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Sustainable Development and the Hawaii Clean Energy Initiative

BY

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SUSTAINABLE DEVELOPMENT AND THE HAWAII CLEAN ENERGY INITIATIVE

An Economic Assessment

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Abstract

The connection between the emerging field of sustainability science and the economics of sustainable development has motivated a line of interdisciplinary research inspired by the notion of "positive sustainability." This notion is founded on three principles or pillars: (1) adopting a complex systems approach to modeling and analysis, integrating natural resource systems, the environment, and the economy; (2) pursuing dynamic efficiency, that is, efficiency over both time and space in the management of the resource-environment-economy complex to maximize intertemporal well-being; and (3) enhancing stewardship for the future through intertemporal equity, which is increasingly represented as intergenerational neutrality or impartiality. This paper argues that the Hawaii Clean Energy Initiative (HCEI) fails to satisfy all three pillars of sustainability, and consequently fails to achieve the "sustainability criterion" put forward by Arrow, Dagupta, Daily et al: that total welfare of all future generations not be diminished. HCEI shrinks the economy, contributes negligibly to reduction of global carbon emissions, and sparks rent seeking activity (pursuit of special privilege and benefits) throughout the State of Hawaii.

Keywords: sustainability science, sustainable development, intertemporal welfare, complex systems, dynamic efficiency, time preference, intergenerational equity, renewable energy, rent-seeking

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I Sustainable Development - What Is It Anyway?

"It's hard to be against sustainability. In fact, the less you know about it, the better it sounds."

Robert Solow, 1991

Resources For the Future (RFF) published the first volume on "Scarcity and Growth" in 1963. As world-wide concern continued to mount in the 1960s, 1970s, and 1980s over natural resource scarcity, limits to growth, and environmental security, it seems inevitable, from the present vantage point, that these issues would coalesce around a unifying theme, a global bumper sticker. And so, the notion of sustainable development was introduced by the Brundtland Commission in its famous 1987 report. As the Brundtland definition of sustainable development is repeatedly quoted, I won't include it here. While vague and not particularly operational, the Brundtland formulation does convey a sense of stewardship for the future. The specific means and mechanisms of sustainable development have been debated now for some 25 years. There is still no universal consensus.

The interpretation of sustainability most favored by environmentalists, ecologists, and the no-growth, anti-capitalism left has become known as "strong sustainability." The mandate of "strong sustainability" is to retard, if not inhibit, global economic growth and to prohibit the depletion of natural or ecological capital, and in its extreme form, the use of particular natural resources. (For some hard-core advocates, "sustainable development" itself is an oxymoron.)

Economists generally have a different perspective, effectively represented by Robert Solow in a 1991 lecture delivered at the Woods Hole Institution in Massachusetts. In discussing what the present owes the future, Solow remarks, *"...what we are obligated to leave behind is a generalized capacity to create well-being, not any particular thing or any particular natural resource."* This perspective is behind the alternative formulation of "weak sustainability," which requires the summed value of produced capital, natural capital, and even human capital, that is, the value of total capital in the economy, to remain constant or increase over time.

As articulated by Solow, it is the economy's productive base, as represented by the totality of capital in its various forms, that provides the capacity for creating well-being now and in the future. The prominent idea is intertemporal well-being or welfare, giving rise to a "sustainability criterion": that total welfare of all future generations not be diminished. As proved by Arrow, Dasgupta, Daily et al, 2004, weak sustainability is a necessary and sufficient condition to achieve the sustainability criterion. Ad hoc sustainability constraints, inhibitions, and prohibitions are not necessary.

However, the degree of substitutability between different forms of capital, especially between produced and natural capital, remains a contentious issue dividing proponents of strong sustainability from advocates of weak sustainability. This controversy presents a challenge to the emerging, multidisciplinary field of "sustainability science," as discussed below in connection with the three pillars of sustainability.

