

Options for Protecting Kentuckians' Economic Well-being in the Face of Energy Cost Increases

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The study on *Protecting Kentuckians' Economic Well-Being In the Face of Energy Cost Increases* reviewed the threats Kentucky faces, the steps already taken to respond, and new moves the Commonwealth might undertake to further enhance the capacity of Kentuckians to respond to – and take advantage of – the changing energy priorities and policies of the United States and countries and companies across the globe. Overall, the study found that the threats are real, but the prospects for Kentuckians can be very bright despite the problems.

We first summarize the findings of that study. Then we examine the issues and options facing the General Assembly in implementing the recommendations put forward.

Energy Cost Threats and Responses: Realities and Potentials

Kentucky is not alone in facing a world with a rapidly changing energy and economic environment. The state's energy assets – ample coal, low cost electricity from coal and employment in companies taking advantage of low cost electricity – may become liabilities as the United States and the world addresses the problems of climate change. The Commonwealth urgently needs to undertake major short term efforts to adapt to a changing energy environment and to launch longer term efforts to strengthen its economy and respond to new opportunities that are opening up in this transition period.

The Threats

The threats are obvious:

- Energy costs are rising – and coal costs per ton are rising more rapidly than the costs of a barrel of oil, so electricity costs alone will soon explode for Kentucky citizens and businesses. These long term patterns will not be affected much by the current economic downturn (and, as of early October, the cost of coal continued to rise as oil prices fell).
- Carbon emissions controls and/or taxes are coming, whether due to US or international action, and will further drive up the cost of coal-fired electricity for Kentuckians and their employers, potentially threatening the basis of the state's industrial economy.
- Kentucky household budgets – and family wellbeing – are exceptionally vulnerable to these cost trends since residential electricity usage in the Commonwealth is 24% higher than the national average.
- Firms using traditional coal-fired electricity may face negative publicity, if not actual economic disadvantages such as new tariffs, in a world that penalizes carbon emissions and values cleaner energy, so attracting new employers could become more difficult for Kentucky, whatever the costs of its electricity.

These threats pose major problems for a Kentucky economy that saw limited growth even before the economic downturn and credit crunch, evidenced by employment in building construction, which barely grew over the 2002-2008 period. When there is little new business development or population immigration, construction slows, so this pattern is a good measure of statewide economic stagnation.

Initial Opportunities and Responses

But opportunities for rapid responses also abound – and the Commonwealth is already taking some action:

- Energy efficiency investments will produce higher cost savings and greater usage reductions in Kentucky than elsewhere: consumption has been so high in the past that just cutting back to national average will generate significant benefits for households, governments, schools, and businesses.
- Led by the Kentucky Department of Education's Facilities Management Division, schools in the Commonwealth are leading in the nation in pursuing school building energy efficiencies.
- Energy saving performance contracting by state agencies and universities is saving millions annually in utility costs, even at current power costs, and the payoffs will grow over time.
- House Bill (HB) 1 launched a re-examination of the role played by the Public Service Commission and initiated examination of demand-side management, alternative energy portfolios, full-cost accounting and modified rate structures as energy and emissions management approaches, so Kentucky already has data on options that make it easier to take rapid action.
- HB 2, passed in the last legislative session, has already declared "it to be the public policy of the Commonwealth to maximize the use of energy efficiency measures in the construction, renovation, and maintenance of buildings owned or leased by the Commonwealth."
- In pursuit of that policy and in that law, Kentucky has:
 - Mandated state-level pursuit of further energy efficiencies in government operations;
 - Offered tax incentives to induce new private investments in energy efficiencies;
 - Facilitated small-scale private generation of alternative, renewable energy; and,
 - Authorized up to \$80 million in state bonds to help finance energy efficiency investments.

Overall, the Commonwealth appears to have done more than many other states, and energy clearly has become a major part of the state-level policy agenda.

