" coal mining, the EPA "has proposed a rule that EPA Administrator Lisa Jackson concedes would effectively outlaw an industry that employs more than 15,000 miners in Appalachia."[70] It is hard to escape the conclusion that the EPA is anti-coal in principle, regardless of the costs to human beings whose livelihoods and energy needs depend on coal. For some local communities, the impact could be devastating.

Often, people misled by unrealistic risk assessments can form enough opposition to drive off economic investment that could bring economic recovery and all the consequent benefits. Earlier this year, Birmingham, Alabama coal mine owner Ronnie Bryant, at a public hearing crowded with vocal opponents of a new coal mine, decided to abandon his efforts to open the new mine. While a permit for the mine had been granted, and both state environmental officials and mine operators stated that the mine would not pose a threat to local drinking water, the opposition was unconvinced. Bryant's new mine would have employed around 125 people at wages from $50,000 to $150,000 a year.[71]

Section Three: Economic Growth and Alternative Energy

Opposition to particular projects like the Spruce No. 1 mine or Ronnie Bryant's Alabama mine is rooted in mistaken conceptions of the relationship between prosperity and environmental quality. The idea that economic development and environmental quality are mortal enemies is common—and false. Paul Ehrlich and Barry Commoner have famously argued that increasing economic growth leads to environmental degradation.[72] Yet the evidence suggests that affluence leads to environmental degradation only temporarily, and that the path to environmental improvement is ultimately the same as the path toward economic prosperity. Environmental improvement is, after all, a good, like energy, education, medical care, or transportation. When people grow wealthier, they typically want to have more of that good, and they will devote resources to acquiring it. Environmental economist Indur Goklany pointed out the nature of the relationship between affluence and environmental quality:

[68] Viscusi (2005), p. 741.
[69] Yeatman (2011a).
[70] Yeatman (2011c).
[71] Clabough (2011).
[72] Ehrlich (1971), Commoner (1972).

> The level of affluence at which a pollutant level peaks (or environmental transition occurs) varies. A World Bank analysis concluded that urban [particulate matter] and [sulfur dioxide] concentrations peaked at per capita incomes of $3,280 and $3,670, respectively. Fecal coliform in river water increased with affluence until income reached $1,375 per capita [and then declined].
>
> Other environmental quality indicators (e.g., access to safe water and the availability of sanitation services) improve almost immediately as the level of affluence increases above subsistence. For these indicators the environmental transition is at, or close to, zero.
>
> … Other indicators apparently continue to increase, regardless of gross domestic product (GDP) per capita. Carbon dioxide and NO_x [oxides of nitrogen—a contributor to smog—but see note below updating this information] emissions and perhaps dissolved oxygen levels in rivers are in this third category. On the surface, these indicators seem not to improve at higher levels of affluence, but their behavior is quite consistent with the notion of an environmental transition. The transition is delayed in these cases because decision makers have only recently realized the importance of these indicators, or the social and economic consequences of controlling them are inordinately high relative to the known benefits, or both.
>
> All the evidence indicates that, ultimately, richer is cleaner, and affluence and knowledge are the best antidotes to pollution.[73]

The role of government regulation in reducing pollution in developed countries may be considerably smaller than is commonly thought. In 1999, Indur Goklany demonstrated, using data from the 1900s to the 1990s, that air pollution reductions in the United States began long before federalization of air quality protection in the 1970s.[74]

It is tempting to observe the cleaner technologies in industrialized nations and assert that developing nations would be better off if they were simply to adopt these same technologies. Better to avoid making an environmental mess by paying something up front, than to have to incur health problems along the way to prosperity because of pollution, and then face cleanup costs later. Yet this misses the important health benefits of prosperity itself. Also, as economists Jody Lipford and Bruce Yandle found in their recent study, "the economic cost associated with carbon emission reductions by relatively inefficient developing countries could be substantial."[75] In our comfortable, air conditioned homes, we in the developed nations of the world forget that the hazards of coal-fired power plants are far smaller than the hazards of the current energy sources of much of the world. About two billion people in the world cook and heat their homes with dirty fuels like wood and dung. Developing nations may benefit greatly by moving toward electrification provided by cheap, available coal supplies, which would allow cleaner

[73] Goklany (1995), pp. 342–343. The relationship between prosperity and environmental quality that Goklany described is an inverted "U" (with the pollutant on the vertical axis and wealth on the horizontal axis) often called the "environmental Kuznets curve" (EKC). A review of many of these studies can be found in Yandle, Bhattarai, and Vijayaraghavan. (2004). Also see Morriss (2010). More recent work by Goklany (2007, pp. 133, 134) indicates that NO_x emissions started a decline in the United States about 1970. Selden and Song (1994) found that the turning point for NOx appears to be above $16,400 per capita. Carbon monoxide emissions seem to peak at incomes just over $24,600 per capita, and Grossman and Krueger (1995) found a turning point for dissolved oxygen at about $4,400 per capita (with all three figures adjusted to 2001 dollars as *per* Yandle, Vijayaraghavan, and Bhattarai [2004, pp. 93, 95]. Although Cole, Rayner, and Bates (1997) found a turning point for CO_2 in the range of $37,000–$57,000, Lipford and Yandle (2010) do not find any evidence that an EKC exists for CO_2.

[74] Goklany (1999, 2007). Goklany (2007, p. 137) notes: "For the pollutants of greatest concern before federalization—O_3 and VOC in California and SO_2 and PM everywhere—the improvements in outdoor air quality began before federalization, and they have continued since. The improvements were especially pronounced in urban areas, which traditionally have had the worst pollution problems. Particulate levels, which had been in decline at least since the 1940s, fell an additional 15 percent just between 1957 and 1970 (based on data from 60 cities). SO_2 declined 40 percent between 1962 and 1969 (based on data from 21 cities)."