In the context of weak sustainability, two main approaches have been constructed to link an economy's wealth to sustainability and intertemporal welfare. The first approach is associated with the World Bank and the work of Kirk Hamilton and Michael Clemens, as surveyed in the World Bank, 2006, publication, "Where is the Wealth of Nations?" The theoretical foundation goes back to the classic paper, Weitzman, 1976, "On the Welfare Foundations of National Product in a Dynamic Economy."

So-called "comprehensive wealth" is defined as the discounted flow of consumption over an infinite time horizon, where, as in Weitzman, 1976, consumption is assumed to follow an optimum trajectory. Hamilton and Clemens show that "genuine saving," or net adjusted saving, defined as the change in real asset values, is equal to the change in social welfare, or comprehensive wealth, in an optimal economy.

An earlier, but related, result is that by John Hartwick, 1977, who showed that if genuine saving is equal to zero over all time (all natural resource rents are invested in capital accumulation to offset resource depletion), then utility of consumption remains constant. This result, popularly known as Hartwick's Rule, is valid only under stringent conditions: elasticity of substitution between natural and produced capital must be greater than or equal to one; output elasticity of produced capital in production must exceed that of natural capital; and population growth must be zero in the absence of technological change.

The second approach to weak sustainability is that developed by Kenneth Arrow, Partha Dasgupta, and Karl-Göran Mäler, among others, based on the idea of "inclusive wealth," as extensively discussed in the recent "Inclusive Wealth Report 2012, published by the United Nations. Inclusive wealth in the UN framework differs from the World Bank's comprehensive wealth in that wealth is now defined as the "shadow value" of all capital assets a country owns. (When observable market prices are not available, so-called shadow prices or shadow values must be imputed.) No assumption is made that the economy is following an optimal path of consumption. The virtue of this approach is that it is applicable in imperfect, distorted economies, though second-best shadow prices must be estimated.

While the theoretical foundations of sustainable development are still being debated even within the realm of weak sustainability, the larger challenge is empirical--the measurement of the various capital stocks, rates of depreciation and depletion, and rates of investment, as a basis of comprehensive or inclusive wealth accounting. The challenge is compounded by lack of uniform accounting standards, methods, and data across countries, making cross-country analysis difficult. Both the World Bank 2006 publication and the UN 2012 report discuss measurement techniques and associated issues in great detail, so I will defer further consideration to those documents.

II Trilogies, Triads, and Triangles - They're Everywhere

The RFF trilogy on scarcity was published over a period of 42 years (1963, 1979, and 2005). Only the third volume addresses the concept of sustainability and its link to scarcity and growth, and none of the three volumes touches on the field of sustainability science, which gained momentum and visibility in the early 2000s. The U.S. National Academy of Sciences (NAS), The American Association for the Advancement of Science (AAAS), and the National Science Foundation (NSF), represent a triad of strong advocates.

On its website (www.pnas.org), the Proceedings of the National Academy of Sciences describes sustainability science as "an emerging field of research dealing with the interaction between natural and social systems and how these interactions affect the challenge of sustainability..." There is now an impressive sustainability literature, which is summarized in a "reading list," published by Harvard University's Center for International Development (Kates, 2010).

1. Positive Sustainability and the Three Pillars

The connection between sustainability science and the economics perspective on sustainable development is more recent. Roumasset et al, 2010, applies sustainability science and economics to the case of Pacific watersheds. Burnett et al, 2011, considers sustainability across space as well as time in the management of renewable resources. This line of research is inspired by a formulation of "positive sustainability," founded upon three principles or pillars, the first influenced by sustainability science and the second two put forward by Stavins et al 2003:

(1) adopting a complex systems approach to modeling and analysis, integrating natural resource systems, the environment, and the economy; (2) pursuing dynamic efficiency, that is, efficiency of over both time and space in the management of the resource-environment-economy complex to maximize intertemporal well-being; and (3) enhancing stewardship for the future through intertemporal equity, which is increasingly represented as intergenerational neutrality or impartiality. I will comment on each of these key pillars.