Limited Efforts to Date

While initial steps have been taken, Kentucky has a long way to go to seriously address the threats it faces:

- The Public Service Commission report issued under the HB 1 requirement ignores the risks inherent in doing nothing and continuing the Commonwealth's 94% dependence on coal for electricity, despite the fact that it is obvious that plant operating procedures and costs can be massively affected by the actions of regulatory bodies over which the Commonwealth, the PSC, and the generators have no power. As a result, the apparent costs of innovation are exaggerated relative to the (overlooked) costs of the *status quo*.
- Little in-state regulatory action has been proposed or seriously examined, despite decades-long experience with demand-side management and energy efficiency promotion efforts in other US states that could be examined and adapted to local conditions. The PSC regulatory powers remain extremely limited relative to those in other states.
- Short-term internal rate of return calculations are mandated to govern energy and environmental policy decision-making under both HB 1 and HB 2. Calculations tend to ignore the long-term trend lines in costs and thus undervalue major restructuring that will pay off over time. The approach undermines efforts to take longer term looks at where the

Commonwealth wants to be in a decade or more, and to undertake major efforts to assist its citizens and businesses to compete in the global economy.

- The \$80 million in bonding for energy efficiency under HB 2 is merely symbolic and woefully inadequate in light of obvious needs – Kentucky schools spend over *ten times that annually* on new and renovated buildings.
- The needs of all the businesses and households in the Commonwealth that do not have – and cannot borrow – the money needed to make energy efficiency investments that are known to pay off have been totally ignored to date. This omission is made more serious by the current economic contraction and liquidity crisis facing the world economy.
- Tax credits only work for those who can afford the investments or can borrow to make the investments that will be rewarded with the tax relief. Thus the lower income families and the smaller and more marginal businesses that can least afford the budget-breaking energy costs increases they face have not been helped by any of the measures taken to date by the Commonwealth.

Kentucky has acknowledged problems with regard to energy, and has taken some tentative steps, but much more needs to be done.

Possible Next Steps and The Payoffs

There are myriad opportunities to put more Kentuckians to work and to limit the negative effects of rising energy costs and constraints on domestic reliance on coal-fired electricity:

- ✓ Just improving average home energy efficiency could save the average household \$150 a year *at current energy costs* and would be a gift that kept on giving over time.
- ✓ The payback period for replacing an incandescent with a compact fluorescent light bulb, for example, is about a year at mid-2008 residential electricity costs – a 100% rate of return!
- ✓ Heating and cooling costs are a big part of building energy efficiency and special needs exist for many of the 150,000 manufactured homes in the Commonwealth, who residents are among those least likely to have the funds to invest in their homes and need help.
- ✓ Those energy savings, applied to state and local government buildings and schools, can save operating costs and hold back tax increases and/or improve the efficiency of government services to all the taxpayers in Kentucky.
- ✓ Data from the state's public school systems show savings of over 45% in energy costs for schools upgraded to ENERGY STAR standards – and similar results are possible for state and university premises, with energy performance contracting firms bidding for the right to do the improvements, with costs paid for by energy savings.
- ✓ Similar results should be possible for commercial enterprises and office buildings, with the savings contributing to increased profits for owners and/or lower costs for the consumers to whom they sell.
- ✓ Alternative energy generation in Kentucky is possible, but the Commonwealth does not have the obvious high impact opportunities available in deserts for solar power and major open spaces or bodies of water for windpower, so immediate impacts from these arenas will be limited.
- ✓ All the immediate prospects for helping Kentuckians address their future of higher cost energy will produce jobs in the building trades – thousands of jobs at above average salaries.

- ✓ Tax savings from energy efficiencies overall in the Commonwealth, including state and local governments, will start at 0.5% and keep growing as the cost of power rises.

Overall, an energy efficiency program that served just 10% of the total households in Kentucky (165,577) and saved an average of 10% on their annual bill through education and efficiency investments (a very low number to expect, given available data) *could save householders \$16,557,700 in the first year, and keep rising from there.* Such an investment program would cost around \$130,000,000, would generate some \$100,000,000 in new building construction spending, adding a bare minimum of 1,830 new jobs, and \$33,215,308 just in new construction job wages and salaries, not including construction firm profits and the sales, profits, and payrolls of the firms supplying materials and equipment to the construction industry.

Such a program could easily be financed by state bonds, with the debt service from the very first year financed 100% from the savings in energy costs. The faster the energy costs rose, the greater the payoff to Kentuckians as homeowners and taxpayers would become over time.