[75] Lipford and Yandle (2010), p. 436.

households and more productive industry. Yet they are pushed toward international agreements that would limit growth and prolong the period of time the populations of these nations inhale the smoke of their dung fires. Use of intermediate technologies should not be restricted simply because developed nations have already moved past them and regard them as dirty. Doing so could force death and suffering on the poorest and weakest of the world's population. Such restrictions force these nations to linger in poverty, with all that tends to accompany low incomes: shorter life expectancies, higher rates of infant mortality, low literacy rates, and hunger.

"Green Jobs" and the Alternative Energy Canard

Most efforts to promote "green" energy will make some mention of the jobs created by the transition to alternative or cleaner forms of energy. But a little investigation reveals that the push toward "green" energy is likely to produce far more economic harm than good.

First, there are conceptual problems with linking "economic progress" with "job creation." An economy progresses when the output from a person's work increases. When government "creates a job," through subsidies, government-guaranteed loans, or other wealth transfers, it is widely proclaimed as a government-sponsored success story. Rarely are the actual benefits of the newly created jobs compared fairly and honestly with the costs, over the long run. Furthermore, the new jobs are easily listed for the media, while job losses and lower productivity in other parts of the economy are difficult to trace specifically to the government's action. But the losses are no less real. The private sector finds its costs rising due to taxes, or has difficulty borrowing money in an economy in which the government soaks up available funds with its own massive borrowing.

A market-driven economy applies a basic rule to jobs: if the worker cannot produce enough to justify the expense of his employment, the worker will not be hired. Paying someone $800 a week to do $700 worth of work is a quick path to going out of business. The route to higher incomes is to increase the productivity of labor. When a worker can produce $900 a week instead of $700 a week for his employer, a competitive labor market will tend to push wages up as well. Generally, incomes increase when workers gain more skills, have more and better tools to work with, and have lower-cost raw materials at their disposal. But when governments subsidize a job, waste can be concealed, particularly when a spurious environmental benefit is thrown into the argument for the policy.

The U.S. Conference of Mayors defines a "green job" as

> any activity that generates electricity using renewable or nuclear fuels, agriculture jobs supplying corn or soy for transportation fuels, manufacturing jobs producing goods used in renewable power generation, equipment dealers and wholesalers specializing in renewable energy or energy-efficiency products, construction and installation of energy and pollution management systems, government administration of environmental programs, and supporting jobs in the engineering, legal, research and consulting fields.[76]

The emphasis on renewable as opposed to lower-pollution forms of energy production is an interesting concept of "green." The mayors' definition would include wood and dung fuels that create health-diminishing pollution in households in developing countries. For that matter, the definition is so broad it would encompass what few people would consider "green." Is building an access road to a wind turbine used in renewable power generation a "green" job? How about making the massive amounts of concrete (a process generating large amounts of carbon dioxide) used to anchor the wind turbines? What of making the steel for their towers and blades? It is not difficult to imagine being able to call many, many kinds of

[76] U.S. Conference of Mayors (2008), p. 5.

jobs "green" by this definition—jobs that environmental organizations like Greenpeace or the Sierra Club would never imagine calling "green." What appears to be "green" might not be so "green" after all. But depending on varying political agendas, "green" jobs might include those in hydroelectric power, or nuclear power, or natural gas. Andrew Morriss points out that "the green-economy literature has mostly produced lists of 'technologies we like' and 'technologies we don't like' based on politics. We certainly shouldn't be spending billions of dollars promoting what we can't define."[77]

Yet the billions are being spent, on projects that are sold to the public as economically viable but have deep-rooted problems. Some appear to be little more than boondoggles milking the federal government's "green jobs" agenda. The optimistic projections of how the "green" jobs are going to affect the economy are rarely borne out in practice, while mainstay forms of energy production are crippled with regulation.

One example is the federal government's handling of the proposed Keystone XL pipeline from Alberta to the Gulf coast. This would carry oil from Canadian oil sands to the Gulf, and that could be a lot of oil. Mary Anastasia O'Grady, writing in the *Wall Street Journal*, notes that Alberta "is on track to become the world's second largest oil producer, after Saudi Arabia, within 10 years."[78] Yet the EPA has blocked the pipeline from 2008 through late 2011, putting on hold the potential $20 billion investment in the U.S. from pipeline construction.[79] While Canada's less restrictive policy toward conventional energy has contributed to faster economic recovery than in the U.S., the U.S. misses out on a possible 118,000 job opportunities as long as the EPA refuses to issue a permit.

While the anti-fossil fuel environmental program blocks coal and oil, "green jobs" involving renewable energy waste resources. Gordon Hughes of the University of Edinburgh, and former senior adviser on energy and environmental policy at the World Bank, has found that in Britain, "renewable" energy investments will cost about $170 billion more than building the same energy capacity using natural gas. While the "fuel" of windmills and solar plants is commonly thought of as "free," the cost of building the equipment necessary to harness that energy and make it useful is 9 to 10 times that of conventional power. Data from a survey conducted by the International Energy Agency indicate that while lifetime electric generation costs are $2.70 per megawatt hour (MWh) for nuclear energy, $2.80 for high-quality coal, and $4.80 for gas, costs soar to $5.98 per MWh for the less expensive onshore wind farms and between $16.88 and $17.00 for solar plants.[80] A more recent study, by the Institute for Energy Research, analyzing data from the Energy Information Administration that reflects major increases in subsidies to renewables, finds the subsidy per MWh at $0.64 for natural gas, petroleum liquids, and coal; $0.82 for hydropower; $3.14 for nuclear; $12.85 for geothermal; $56.29 for wind; and $775.64 for solar.[81]