(1) A systems approach:

Although influenced by the field of sustainability science, the concept of integrating natural resource, environmental, and economic systems is not new. Resource and environmental economists have long included natural resources as inputs to production and environmental amenity as a component of utility in economic models, including models of growth.

Feasibility constraints in these models are typically a variation of what might be characterized as the "stuff equation," which has engineering roots. The time rate of change of the quantity of "stuff" is equal to the difference between the rate of its growth and the rate of depletion. (Think fill and drain, birth and death, investment and depreciation.) I first came across this equation in connection with the neutron inventory in a nuclear fission reactor. Of course, the equation has wide application and is used to describe the dynamics of produced capital, natural capital, and population.

Clark 1990 considers the dynamics of economic and biological systems (fisheries, forests), including predator-prey and source-sink models, that exhibit coupling. In such models, rates of growth and depletion of one form of capital depend on the stock levels of other forms of capital in complex, possibly non-linear, modes on interaction. These models readily become computationally challenging, and like many multidimensional dynamical systems, often defy closed form analytical solutions. Computer simulation is then required.

Much interdisciplinary research, both theoretical and empirical, remains to be done, and this is where sustainability science has the potential to make a substantial contribution. For example, more sophisticated analysis of substitutability among different varieties of capital, especially in coupled systems, appears possible. Notions of network effects, emergence, spontaneous order, non-linearities, critical transitions, bifurcations, regime shifts, tipping points, and chaos in adaptive, complex systems, though regarded as "faddish" in some circles, are now being incorporated into advanced models. "Critical Transitions in Nature and Society," 2009, by environmental scientist, Marten Scheffer, is a good example.

The temptation here is to regard everything as connected to everything else in an incredible web of interactions and feedbacks, both positive and negative. The challenge is to identify those connections which really matter for sustainability as intertemporal welfare. Nonetheless, in pursuit of sustainable development, we should also be cautious to avoid single-issue agendas, initiatives, and programs that neglect or undermine the integrity of other dimensions of the economic-ecological complex. That's the essence of the systems approach.

(2) Dynamic efficiency:

This principle or pillar is already a mainstay of neoclassical natural resource and environmental economics, going all the way back to 1931 and Harold Hotelling's classic paper on the economics of exhaustible resources. What has become known as "Hotelling's Rule" says that an optimal program of exhaustible-resource extraction exhibits a special trajectory of resource prices: at each time t, price is equated to the marginal cost (i.e., unit cost) of extraction plus marginal user cost, where the latter reflects the scarcity value of the unit of resource just extracted (or equivalently, the opportunity cost of future use foregone).

As the field of resource and environmental economics has matured, the Hotelling Rule has been extended to renewable resources, and by British economist, David Pearce, to environmental externalities, such as pollution, as well. (Pearce and Turner, 1990, is an excellent reference.) The dynamic efficiency condition for optimal resource management, with possible environmental externalities, has evolved into what has become known as the Pearce equation.

Along the optimal trajectory in the Pearce formulation, price (P), at every time t, is equal to the sum of three factors: marginal extraction or harvesting cost (MC), marginal user cost (MUC), and marginal externality cost (MEC, e.g., pollution damage cost) attributed to the unit of resource just harvested and used.

So the Pearce equation can be written as $P = MC + MUC + MEC$. The sum of the three terms on the right hand side is often given the name marginal opportunity cost (MOC) of resource harvesting and use.

A second dynamic efficiency condition, serving as a complement to the Pearce equation, is attributed to the mathematical philosopher, Frank Ramsey, 1928, and is known as the Ramsey condition: $r = \rho + \Theta g$. At each point in time along the optimal path of consumption, the market rate of interest, r, is equal to the consumption rate of interest (so designated by Little and Mirrlees, 1974), where the latter is determined by three factors: the rate of time preference (ρ), the elasticity of intertermporal substitution ($1/\Theta$), and the rate of growth of consumption (g).