Moving Forward

While there are real problems in the financial markets at present, Kentucky has an excellent credit rating, and energy savings produce effectively guaranteed cash for servicing debt. This means that the Commonwealth has the capacity to commit hundreds of millions of dollars to energy efficiency investments. The General Assembly has already committed close to \$400 million for energy projects and those funds could be reallocated in order to:

- Reduce taxes on all Kentuckians, now and in the future;
- Reduce monthly energy bills for hundreds of thousands of households, saving them more money as time goes by;
- Provide new jobs for thousands of workers at a time when the sector in which they work is depressed;
- Reduce economic risks in the future by diversifying the economy and stimulating new activities and training for works; and,
- Bring the Commonwealth to prominence in a global economy striving to reduce the carbon intensity of human activity.

Over the longer term, these are returns that any government would be pleased to provide to its taxpayers and citizens.

One big fear about any innovation is always the cost in the immediate period. But the data exhibited here show that the steps to get there do not need to cost the Commonwealth *anything* in the current period:

- Performance contracting and lease-buyback arrangements can finance all the public sector energy efficiency investments needed. The investments pay for themselves at first, and earn additional savings with the passage of time.
- Removing the unlegislated 12-year payback requirement for energy efficiency building improvements with longer lifetimes can expand the current performance contracting markets and promote more efficiency over the long term.
- The \$30 million in bond financing already committed to energy efficiency in the public sector program of the Bluegrass Turns Green initiative can be diverted from

unnecessary grants to use as loan guarantees and finance \$300 million in household or business energy efficiency investments for which the short term self-financing systems do not work.

- The \$300 million in bond financing that the Commonwealth committed to the Peabody coal liquefaction plant under HB 1 is not likely to become a factor for over a decade, with the US Department of Energy expected delays in carbon capture and sequestration technology development. Borrowing capacity currently committed to economic development can be shifted to promote energy efficiency investments and the job and income potentials (plus user cost savings) they promise. This shift and the economic diversity and positive image it could generate may contribute more to long term economic prosperity for Kentucky than the traditional uses of these resources.
- The 150,000 occupants of manufactured and mobile homes, some of whom are among the lower income households in the Commonwealth, as well as others living in poor quality housing may have to face a less severe “heat or eat” choice in the coming winters and as a result are likely to place fewer demands on health care and other support services that have to be paid for in the end by other Kentuckians, so both groups are better off.

A \$1 billion initiative with debt financed through savings on energy costs should not be difficult to finance once the current debt markets are stabilized. Lowered interest rates provide additional opportunities for cost savings. While private borrowers are being shunned right now, public debt is being purchased. The economic risks and threats posed by global warming translate into grounds for expectations of the capacity to service debt out of costs avoided, so financing should become available.

The time for Kentucky to act is now. Two years from now, the nation may have taken a stand on carbon emissions and the Commonwealth, doing nothing different than what is proposed here, but then doing it because it had to, would be seen as a follower, not a leader. The economic development potential of taking the initiative will have been lost. The economic return to the program suggested here thus is far greater if it is implemented early in 2009 than in any later session of the General Assembly.

Program Implementation Options

The majority of government units, businesses and households are unlikely to have the funds on hand or incomes in any given year to make the investments that could increase their energy efficiency and save them money in future. The fact that the future energy cost savings might provide a return on investment that exceeds traditional income investments does not change that reality. It just emphasizes the need to develop the public policies and implementation tools that permit the investments.

A process to facilitate investments when current funds are not available involves identifying and efficiently combining five elements:

- 1) A “beneficiary” that will reap the energy efficiency cost savings from the new investments
- 2) A source of capital for those needed investments
- 3) A source of funds for debt service, if needed, which may or may not be the beneficiary itself
- 4) A mechanism for collecting those funds
- 5) A risk management scheme or a guarantor of debt service capacity if the capital is borrowed

These elements can be found in a variety of combinations, with the mix varying across different types and sizes of governments, businesses and households. Assuming government commitment to energy efficiency, however, a combination can be found for *all* situations if both the police and fiscal powers of the state are employed. *There is no impossible case.*

First and foremost, it is necessary to distinguish three general classes of “beneficiaries” and the differences in the issues they face.

- A. The Public Sector (state government, counties, cities and school districts) can issue tax exempt bonds and has the taxing capacity to address risk management. The tax capacity and the extent of prior borrowing and debt will vary, but the power to act exists, even for very small cities.
- B. Private parties with future cash flows that can provide at least a partial cushion through incomes to assure additional debt service capacity beyond that generated by future energy cost savings. These parties will include most currently profitable businesses, economically stable non-profits, and households with the income flows to consistently pay utility bills and other obligations monthly. They may or may not have borrowing capacity, and may or may not be willing to act, but would have to borrow at taxable rates in any case.¹
- C. Private parties currently having problems paying monthly obligations, including utility bills, such as households receiving cash assistance and LIHEAP and private organizations on an economic knife-edge. Whether or not they can pay their current utility bills, they cannot offer any assurance that they will be able to do so in the future and pose the greatest risk of investment losses if the efficiency gains do not match those expected.