The enormous expense can have far-reaching effects, as manufacturers using large quantities of energy end up relocating or going bankrupt. "Claims by politicians and lobbyists that green energy policies will create a few thousand jobs are not supported by the evidence," Hughes argues. "In terms of the labour market, the gains for a small number of actual or potential employees in businesses specializing in renewable energy have to be weighed against the dismal prospects for a much larger group of workers producing tradable goods in the rest of the manufacturing sector." The "green jobs" involved in building

[77] Morriss (2010).
[78] O'Grady (2011).
[79] The U.S. State Department issued an environmental impact statement of Keystone XL, saying it "posed 'no significant impacts' to most resources along its proposed corridor" though it could have "significant adverse effects to certain cultural resources." *See* Tracy and Welsch (2011). A final decision to approve or disapprove the project was pending as this paper was being prepared.
[80] Costs are in 2008 U.S. dollars, and include capital costs, operating and maintenance costs, and fuel costs, discounted to the present. These are midpoint costs; the high end of the range is about $7.10 per MWh for coal and $192.75 for photovoltaic solar. See Cornwall Alliance (2010), p. 66.
[81] Institute for Energy Research (2011); Energy Information Agency (2011).

the capital are short-term, but the implications of diverting resources into building tremendously expensive "renewable energy" facilities are long-lasting: Hughes estimates that the cumulative impact of government support of these projects could mean the loss of 2 to 3 percent of GDP (i.e., about $30 billion to $45 billion) every year for 20 years or more.[82]

Morriss comments that "green energy" optimism unrealistically ignores downsides of "green" energy transitions on the economy:

> … the green-economy predictions rest on extremely optimistic estimates of the impact of spending on new technologies. Almost no advocates of these policies deduct the jobs lost from replacing existing technologies with the new, green ones. Refinery workers, coal miners, fossil-fuel power plant workers, and many others will all lose their jobs if the proposed shift to nonfossil fuels takes place. Some of those workers may find jobs insulating public buildings or bolting together windmills, but many will not. Because all that public spending to produce these new technologies comes from taxes (whether today or in the future), it reduces private spending and so eliminates the jobs that would have been created by the higher private spending displaced by the taxes.[83]

While well-intentioned "green energy" advocates seek government favors for alternative energy sources, the economics and even the basic physics of energy sources are against them. Energy expert Robert Bryce points out in *Power Hungry: The Myths of "Green" Energy and the Real Fuels of the Future*[84] that the power density of ethanol, wind, and solar power do not measure up to more conventional energy sources like oil or nuclear power. Power density, which Bryce says is the "energy flow that can be harnessed from a given unit of volume, area, or mass," is 27 or 28 watts per square meter from a modestly productive oil or gas well, or about 56 W/m^2 for a nuclear power plant. Corn ethanol produces only a tiny fraction of that, at 0.05 W/m^2, wind about 1.2 W/m^2 at best (intermittently, of course), and solar about 6.7 W/m^2 at best (also intermittently). Bryce argues that basic physics implies that these "renewable" energy sources will fall short not only in power density, but also in three other dimensions of energy production: energy density, scale, and cost. The likelihood that these sources will ever replace fossil fuels or nuclear power is therefore slim. As it is, solar and wind power are an insignificant proportion of U.S. energy consumption, and will remain an energy sideshow for a long time. Solar power provides about 0.05 percent of U.S. energy consumption, and wind power about 0.6 percent.[85]

Even in Denmark, beloved by "green energy" advocates for its heavy (and subsidized) use of windmills, alternative energy has not produced the results we have been led to expect. Bryce writes that

> a close look at Denmark's energy sector shows that its embrace of wind power has not resulted in "energy independence"; nor has it made a major difference in the country's carbon dioxide emissions, coal consumption, or oil use. Despite massive subsidies for the wind industry and years of hype about the wonders of Denmark's energy policies, the Danes now have some of the world's most expensive electricity and the most expensive motor fuel. And in 2007, their carbon dioxide emissions were at about the same level as they were two decades ago.
> … The Danes import all of their coal. … Those coal imports—and coal consumption among the Danes—show little sign of declining, even though Denmark's wind power production capacity is increasing. And Denmark is even more dependent on coal than the United States.[86]

[82] Hughes (2011).
[83] Morriss (2010).
[84] Bryce (2010).
[85] Morriss (2010).
[86] Bryce (2010), pp. 104–105.

Wind power is subject to several serious problems: it requires large, intrusive wind turbines that ruin landscapes and kill birds,[87] and it only works when the wind is blowing. To make sure electric power is reliable, backup power generation (often fossil fuels, sometimes hydroelectric) must be available. In Britain, where subsidies to wind power are measured in the hundreds of billions of pounds, energy companies informed Britain's Department of Energy and Climate Change that 17 new gas-powered generating facilities would be required to provide backup for times when the wind fails. The *Telegraph* reported that these power stations would have to be kept constantly on a "spinning reserve," which means that they are creating much more CO_2 than when they are running at full power. Reduction in CO_2 emissions accomplished by windmills should be compared to the added emissions from gas backup generators for an honest accounting of the gains.

Wind turbines can also constitute a serious aesthetic blight on the environment when hundreds of them are spread across thousands of acres to form a wind farm. Because photos of wind turbines rarely offer context, few people recognize just how enormous commercial wind turbines are. The diameter of the circle inscribed by their blades can reach 230 feet, the length of a Boeing 747 jet airliner. The tower on which the blades are mounted can be over 260 feet high, putting the highest point reached by a blade tip at 375 feet high.