The parameters ρ and Θ are key in the theory of optimal growth. The rate of time preference (ρ) represents the degree of impatience on the part of economic agents, reflecting a preference for consumption sooner rather than later; the higher the value of ρ, the greater the degree of impatience. The other parameter, Θ, registers a preference for smoothing out, or evening out the level of consumption over time. A higher Θ reflects a preference for more consumption smoothing. (At the extreme, an infinite Θ would represent a preference for a constant level of consumption.)

The Pearce equation and the Ramsey condition are special cases of the efficiency condition that pervades neoclassical economics: to achieve optimality with respect to some economic objective (e.g., consumer welfare, producer profit), continue the policy or program until the marginal benefit and marginal cost of so doing are equated. In the special case of the Pearce equation, marginal benefit to the resource manager is price, P. The marginal cost is MOC. This is a non-trivial formulation. When the systems approach is rigorously adopted (first sustainability pillar), the construction and computation of MOC can be a challenging endeavor.

In most cases, the efficiency condition implies an interior solution to the problem: the optimal policy or program is not a matter of all or nothing. So, with rare exception (plutonium comes to mind), a zero level of pollution would entail huge net cost and would not be optimal; neither would a program of 100% recycling. Nonetheless, there are strong advocates for such all-or-nothing approaches to policy as moral imperatives.

Economists think, write, and talk a lot about efficiency, so it's not surprising that policy makers and the general public have the common, but erroneous, view that economists see efficiency as an end in and of itself. On the contrary, as economists see it, efficiency relates to eliminating economic waste and is a means, in fact, a necessary condition, for enhancing well-being in society, which should by the objective or end of economic policy, including that for sustainable development.

(3) Intertemporal Equity:

The third pillar, concerning how we weight the welfare of future generations relative to our own, is perhaps the most controversial. It has everything to do with intergenerational justice and goes back to the sentiment of British philosopher Frank Ramsey, expressed in his classic 1928 paper on the mathematical theory of saving: *"...it is assumed that we do not discount later enjoyments in comparison with earlier ones, a practice which is ethically indefensible and arises merely from weakness of the imagination."* The neutral or impartial weighting of generations across time implies, of course, that the rate of time preference be equal to zero. The debate among economists, ecologists, and political philosophers pertaining to time preference and intergenerational weighting is far from settled, especially on the context of sustainability and climate change**.**

Zero time preference was first rejected on technical grounds: attempting to maximize welfare over an infinite time horizon without discounting led to sums (in discrete time models) or integrals (in continuous time models) that were infinite: they didn't converge, and so alternative time-paths of consumption and utility could not be ranked to yield the optimum path, that which maximized intertemporal welfare.

Koopmans and Diamond demonstrated this technical difficulty in the early 1960s, but in a 1965 paper, "On the Concept of Economic Growth," Koopmans developed a solution to his own problem by constructing a clever integral transformation using Solow's "golden rule" steady state result. The transformed integral was shown to converge for a non-empty set of so-called eligible paths that were compatible with the dynamic constraints of the economy. Endress et al, 2005, extended this result to a production economy with a natural resource as an approach to modeling sustainability.

Current objections to zero time preference are put forward on ethical, rather than technical grounds. A common complaint is that zero time preference, as might be imposed by a planner, violates consumer sovereignty and a natural, positive rate of impatience. In the recent book, "Carbon Crunch," 2012, British energy economist Dieter Helm goes so far as to characterize intergenerational impartiality as a form of radical socialism that has actually impeded significant progress on global reduction of carbon emissions. (Helm is by no means a climate-change denier.)