It is important to realize that this last group, category C, can include both property owners and renters, and that their landlords, if they are renters, are more than likely to be in category B. The discussion below will address landlord/tenant issues in energy efficiency investment as a special case.

Next, the matter of how funds are raised warrants consideration, especially with respect to the tax-exempt/taxable bond distinction. Whether or not the investment is debt-financed, it is not worth making if the future returns do not at least match other possible returns on that capital. Those other returns are not just private returns but also include the possible returns to different public uses of the same funds. (By requiring that investments meet at least the taxable bond financing criterion, this analysis can avoid the complexities of the distinction between public and private rates of return, which gets into the issue of measuring the dollar value of such outputs reducing emissions that have no immediate impact on the current Kentucky population.)

For publicly-raised funds, whether borrowed through bonds or ESPC lease-buyback arrangements or included in current appropriations, the project approval principle is simple: the project returns must be such that the expected energy cost savings should be sufficient to service debt on bonds issued to cover its cost. This basic principle has a number of implications:

- The lower the bond interest rate, then, the lower the bar for what gets defined as energy efficient investments, and the longer the bond term – which also may make monthly and

¹ Some companies may not be willing to invest in energy efficiency even if their returns far exceed their debt service costs because they see a higher rate of return on their capital available from investing in their core business activities. If Kentucky uses any state funds to encourage them to take action as part of an effort to create a greener Commonwealth, then the deal should be structured so that taxpayers get *all* their monies returned through the company's savings on energy costs.

annual debt service obligations lower – the lower the next year energy efficiency target must be met.

- This lowered first year target *increases long term efficiency* relative to a higher bar in the context of rising energy costs, since it permits more complete investments in the short term, reducing the likelihood that additional investments will be needed in the future.
- There is no reason under any conditions for grants to be offered to entities using these funds for approved projects. The Bluegrass Turns Green initiative in HB 2 provides for state grants to local governments in an energy cost and efficiency potential context in which those local governments are expected to save more than they would have to repay on a loan from the first year, and save more in each successive year. Why, then, offer them a grant? The incentive is not necessary, especially since the state taxing capacity stands behind the debt, so there really is no cost, even to the credit rating, of the local government and its fisc.
- The “costs avoided” principle for the debt service provides a rationale for public acceptance of a debt service obligation for private sector beneficiaries to the extent that the investment lowers the amount the state would otherwise have to pay in support of those private parties, whether in energy assistance funds, Medicaid or other support for health care costs, or yet other types of assistance.
- The principle also constitutes a high bar for public support for investments by private firms that can be expected to generate significant returns to those private parties. The only time such commitments of public funds might make sense is if (a) the project returns are so small and marginal that the energy savings could cover debt service only at the tax-free, but not the taxable, interest rate, *and* (b) public funds in support of the private party would have to be committed if the investment was not made or there is another measurable public return to the project. In any case, even if those two criteria were satisfied, the public entity accepting the debt service obligation logically would be entitled to at least share in the private “profits” as they grew with energy costs avoided, unless there was a strong economic reason for a continuing subsidy to the firm to grow over time.

These conclusions, in turn, suggest why state-level leadership in guiding energy efficiency investments is desirable in pursuit of a cost-effective response to rising energy costs.

State-level leadership is desirable since centralized bond issuance can save on underwriting fees and/or interest rates, and the broader experience of a state-level construction financing authority may help improve the efficiency of the retrofits and other energy saving investments. The potential for combining investment in buildings and their efficiency with land use priorities and transportation investments that add to the savings is also greater at the state-wide scale. Even for those activities that may be pursued at the Area Development District scale, the Commonwealth can contribute to the efforts of all by sharing experiences and disseminating information on best practices.