In the U.K., politicians are signing contracts guaranteeing huge incomes to landowners and power companies, and "guaranteeing thereby the destruction of landscapes and jobs," author Matt Ridley argues. "The government's 'green' subsidies are costing the average small business £250,000 a year. That's ten jobs per firm. Making energy cheap is—as the industrial revolution proved—the quickest way to create jobs; making it expensive is the quickest way to lose them."[88]

Subsidized, inefficient energy programs tend to topple easily, even with ample favors extended them by government. They are also ripe for abuse. On September 8, 2011, the FBI raided a California solar energy firm named Solyndra, which filed for bankruptcy and laid off over 900 full-time employees. The *Washington Times* reported that in 2009, Solyndra, touted by President Obama and Vice President Biden as a model of green jobs creation, had been awarded "a $535 million federal government loan as part of Mr. Obama's stimulus package," a loan that now seems unlikely to be repaid. The report noted a pattern of financial trouble for alternative energy firms:

> Solyndra was the latest in a string of solar bankruptcies this year. Others are New York-based SpectraWatt and Michigan's Evergreen Solar.
>
> Critics aren't surprised. Spain and other European countries have embraced green-jobs programs only to see higher-than-expected costs and little payoff ….
>
> Some traditional-fuel companies left the country in favor of more level playing fields elsewhere, the report says.
>
> "But amazingly enough, this debate is not over," said Daniel Kish, senior vice president for policy at the Institute for Energy Research, a nonprofit energy-research organization. … Mr. Kish and many others think large-scale wind and solar projects are inherently unprofitable, largely as a result of the

[87] A 2008 study funded by the Alameda County Community Development Agency "estimated that about 10,000 birds—nearly all protected by the migratory bird act—are being whacked every year at [the wind farm at] Altamont." According to one estimate by the American Bird Conservancy, wind turbines in the U.S. kill between 75,000 and 275,000 birds per year. But while oil companies are assessed millions of dollars in fines for killing birds that come into contact with oil or pollutants (e.g., a $1.4 million assessment against Oregon electric utility PacifiCorp for killing 232 eagles over two years in Wyoming), wind power companies are not prosecuted. See Bryce (2009).
[88] Ridley (2011).

unpredictability of when the sun will shine brightly enough and when the wind will blow. Without government subsidies, he said, such projects would have no chance of competing with oil, natural gas, nuclear power or coal.[89]

A 2009 study[90] by scholars at Madrid's King Juan Carlos University found that subsidies to "green jobs" were economically counterproductive for Spain, and that U.S. policies along the same line could expect similar results. Among the study's findings:

- The U.S. should expect a loss of at least 2.2 jobs for every "green job" created.
- The high cost of "green" electricity production "affects costs of production and employment levels in metallurgy, non-metallic mining and food processing, beverage and tobacco industries."
- "Each 'green' megawatt installed destroys 5.28 jobs on average elsewhere in the economy: 8.99 by photovoltaics, 4.27 by wind energy, 5.05 by mini-hydro."
- "These schemes create serious 'bubble' potential, as Spain is now discovering. The most paradigmatic bubble case can be found in the photovoltaic industry. Even with subsidy schemes leaving the mean sale price of electricity generated from solar photovoltaic power 7 times higher than the mean price of the pool, solar failed even to reach 1% of Spain's total electricity production in 2008."[91]

Many of these "green" policies are not only expensive—their contribution to environmental quality is highly suspect. The expense reduces economic growth rates and thereby slows progress along the environmental Kuznets curve, meaning that countries linger in their higher-pollution state. Some of the "renewable" energy sources, like ethanol from corn or other sources, require large quantities of land, water, and fertilizer, not to mention the machinery for harvesting, transporting, and processing the crop into fuel.[92] In this way, the heavily subsidized shift to biofuels may counteract some key goals of the environmental movement itself, by converting more habitat from natural to cultivated, encouraging farm monoculture, consuming scarce fresh water, increasing the use of pesticides and herbicides, and increasing energy consumption and greenhouse gas production.[93] Matt Ridley points out that "to meet America's stated aim of growing thirty-five billion gallons of ethanol a year would require using as much water as is consumed each year by the entire population of California. Be in no doubt: the biofuel industry is not just bad for the economy. It is bad for the planet, too."[94]

The most tragic effects of the "green energy" movement may be the death and suffering imposed on the world's poor. Using crops for fuel production instead of food production means that food prices will rise. Indur Goklany estimates that the rising global food prices attributable to biofuels production may have led to at least 192,000 excess deaths and 6.7 million disability-adjusted life years[95] (DALYs) in 2010 alone. Dr. Goklany's study conservatively considered only recent increases in biofuels production, and omitted some deaths that are directly related to poverty, such as those related to indoor smoke from burning coal,

[89] Wolfgang (2011).
[90] Alvarez et al. (2009).
[91] Alvarez et al. (2009), pp. 1–3.
[92] See Cornwall Alliance (2010), p. 63.
[93] The science on global warming is far from settled. But for those concerned that global warming might exist, might be caused by human activity, and might be damaging, a recent study led by Nobel prize-winning chemist P. J. Crutzen et al. (2008) indicates that ethanol and biofuels in general may actually increase warming with their nitrous oxide production. The study found that biofuels made from rapeseed and corn release about twice as much nitrous oxide as was previously thought. Nitrous oxide, a by-product of nitrogen application in agriculture, is nearly 300 times more powerful as a greenhouse gas than carbon dioxide. While the methods of the study have been criticized, the analysis at least indicates that the biofuel contribution to reduced greenhouse gases is uncertain.
[94] Ridley (2010), p. 242.
[95] Disability-adjusted life years are those years lost due to premature death from disease, plus the number of years spent in a disabled condition due to disease, weighted by the severity of the disease. See Goklany (2011), p. 9.