In response to these ethical objections, Endress et al, 2012, adapts, and extends to a full production economy, a model of overlapping generations with natural resources (Burton, 1993) that distinguishes intratemporal impatience from generational weighting. In this adaptation, the distinction permits neutral weighting across generations without violating consumer sovereignty. Public policy approximating neutral weighting could include a carbon tax, a national consumption tax (in lieu of an income tax) to encourage saving and investment, and meaningful reduction of the U.S. national debt so as not to pass a growing debt burden forward to future generations.

2. Public Policy: Pro-sustainability or Not?

The project of sustainable development comes with problems standard in natural resource and environmental economics: externalities (spillover effects, like pollution, with missing markets), under-provision of public goods (goods that exhibit non-rivalry in consumption, for example, protection of ecosystems from invasive species), and open access natural resources (open ocean fisheries, the global climate), which are vulnerable to ruinous depletion ("Tragedy of the Commons," Hardin, 1968).

Appropriate policies for addressing these problems will rest upon the three pillars outlined above. They will also be shaped by systematic consideration of the policy environment at three levels of analysis: first-best, second-best, and third-best. (Dixit, 1996, offers a transaction-cost perspective of economic policy along these same lines.)

The **first-best** world features an idealized, frictionless economy without information costs, contracting costs or agency costs. Information is complete, contracts cover all contingencies and can be fully monitored and enforced. Crime, corruption, and rent-seeking (pursuit of special privilege and benefits) can be costlessly nullified. At this level, government intervention and private contracting can be equivalent solutions to the problem of missing markets. This result is sometimes labeled the "Coase equivalency theorem." Prudent policy analysis and design starts by getting it right at the first-best level.

Second-best brings information, contracting, and agency costs to the forefront. Because information gathering is no longer costless, asymmetric information is a common occurrence: one party to a transaction has much more accurate and timely information than the other. Information, legal, and administrative costs result in incomplete contracts. Agency costs prevent full monitoring and enforcement. The optimal levels of crime, corruption, and rent-seeking are no longer likely to be zero when the net costs of combatting them are taken into account. The default view, often associated with Nobel Laureate economist, Joseph Stiglitz, is that second-best costs are pervasive and government intervention (via taxes, subsidies, and regulation) is necessary to improve social welfare. Of course, government faces the same types of cost and information constraints as the private sector. Hence, it can not be a foregone conclusion that government can always do it better; private sector solutions with market competition may in some cases be superior. (This is the essence of the healthcare debate in the United States.)

Third-best is the world of political economy, wherein costs and benefits directly influence the formation of coalitions that compete for political and economic advantage in society. The pursuit of such advantage is called "rent-seeking" in economics and typically involves activities such as lobbying, public relations campaigns, political contributions, and sometimes, outright bribery. Unfortunately, the expansion of government that accompanies intervention on second-best grounds can facilitate third-best level rent-seeking. Corollary: the antidote to rent-seeking is not more government and regulation, but competition. This was a key insight of Adam Smith (1776, Book IV, Chapter VIII), who observed: *"People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices."*

A particularly powerful type of rent-seeking coalition, long studied in political science, is termed "the iron triangle," because of the strength of the collaborative relationships among a triad of actors: politicians who seek campaign contributions, votes, and, ultimately, re-election; government bureaucrats who aspire to expanding fiefdoms and budgets; and private sector interest groups who seek special privilege in the form of political access, favorable legislation, subsidies, protection of monopoly position, and lucrative government contracts. The iron triangle is durable and impenetrable because it functions as a highly efficient, three-cornered, rent-seeking machine.

Nowhere (except perhaps health care) do third-best politics sink first-best and second-best economic considerations as deeply as in the realm of energy policy. In assessing energy policy in Europe and the United States, Dieter Helm, 2012, is especially critical of policy-maker obsession with current-technology renewable energy, which is not yet commercially viable without major government subsidies and mandates. Deficiencies of current technology include intermittency (wind and solar), lack of low-cost energy storage capability, and the need for costly system redundancy to maintain base-load capacity. Consequently, renewables have remained ineffective in lowering energy prices, creating green jobs, and reducing carbon emissions world wide. Bottom line: high costs for little gain. In a review of Helm's book, "The Carbon Crunch," The Economist (Oct 20, 2012 issue) highlights Helm's observation that the entire renewable sector has become an "orgy of rent-seeking."