But a series of questions arise in the implementation of such an investment leadership function for Kentucky state government:

- How should the economic returns from energy savings (which could rise very substantially over time) be allocated between the state fisc as the borrower and funder and the benefiting entities supported? Under the existing ESPC process, the state agencies that control the buildings for which retrofits are financed through the lease – buyback arrangements gain the cost savings. This arrangement limits the capacity of the office that has to negotiate and approve those performance contracts to expand its services, and the increased burden on the state-level budgets of providing comparable services to lower level government units, not to

mention private parties, would be excessive without some benefit sharing. The problem is striking the right balance so that the potentially benefiting entity still has an incentive to participate in the state program.

- Allocation of the cost savings from reliance on tax-free bonds (and possibly lower state borrowing rates) remains another issue. It may be that only some of the benefit should be retained by the state and the rest should subsidize – and further incentivize – the parties pursuing energy efficiency, but the allocation formula is not obvious.
 - Should funds provided to local governments and schools differentiate by size, by borrowing capacity, by level of local tax effort or fiscal stress, or on some other basis?
 - Should funds provided to, or used to assist, homeowners differentiate by income, by past utility bills as a proportion of income, by total savings in immediate post-investment years?
 - Should funds provided to residential or commercial landlords be subsidized at all, given that the profit-making recipients are ending up with assets worth more by virtue of the energy efficiency investments made, or should conditions about not capitalizing the benefits in current rent charges be imposed to allow the benefits to pass through to tenants
 - Should funds provided to businesses that own and operate their own buildings be provided at all at state tax-exempt rates, or should the Commonwealth capture the entire interest gap gain, providing the businesses only the limited subsidy associated with not having to use their own access to capital to finance energy efficiencies that contribute to their bottom line?
 - In the case of firms whose production processes could benefit from energy efficiency investments in processes or new equipment be provided any state subsidy at all, or should that support be provided only for those firms which are demonstrably less energy efficient than their competitors elsewhere?

These are not straight-forward questions, and the answers will shape the cost of any Kentucky program, as well as the extent of its impacts on individual household well-being. Therefore, the complexity they imply should not be understated. Formulaic responses developed in pursuit of simplicity should be avoided when such approaches impose costs in the form of economic inefficiencies the Commonwealth cannot afford.

The biggest question to be resolved in any procedures for financing energy efficiency investments, however, involves the relationship between the borrowers, the loan recipients, the investors and the debt service collectors. Obviously, under some conditions those four roles may be played by the same party, but they also could be played by four different parties – each with slightly different relationships to the beneficiaries, the parties enjoying the lower energy usage and bill savings. There are at least seven different possibilities. Depending on the nature of the efficiency investments required and the capacities of the beneficiaries, a mix of approaches might be most effective for the Commonwealth.

1. Utilities as loan recipients, investors and repayment collectors (through add-ons to ratepayers' utility bills). In this scenario, PSC regulation would impose the burden for weatherization and other energy efficiency retrofitting on utilities, possibly linking some level of effort and/or demonstrated savings to eligibility to file for utility rate adjustments. The utilities could be provided with the opportunity to make the efficiency program a profit-making enterprise by permitting a fee to be charged for the service rendered. To limit stress on ratepayers, the

state might assure them and the utilities that it would contribute to debt service to assure that no monthly bills that combined payment for power and for the investments would be above the expected bill had the power usage been the equivalent of the same month the prior year or two, provided state approved or certified contractors did the energy efficiency work. (Given the experience with the ESPCs, this should not impose a heavy burden on the state fisc as guarantor.) In order to assure long term maintenance of the energy efficiency improvements and assure the utilities the needed repayments, the add-on payment obligation should be attached to the premises, not the individual ratepayers, if buildings are sold, or occupants changed.

2. Utilities as investors, installing cogeneration or renewable generation capacity on large ratepayers' premises as appropriate in place of spending on new fossil fuel-fired electricity and adding the installations to their rate bases. The ratepayers might not benefit in terms of lower power usage, or lower cost to distribute the power to them, given standard rates, but could benefit by leasing the premises for the generating capacity to the utility. If Kentucky imposed an alternative fuel mandate on utilities, this response might be cost-effective for the utilities even when it has no significant effect on the operating costs and profits of large building owners and industrial firms. (Alternatively, at least for large heat generating industrial premises, the cost savings from generating their own power plus the revenues from selling to the grid may be sufficient to get the company to make the investment, with or without state – or utility – support in the form of the needed debt capital.)