wood, and dung. If we accept for the moment the common argument that global warming is causing net deaths worldwide, we find that the annual death toll from biofuel production exceeds those the World Health Organization attributes to global warming.[96] Goklany concludes that "there can be no honest analysis of the costs and benefits of biofuel policies if they do not consider their effects on death and disease in developing countries."[97] Matt Ridley comments that "[n]ot even Jonathan Swift would dare to write a satire in which politicians argued that—in a world where species are vanishing and more than a billion people are barely able to afford to eat—it would somehow be good for the planet to clear rainforests to grow palm oil, or give up food-crop land to grow biofuels, solely so that people could burn fuel derived from carbohydrate rather than hydrocarbons in their cars, thus driving up the price of food for the poor. Ludicrous is too weak a word for this heinous crime."[98]

Conclusion

Efforts for environmental improvement must be honest. Modern environmentalism, however, has employed fear and hyperbole to accomplish goals that may have as much to do with shutting down industrial competition as with promoting a cleaner world. Sadly, many evangelical environmentalists have adopted this politicized program. By exaggerating environmental risks (as from mercury contamination) while downplaying the all-too-real costs of the policies they support, "stewardship" is distorted into a government regulatory agenda that impoverishes and destroys lives.

A Christian worldview acknowledges the presence of a creating and sustaining God. While the world in which we live is a fallen world, corrupted by sin and cursed (Genesis 3:14–19), there is hope—not only for spiritual redemption in Christ, but also for material fruitfulness on the Earth. As Adam's descendants[99] carried out the original creation mandate (Genesis 1:28), man's stewardship required creativity and wisdom to suppress the "thorns and thistles" (Genesis 3:18) and bring food from the Earth. While the modern environmental agenda proclaims impending disaster from increasing wealth, Christians may see wealth as a tool for the cultivation of the Earth (Genesis 2:15) and thereby the alleviation of some of the physical consequences of the Fall. The prosperity that allows more people to be fed, clothed, sheltered, and ministered to in sickness tends to arise from a decentralized stewardship—a stewardship that is based on organically provided local information, not a governing elite.

While a Christian should be wary of political control (I Samuel 8) and careful to secure the boundaries of the family, the church, and the individual, modern environmentalism demands global centralization of the control of resources. E. Calvin Beisner writes,

> because environmentalism is inherently totalitarian, demanding to define and control every aspect of life, it aims to take control of our entire political and legal structure, and indeed has already advanced far in that direction over the last three decades. You, as an individual, have a tremendously important role to play in the church's battle against this impostor, with its alternative world view, its substitute doctrines of God, creation, man, sin, and salvation, and its lethal mix of bogus science and Marxist economics that threaten to fulfill the radical environmentalists' and deep ecologists' dream of ending industrial society and forcing humanity back into a primitive lifestyle—in which, as Thomas Hobbes put it, life was solitary, poor, nasty, brutish, and short.[100]

[96] Goklany (2011), p. 9.
[97] Goklany (2011), p. 12.
[98] Ridley (2010), pp. 239, 240.
[99] Increasing population is, in the biblical worldview, a blessing (Genesis 12:2; 15:5; 17:1–6; 26:4, 24; Deuteronomy 10:22; Proverbs 14:28) and the result of carrying out a divine mandate (Genesis 1:28; 9:1, 7).
[100] Beisner (n.d.).

It is our hope that this publication will advance the biblical perspective on the environment, particularly with regard to energy usage. Careful thought and action on environmental issues can lead to both increased prosperity—especially for the poor and weak—and a cleaner environment.

Appendix

Do Health Risks from Mercury Justify Stringent New Regulations on Emissions from Coal-Fired Power Plants?

Theoretically, some mercury emitted from various human activities, such as those that require burning fossil fuels, could wind up in human blood through the consumption of fish that have accumulated mercury.[101] This is the source of the Evangelical Environmental Network's recent objections to coal-fired power plants. The risks, however, are being overstated, as are the damage estimates.

Defining Risk, Risk Dose, and Population at Risk

Part of the misunderstanding of the hazards of mercury may result from the EPA's methods of establishing the level of mercury in one's blood above which people are said to be at a risk level providing reason for concern. This level, called the "reference dose," is what the EPA has determined to be the highest daily dose that the most sensitive people in the population can be exposed to over a lifetime without adverse effects. Since 1995, the EPA has set a limit of 1 mcg (microgram) per kg (kilogram) per day of body weight.[102] For concentrations of mercury in blood, this is equivalent to a maximum of 5.8 mcg/L of blood, or approximately 5.8 parts per billion (ppb).[103] It is important to understand how the EPA arrived at this limit.

The EPA benchmark relies on a long-term study in the Faroe Islands,[104] which was based on evaluation of methylmercury levels in umbilical cord blood and hair samples taken in childhood. This study indicated some effects from methylmercury exposure, which for one of five tests started at 85 (not 5.8) mcg/L of umbilical cord blood. That is an estimate, and as with any statistical work, there is some uncertainty associated with that number. The *actual* concentration of methylmercury leading to detectable results for that particular test was probably close to 85 mcg/L, lying somewhere between 58 and 112 mcg/L. The EPA chose the lower limit of 58.[105] Then the EPA divided by 10 to account for remaining uncertainties, obtaining the reference dose of 5.8 mcg/L. In short, the "reference dose" is not necessarily the same as "the level which causes harm to unborn children." The EEN's unequivocal statement that "700,000 babies are born with harmful levels of mercury in their blood" is based on a misinterpretation of the statistics.