III The Hawaii Clean Energy Initiative (HCEI): Well, Watt?

The HCEI, introduced in 2008, is a partnership between the State of Hawaii and the U.S. Department of Energy intended to lead Hawaii toward energy independence.

How well does the HCEI comport with the three pillars of sustainability? Unfortunately for Hawaii residents and their long-term welfare, not very well, despite almost unshakeable political support state-wide. The problem is not clean energy, pursuit of which, in advanced technology forms, is a worthy policy objective. The problem, rather, is the current approach to the initiative itself, with its emphasis on mandates, subsidies, and picking winners.

It just doesn't add up, starting with the HCEI goal: *"...achieve 70% clean energy by 2030 with 30% from efficiency measures and 40% coming from locally generated renewable sources."* (After accounting for 30% efficiency, 40% of remaining energy use is 28%, for a total of 58% clean energy, not 70%) Few HCEI advocates seem to notice or care.

What about alleged benefits (www.hawaiicleanenergyinitiative.org) of HCEI? Here's a brief reckoning:

- Strengthen our economy: Very doubtful. Renewable energy mandates and subsidies, coupled with the continuing monopoly power of Hawaii's electrical utility, especially under the present revenue decoupling scheme, will maintain energy prices high, reduce consumer and taxpayer welfare, and accordingly, shrink (weaken) the economy. This was a key message of Nobel Laureate, Joseph Stiglitz, in his special lecture on sustainability at the University of Hawaii at Manoa in February 2012.

- Increase our energy security: Not likely. Abundance of shale oil and gas is changing the global energy market, including prices and geographic sources. The future should see lower oil and gas prices and less dependence on supply from the Middle East. Even with the current high price of low sulphur fuel oil, current-technology renewable energy is not competitive in Hawaii without subsidy. Is it really better for consumer welfare to have higher, but allegedly stabler prices? Concern about supply disruption seems wildly exaggerated. After all, the mission of the U.S Pacific Fleet, headquartered in Honolulu, is to provide maritime security throughout the Asia-Pacific region, including commercial shipping to the State of Hawaii. And a natural disaster, severe enough to impede fuel delivery, would, in all probability, cause major damage to local energy infrastructure. Less severe disasters might cripple the vulnerable renewable energy sector without preventing maritime delivery of fuel. Security is enhanced, not diminished, by the diversity of energy sources.

- Reduce our carbon footprint: A large, costly shoe for such a small foot. Hawaii currently imports about 40 million barrels of oil per year or about 0.1 million barrels per day. World-wide fossil fuel consumption (oil, coal, natural gas) comes to about 250 million barrels of oil equivalent per day (see annual data from the International Energy Agency or the U.S. Energy Information Administration). Accounting for the carbon intensity of the different fossil fuels, Hawaii's contribution to global carbon dioxide emissions is on the order of 0.01%. HCEI will not meaningfully prevent climate change nor save the planet.

- Make Hawaii a world model for energy independence: And serve as a model of welfare erosion as well. A common justification for independence among HCEI proponents is "keeping the money at home," which represents crude, modern day mercantilism (exports are good; imports are bad), an economic policy that was discredited over two centuries ago by Adam Smith (The Wealth of Nations) in favor of international specialization and voluntary exchange (Endress, 2012, Economic Currents, UHERO). Pursuing independence, foregoing the welfare gains from trade, shrinks the economy.

- **Create a cleaner, more sustainable environment:** Does this alleged benefit measure up to the three sustainability pillars?