3. County and/or city governments as loan recipients, investors on behalf of their residents and taxpayers, and repayment collectors from those for whom they invested (through taxes and fees). In this approach, the debt service could be added as a non-tax charge against the property improved by the energy efficiency investment, remaining as a charge against the land and improvements until the debt is discharged. The real estate valuations may also go up with the improvements, but a tax holiday could be permitted for that portion of the property assessment – or the state could guarantee all (or just needy) property owners that the total of the new taxes and fees minus the energy savings would not exceed zero in any given year. (Note that, while the guarantee might cost the state – or the locality – money in the early years, the net effect of not providing the tax holiday as energy costs rose over time would be to add to the revenues collected from taxing the improvements.)

4. School districts, counties and cities as loan recipients, and investors in their own energy efficiency and repayers to the state or an arms-length authority structured to make the loans and collect payments. Once again, the repayment capacity would be a function of energy cost savings, so that the new debt obligation need not increase local operating costs. (The Commonwealth already has a model for assuring cost savings potentials in dealing with sub-state jurisdictions' building plans: the highly successful process of review and certification for all school construction projects by the Department of Education's Division of Facilities Management.)

5. Individual homeowners and businesses as loan recipients, investors and repayers to the state or an arms-length authority structured to make the loans and collect payments. If the prior option is adopted for sub-state public jurisdictions, there is no logical reason not to extend the same financing option to private parties who wanted state funding, provided they meet credit standards and are willing to pay fees for oversight of their projects in return for the lower cost of capital obtained through tax free financing. (If fact, another benefit would accrue to the private parties: the state oversight of project plans and perhaps screening of contractors to assure energy efficiency goals are likely to be met.)

6. The state itself as investor of bond funds raised, in its own buildings' energy efficiency, reaping the benefits of lower operating costs, thus avoiding tax increases or providing funds for improved services. This is, in effect, making the current ESPC process more open, acknowledging the inherent debt obligation in the lease-repurchase agreements now used, and integrating it into a larger program of state-led investment in energy efficiency, possibly reopening the current practice of limiting the ESPCs to those with a 12 year payback and addressing the issue of how to invest in a climate in which the assumption of a constant cost of power is no longer reasonable. (The added visibility of that state activity is likely to have the additional benefit of acting as a demonstration for private sector owners of other office and similar premises in the Commonwealth, stimulating their energy efficiency efforts.)

7. The state itself as investor in new transportation infrastructure where appropriate, and in development of, or subsidies to, public transportation system development or expansion, where savings can be demonstrated to serve the public good. Kentucky, unlike a massive state like California, cannot expect to influence the types of cars available through regulation of its internal market. However, the Commonwealth does have the capacity to finance paratransit or commuter bus operations in rural and small town areas where the costs of providing transportation for the elderly and disabled using private cars keeps rising but local institutional and financial capacities do not exist to provide any alternatives. As the price of fuel and car reliance grows, people needing transportation assistance may eventually save money even if they have to pay the full cost of the publicly provided alternatives. State-level leadership and funding, however, will be necessary to make the alternatives available even if they become fully self-financing. (The primary special demands and need for state support are most likely to exist in those locations in which there is little or no public transportation capacity; if Kentucky were to get into the debt financing arena for transit availability, unit cost might actually go down if the Commonwealth centralized all borrowing for new capacity, even for those locations which already have bus systems.)

The primary focus of this analysis has been protecting Kentuckians from the negative effects of rising energy costs. However, the same implementation elements and logic could guide design efforts in the Commonwealth to promote the alternative energy technological capacities that could provide new jobs for the future. In this application, however, caution must be applied to avoid over-subsidization and to assure a return to the taxpayers who become, in effect, investors in the private firms that are supported with state funds:

“... governmental support for renewable energy technologies, if properly designed, could well serve the public interest. ... caution must be exercised to avoid the permanent subsidization of the private sector engaged in the commercial development of renewable energy technologies. ... The proposed analysis is the basis for generating a performance-dependent mixed strategy across alternative renewable energy technologies with exit clauses for terminating policy instruments that generate rents and subsidies to the private sector.” -- Gordon C. Rausser Maya Papineau. 2008. *Managing R&D Risk in Renewable Energy*. CUDARE Working Papers Berkeley, CA: University of California, Berkeley. p. 30. (Downloaded from: <<http://repositories.cdlib.org/are/ucb/1058>>/.)