There are other problems with the 700,000 figure. The 1999–2000 National Health and Nutrition Examination Study (NHANES) indicated that about 7.8 percent of U.S. women of childbearing age (16–49) had levels of mercury exceeding the EPA's reference dose (5.8 mcg/L, not the benchmark dose, 85 mcg/L, the lowest at which adverse effects were observed).[106] Fecundity statistics allow us to estimate the babies born to this group at about 317,000 annually, at that time. This number is approximately doubled

[101] The mercury hazard with which we are generally concerned here is the organic form of mercury known as methylmercury, which can be formed by microbial interactions with mercury. Burning coal does not produce methylmercury directly.
[102] The EPA's reference dose for environmental exposure is currently the lowest in the world, at 0.3 micrograms per kilogram of body weight per day (mcg/kg/day). The World Health Organization has set the risk level at 0.5 mcg/kg/day, and Japan—where two major mercury-poisoning events occurred in the 1950s and 1960s—set its level at 0.48 mcg/kg/day.
[103] This is analogous to the first 5.8 seconds out of 31.7 years. 5.8 parts per billion and 5.8 mcg/L in blood are not exactly equivalent, because a liter of blood has a mass of 1060 grams, not 1000 grams (as a liter of water does). 5.8 ppb of blood translates to about 6.1 mcg/L. However, the literature on methlymercury in blood tends to use mcg/L and ppb in blood interchangeably. Compare, e.g., Borum et al. (2001), pp. 4–68 and 4–76. We follow Mahaffey's (2004), EPA's, and the 1999–2000 NHANES study's practice of generally using mcg/L as the operative unit.
[104] Murata et al. (2004).
[105] For the other four tests, the probable lower limits were 46, 79, 103, and 104. The test that yielded 46 ppb was not used by the EPA in establishing the reference dose because of problems administering that test. So even 58 ppb (or mcg/L—see note 33 above) is a very conservative estimate of when problems could start to occur, given the much higher numbers other tests yielded.
[106] Mahaffey, Clickner, and Bodurow (2004).

to account for the fact that umbilical cord blood has about 1.7 to 1.8 times the mercury concentration that the mother's blood does. This implies that the limit of 5.8 mcg/L applied to the umbilical cord corresponds to only 3.5 mcg/L in the mother's blood. The number of women who had levels of mercury in their blood exceeding 3.5 mcg/L is about 15.7 percent of the 16–49 age group, and assuming that this group also accounts for 15.7 percent of the births, this group would account for around 630,000 births each year. This helps us understand where the EPA's occasional use of a larger number[107] came from and where the EEN obtained its 1 in 6 (or about 700,000) babies figure.

However, as older women tend to have more mercury in their blood than younger women, and also have fewer children,[108] fewer than 15.7 percent of the women actually giving birth in the U.S. have mercury levels over the 3.5 mcg/L level (see Table 1). The 700,000 or 1 in 6 figure is, for this reason alone, an overestimate. A quick comparison of the percentage of women in various age groups having mercury concentrations over 3.5 mcg/L according to NHANES and the Census data on births to (approximately) those same age groups indicates that the actual number "at risk" based on these data is at least 100,000 fewer than EEN supposes.

Table 1

NHANES age grouping	BTHg concentration > 3.5 mcg/L, percent (NHANES)	Births (2010 Census)	U.S. Census age grouping
16–19	4.9	301,000	15–19
20–29	12.8	1,930,000	20–29
30–39	15.8	1,323,000	30–39
40–49	22.1	131,000	40–44

Sources: Mahaffey et al. (2004), p. 565, Table 3 and *Statistical Abstract of the United States*, 2012, p. 70, Table 91.

Other factors, added to this age-bias problem, indicate that the overestimate is considerably larger than 100,000. For instance, it is important to recognize that *none* of the women in the NHANES study had levels of mercury in their blood that were close to the Faroe Islands study's lower limit of 58 mcg/L. In fact, those who had more than the EPA's reference dose of mercury in their blood had around one-eighth the mercury required to reach even that conservative lower limit.[109] Also, more recent data suggest that even the 7.8 percent figure resulting from the NHANES study may be too high. A large nationwide study by the Centers for Disease Control completed in 2004 found that fewer than *6* percent of women of childbearing age had blood levels of mercury exceeding 5.8 mcg/L.[110] Robert Ferguson contends that since the CDC's Agency for Toxic Substances and Disease Register's (ATSDR) "minimum risk level"[111] is 13.6 mcg/L, not 5.8 mcg/L, the risk may be lower still. Applying the CDC's maximum, by Ferguson's estimation, would mean that only 1 in 100 U.S. women in the NHANES survey, not 1 in 6, were in the range of concern.[112]

Furthermore, the EPA selection of a "benchmark" did not take into account some studies that show that the effects of mercury on children are undetectable. A twelve-year study conducted in the Seychelles Islands found no indication that methylmercury from a high-fish diet caused neurological damage in

[107] See, e.g., Mahaffey (2004).
[108] U.S. Census data indicate that in 2010, there were about 1,454,000 births to women 30–44 years of age, and 2,231,000 births to women 15–29 years of age. Data were not reported for women over 44. *Statistical Abstract of the United States*, 2012, p. 70, Table 91. The NHANES study indicates that the percentage of women with mercury content over 3.5 mcg/L is
[109] FDA (2002), p. 5.
[110] Centers for Disease Control (2004).
[111] See http://www.atsdr.cdc.gov/mrls/pdfs/atsdr_mrls_december_2010.pdf.
[112] Ferguson (2004), p. 11.