-- *Systems Approach*: HCEI is a single-agenda program that downplays its interaction with and impact on the Hawaii's wider economic-ecological system. Renewables are land-use and water-use intensive. Wasteful over-investment in renewable energy (i.e., subsidies and tax credits) may come, for example, at the expense of optimal watershed protection against invasive species. Marine resources, vital to sustainable tourism in Hawaii, may similarly receive inadequate attention.

-- *Dynamic Efficiency*: Mandates and subsidies are notoriously inefficient, because they reduce consumer and taxpayer welfare. Take the solar tax credit, for example. For the fiscal year ending June 2012, Hawaii tax revenue lost due to solar tax credits (i.e., subsidies) amounted to $170 million; the Council on Revenues has adopted forecasts based on the assumption credits will rise to $240 million in the current fiscal year. That's very likely to be an under-estimate, given the solar-installation frenzy that the commission's announcement has engendered in anticipation of a possible credit crack-down by the Hawaii State Legislature.

The revenue loss is a direct burden; but the overall loss is even worse. "Excess burden" is the additional welfare loss to Hawaii residents because subsidies distort prices and incentives in the economy, inefficiently drawing resources from other production sectors into the renewable energy sector. (The renewable sector gains at the expense of jobs and income in the rest of the economy.) On top of that is the added excess burden of tax friction: every dollar of tax revenue raised to finance subsidies costs the economy about another 25 cents. (Economists refer to this friction as the social cost of public funds.) And where do most of the solar panels now being installed in Hawaii come from? China, not the United States. Using welfare analysis made standard by economist Arnold Harberger, 1964 (see technical note below), Professor Jim Roumasset and I estimate that the total amount of excess burden due to solar tax credits for this fiscal year will come to about $360 million. That's $1million a day swirling down the state drain. The benefits and costs of other policy manifestations of HCEI should also be analyzed, including the interisland grid, feed-in tariffs, and regulatory policies regarding consumer prices.

-- *Intertemporal Equity*: HCEI's implicit rate of time preference is high; political imperatives are favoring the present over the future, despite public relations appeals to the contrary. Rather than allowing renewable technologies to advance with R&D and become commercially viable without subsidy, Hawaii is paying a high price and foregoing other productive investment to lock in current, suboptimal energy technology. When the overall economic-ecological system is considered, Hawaii is making inadequate additions to inclusive wealth and is thus in jeopardy of not meeting the sustainability criterion and stewardship for the future.

Economic justice in contemporary Hawaii is also being challenged by energy policy. In February 2010, the Hawaii Public Utilities Commission (PUC) approved a new method, known as revenue decoupling, for setting electric rates designed to encourage progress toward clean energy in Hawaii. A dissenting opinion was filed by (former) PUC Commissioner Leslie H. Kondo (Kondo, 2008) and is a matter of public record. In that opinion, Commissioner Kondo describes revenue decoupling and goes on to discuss its welfare implications:

"... decoupling is a rate adjustment mechanism that breaks the link between the volume of electric sales and a utility's revenues...With decoupling, (the utility) will earn the same amount of revenue by selling one unit of electricity as it will earn by selling ten thousand units. As electric sales decline -- whether that decline is caused by the down economy, customers' energy efficiency efforts, cooler than normal weather or a system power outage -- customers will pay more for each unit of energy they use to make up for any shortfall in (the utility's) authorized revenue requirement...It appears likely that low income, fixed income and elderly customers will feel the greatest impact from decoupling and that those customers have the least ability to reduce their electricity use. Those customers simply cannot afford to, for instance, replace their refrigerators with more energy efficient models or to install solar water heaters."

In his dissent, Commissioner Kondo highlights the distinction between State energy objectives and the public interest, noting that they are not synonymous; he concludes that revenue decoupling is not in the public interest. One might add that solar tax credits, together with revenue decoupling, produces a transfer of income from lower-income citizens, most of whom are home renters, to wealthier home owners, the solar industry, and HECO. This seems like a reverse Robin Hood arrangement: take from the poor and give to the rich.