children.[113] The Faroe Islands population contained important differences. Faroe Islanders consume pilot whale meat and blubber, known to have higher levels of methylmercury than fish, but also other contaminants like polychlorinated biphenyls (PCBs) and cadmium that have also been linked to neurological disorders. For PCBs, the exposure in the Faroe Islanders was 600 times higher than the EPA's reference dose. Some scientists believe that PCBs and methylmercury may work together in causing neuro-degenerative symptoms in the brain, though this is not well-established.[114] The Seychelles study found no PCBs in its subjects. Perhaps more important, pilot whales do not contain as much selenium as ocean fish—*and selenium can reduce the adverse effects of mercury*.[115] Seychelles fish diets were more selenium-rich.

These considerations suggest that the EEN's figure of 700,000 at-risk babies a year grossly overestimates the actual harm to children from mercury. Even the EPA seems now to be using a much lower figure of "more than 300,000."[116] But there are other reasons to be skeptical of the alleged connection between mercury from U.S. power plants and health problems.

The Tenuous Tie Between Power Plant Emissions and Mercury Exposure

First, only a minority of the mercury deposited in the United States comes from sources inside the U.S. The EPA itself estimated that only 16 percent of the mercury deposited in the continental United States came from the U.S. and Canada.[117] Location matters: west of the Mississippi, almost all comes from outside the United States. US power plants contribute less than 1 percent of the global atmospheric mercury,[118] with a huge fraction of mercury produced from natural sources like deep ocean vents, geologic sources (e.g., Yellowstone National Park produces more natural mercury emissions than all eight of Wyoming's coal-fired power plants), and forest fires. Forest fires in the U.S. emit roughly the same amount of mercury each year as all U.S. power plants.[119]

Second, methylmercury concentrations in oceanic fish do not appear to have increased over time, even though global mercury emissions have. A study in Hawaii found that yellowfin tuna had the same methylmercury levels in 1998 as they had almost thirty years before,[120] even though the mercury levels in the atmosphere nearly tripled over that period of time. Non-human sources of mercury were thought likely to be responsible. A similar study found no difference in mercury concentrations in tuna caught between 1878 and 1909 and tuna caught in 1972.[121] Another study that looked at concentrations of mercury in striped bass in the San Francisco Bay area over the period from 1970 to 2000 found no clear evidence that mercury levels were increasing, despite a general increase in mercury in the environment over that period of time.[122]

While the pathway to human consumption of mercury is largely oceanic fish, it seems doubtful that U.S. electric utilities—or man-made sources in general—are contributing significant amounts to the levels of mercury in these fish. This leaves freshwater fish. Freshwater, farm-raised fish have low methylmercury levels, because of how they are fed. That leaves wild freshwater fish (which make up only 10 percent of

[113] Myers et al. (2003a).
[114] Bemis and Seegal (1999), but see Schantz, Widholm, and Rice (2003).
[115] Kaneko and Ralston (2007), Kaneko and Bartram (2009), Ralston and Raymond (2010).
[116] See http://www.epa.gov/mercury/exposure.htm.
[117] The "EPA estimated that 144 tons of mercury was deposited in the continental United States in 2001, and that 121 (or 84%) came from sources outside of the United States and Canada." Griffiths et al. (2007), p. 844. See EPA (2005), also Charnley (2006).
[118] Szwarc (2004), p. 35.
[119] Soon (2011), p. 1.
[120] Kraepiel, Keller, Chin, Malcolm, and Morel (2003).
[121] Miller et al. (1972).
[122] Greenfield et al. (2005).

U.S. fish consumption) as possibly significant sources of methylmercury from power plants.[123] Local "hot spots" of mercury, such as from coal-fired power plants, could cause elevated mercury levels in these fish.[124] But the links between local coal-fired power plants and adverse effects on human health remain far from certain. Gail Charnley points out,

> Most of the mercury emitted from power plants is elemental mercury or is rapidly degraded to elemental mercury, which tends to remain in the atmosphere and be transported away from the source, entering the global mercury cycle. A much smaller proportion remains in a form that is more likely to be deposited close to the source.[125]

The EEN's fact sheet did mention that "[a] study in Florida showed a 60% mercury decrease in fish after 10 years of strict regulations of local sources."[126] But not all sites showed a decline, and variations in mercury in local areas are not well understood.[127] Furthermore, the study pointed out that even a total or near-total elimination of man-made sources of mercury might not be sufficient to bring the mercury concentrations in the fish down enough to meet the regulation.[128]

Mercury reductions in fish may have even less benefit when one considers the impact selenium content has on methylmercury toxicity. Some research indicates that the vast majority of freshwater fish in the continental United States has sufficient selenium content to protect fish consumers against methylmercury. A 2009 EPA-funded study analyzing 40 species of freshwater fish at 137 sites in the western U.S. found that while 56 percent of the fish had quantities of mercury above what has been considered a "safe" threshold, 97.5 percent of the fish had enough selenium to counteract the effects of the mercury.[129] All but one of the fish in the 468-fish sample that had an insufficient ratio of selenium to mercury were pikeminnows (also called squawfish), which are commonly considered a "trash" fish and are not normally consumed as food.

Substituting Greater Risk for Lesser?

For those who would prefer to err on the side of caution, it is important to realize that even if fish did contain levels of mercury that could cause some harm, this would not necessarily mean that consuming fish would cause *net* harm to one's health. Fish have positive health benefits that could offset any existing danger of mercury some might contain. Fish are a fairly low-cost source of protein, and some fish are also important sources of omega-3 fatty acids, which are important to pregnant women and nursing babies as well as to others in the population. While higher-mercury fish species may not be the same as the species

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[123] Heuss (2003), p. 11.
[124] Hammerschmidt and Fitzgerald (2006), White, Keeler, and Landis (2009).
[125] Charnley (2006).
[126] Evangelical Environmental Network (2011), p. 3.
[127] Charnley (2006) argues that

> [t]he potential relationship between power plant mercury emissions and methylmercury concentrations in locally caught fish is complex and poorly understood. Conclusions about the effectiveness of limiting local mercury emissions as a means of reducing local freshwater fish methylmercury levels should be postponed until studies of the impact of current efforts to limit emissions become available.

[128] The study noted that "it may not be practical or even theoretically possible to bring [mercury] concentrations below [the regulatory maximum] on the basis of local anthropogenic [mercury] load reductions alone. … [C]oncentrations in these fish would need to drop by a factor of six to reach [the regulatory maximum]. This decrease is roughly equivalent to the estimated increase in mercury loading to the Everglades over pre-industrial loadings…. Assuming that these inferred increases are from both local and larger scale sources, it is plausible that reductions in [mercury] loading [in compliance with the regulation] may significantly reduce fish mercury concentrations, but still be inadequate to reduce concentrations below [the regulatory maximum], *even if all anthropogenic contributions to [mercury] deposition are eliminated*." [emphasis added] Atkeson et al. (2003), appendix II, p. 49; also see p. 68.
[129] Peterson et al. (2009).

high in omega-3,[130] many consumers are unlikely to observe the finer distinctions in mercury warnings, and may avoid fish altogether.[131] John Middaugh, state epidemiologist with the Alaska Division of Public Health, told the FDA that abandonment of subsistence fish diets in Alaska since the FDA warned against fish-borne mercury in 2001 may have resulted in major increases in obesity, diabetes, heart disease, and vitamin deficiencies.[132] Gary Myers, the lead researcher for the aforementioned Seychelles Islands study, testified to the Senate Environment and Public Works Committee that

> We do not believe that there is presently good scientific evidence that moderate fish consumption is harmful to the fetus. However, fish is an important source of protein in many countries and large numbers of mothers around the world rely on fish for proper nutrition. Good maternal nutrition is essential to the baby's health. Additionally, there is increasing evidence that the nutrients in fish are important for brain development and perhaps for cardiac and brain function in older individuals.[133]

In attempting to reduce a risk that seems exceedingly small for the vast majority of the population, the mercury alarmists may actually be *harming* human health by backing into the health risks that result from less fish consumption.

Not only the risks but also the damages are exaggerated. The EEN, citing a 2005 study by Trasande, Landrigan, and Schechter, warns that brain damage from mercury emitted by U.S. power plants causes "around $1.3 billion"[134] in annual losses. However, a 2007 study by Griffiths, McGartland, and Miller, based on EPA's assumptions, showed that the earlier study overstated losses by well over 600 percent. The 2007 study shows that Cross-State Air Pollution regulation would reduce actual damage by at most $210 million, or, if borne evenly by the 700,000 babies the EEN claims are affected, $300 per person per lifetime. With 80-year life expectancy, that equals $3.75 per person per year (0.009% of 2010 U.S. per capita income). The later study also found that "U.S. EPA assumptions … decrease the estimated impact of U.S. sources (including power plants) by almost 97%."[135]

Finally, to be consistent, mercury exposure from coal-fired power plants should be compared with mercury exposure from other sources commonly regarded as reasonable risks. Consider, for example, compact fluorescent light (CFL) bulbs—the spiral-shaped bulbs that have become the iconic energy-conservation technology promoted by so many environmentalists. While a CFL light bulb manufacturer reminds consumers that a coal-fired power plant produces 13.3 mg of mercury required to use an incandescent bulb, and 3.3 mg for a CFL,[136] the manufacturer fails to mention that only a tiny fraction of that 13.3 mg would be transformed into organic mercury and pass through a long environmental chain into a human body. In addition, the comparison implies that the energy use reduction would occur *solely* through lower demand on coal-fired power plants, when in fact slightly over half of our electric power in the U.S. comes from other sources like natural gas, nuclear power, and hydro. The CFLs themselves contain an additional 4–5 mg (on average) of mercury—in close proximity to the occupants of the home—some fraction of which would be released if the bulb breaks. The EPA's brochure on what to do if a CFL bulb breaks (at http://www.epa.gov/cfl/CFL_brochure.pdf) suggests a level of care consistent with handling hazardous waste. Are mercury emissions acceptable when they occur inside our homes, but unacceptable when they occur at a power plant miles away?

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[130] Mahaffey (2004), p. 7.
[131] In addition, mislabeling or misbranding of fish means that the consumer cannot be certain of the type of fish being consumed. Mahaffey (2004, p. 568) notes that "less than half the fish labeled as red snapper were red snapper."
[132] Dept of HHS, FDA, CFSAN, Food Advisory Committee—Methylmercury. Transcript of meeting July 24, 2002, available at http://www.fda.gov/OHRMS/DOCKETS/ac/02/transcripts/3872t2.pdf.
[133] Myers et al. (2003b).
[134] Evangelical Environmental Network (2011), p. 3.
[135] Griffiths et al. (2007a), p. 841. Also see subsequent correspondence: Trasande et al. (2007) and Griffiths et al. (2007b)
[136] See http://www.gelighting.com/na/home_lighting/ask_us/faq_compact.htm#what_is_mercury.

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