IV SUMMING UP

I would extend Commissioner Kondo's finding to the HCEI overall; HCEI may serve State energy objectives, but it is not in the public interest (i.e., overall consumer/taxpayer welfare. HCEI does not enhance intertemporal well-being and can not help save the planet through meaningful contribution to global carbon reduction. At best, it serves rent-seeking interests in the State of Hawaii. And for those inclined to justify the HCEI on moral grounds, a question: In what way is the undermining of sustainability in Hawaii, and hence, the intertemporal well-being of Hawaii's citizens, a moral outcome?

So, what are the alternatives? Helm, 2012, offers some constructive recommendations for rational energy policies in Europe and the United States: (1) Institute carbon taxes; (2) Increase investment in R&D for advanced renewable technologies; (3) Adopt natural gas as a transition fuel until advanced technology renewables are ready for prime time. The first two recommendations are best pursued at the national level, although Hawaii should have some comparative advantage in R&D for ocean and geothermal energy. As to the third recommendation, the natural gas option should be put on the table in Hawaii for serious study and debate. The current administration in the State of Hawaii seems open to that idea (Governor Abercrombie 2013 State of the State address).

TECHNICAL NOTE

The HCEI involves inefficient mandates and subsidies for renewable energy, creating deadweight loss of social well-being in Hawaii. One instructive example is the deadweight loss due to solar tax credits. A first-order estimate of dead weight loss (DWL) from solar tax credits can be derived using the approach in Harberger, 1964, p37. We start with the Harberger formula for dead weight loss from a simple excise tax in sector X, given a pre-existing tax in sector Y. The following notation applies:

R is government revenue arising from the tax on X.

η_X is the price elasticity of demand for X: this number is the percentage change in the quantity of X demanded in the economy as a result of a one percent increase in the price of X. (Elasticity of demand is normally negative.)

t_X is the percentage rate of tax on X.

t_Y is the percentage rate of tax on Y.

The applicable Harberger formula then is DWL = $-(1/2)(R)(\eta_X)(t_X - 2t_Y)$.

For the case of solar tax credits, or subsidies, in Hawaii, we make the following assumptions in applying the Harberger formula:

R = - \$240 M(Council on Revenue estimate of revenue loss for current fiscal year)

$\eta_X = -3$ (The demand for solar installation is taken as elastic, i.e., highly price sensitive; the number we use is likely to be a conservative underestimate.)

$t_X = -0.35$ (Sector X is the solar sector in Hawaii. The solar tax credit, at 35%, works like a negative tax.)

$t_Y = 0.075$ (Here we take sector Y as the rest of the Hawaii economy; the tax rate is the simple commodity tax equivalent of the Hawaii General Excise Tax (GET). Because of pyramiding in the GET, the equivalent rate has been estimated as high as 14%; we use a more conservative equivalent of 7.5%.)

Using these values, DWL = - (1/2) (-\$240 M) (-3) (- 0.35 - 2 (0.075)) = \$180 M

But that's not all. We need to account for tax friction, or the social cost of public funds (SCPF) raised to finance the solar tax credits. Public sector economists usually assume a rate of 25%. So for estimated credits of \$240 M, SCPF = (0.25) (\$240 M) = \$60 M.

That's still not all. Most of the solar panels installed in Hawaii come from China, not the United States. So the solar tax credits serve, in part, as an import subsidy. Assuming 50% of installation cost is for the solar panels themselves, not labor, transfer (TR) of Hawaii taxpayer revenue to China, linked to the "import subsidy," is TR = (0.50) (\$240 M) = \$120 M.

So total welfare loss = (DWL + SCPF + TR = (\$180 M + \$60 M + \$120 M).

That comes to \$360 M or almost \$1 M per day of welfare loss due to solar tax credits. The daily loss of social well-being from the HCEI overall is much greater.

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