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RECEIVED
FEB 29 2008
PUBLIC SERVICE
COMMISSION

February 29, 2008

Ms. Elizabeth O'Domell
Executive Director
Kentucky Public Service Commission
2 1 1 Sower Boulevard
Frankfort, Kentucky 40602

Via Hand Delivery

Re: In the Matter of: An Investigation of the Energy and Regulatory Issues in Section 50 of Kentucky's 2007 Energy Act - Case No. 2007-00477.

Dear Ms. O'Donnell:

Enclosed for filing in the above-captioned matter is an original and ten (10) copies of Direct Testimony of Wallace McMullen, Andy McDonald, Richard M. Clewett, Jr., and Richard E. Shore which I am submitting on behalf of the Sierra Club. I would appreciate if you would see that this is properly filed with the Commission.

Thank you for your attention to this matter. Please contact me if you need any further information.

Sincerely,

Stephen A. Sanders
Attorney at Law

Enclosures

CERTIFICATE OF SERVICE

I hereby certify that a true copy of the foregoing Direct Testimony of Wallace McMullen, Andy McDonald, Richard M. Clewett, Jr., and Richard E. Shore on behalf of the Sierra Club has been served on the following by United States mail this **29th** day of February, 2008:

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FEB 29 2008
PUBLIC SERVICE COMMISSION

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

AN INVESTIGATION OF THE ENERGY AND REGULATORY ISSUES IN SECTION 50 OF KENTUCKY'S 2007 ENERGY ACT	))))	CASE NO. 2007-00477

Direct Testimony of Wallace McMullen, Andy McDonald,

Richard M. Clewett, Jr., and Richard E. Shore

On Behalf of the Sierra Club

February 29, 2008

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

AN INVESTIGATION OF THE ENERGY AND REGULATORY ISSUES IN SECTION 50 OF KENTUCKY'S 2007 ENERGY ACT	))))	CASE NO. 2007-00477

RECEIVED

FEB 29 2008

PUBLIC SERVICE COMMISSION

Direct Testimony of Wallace McMullen

On Behalf of the Sierra Club

February 29, 2008

Q. Please state your name and address for the record:

A. Wallace McMullen.

Q. What is your formal education?

A. I have a BA and a Master of Science (Industrial Relations) degree from the University of Wisconsin-Madison.

Q. What is your background pertaining to the issues which are addressed in this case?

A. I worked for the Missouri Department of Natural Resources Division of Energy for nine years, 1986-1995. In 1994 I was the Department's representative in the Public Service Commission proceeding pertaining to the IRP of Kansas City Power and Light.

In 1999 I became the Energy Chair of the Missouri Chapter of the Sierra Club, and served in that capacity until 2006, dealing primarily electric utility issues. In 2006 I moved to Kentucky, and became the Energy Chair of the Cumberland Chapter. We have been dealing extensively with electric utility issues and the topics which are included in this proceeding.

Q. Please discuss the issues in this case as set forth in Section 50 of the Kentucky 2007 Energy Act, particularly those relating to:

3. Incorporating full-cost accounting that considers and requires comparison of life-cycle energy, economic, public health, and environmental costs of various strategies for meeting future energy demand:

Q. Concerning Public Health, when incorporating full-cost accounting, why should Kentucky be particularly concerned about the negative health effects of coal-fired power plants?

A. Kentucky has about 21 operating coal-fired power plants, and gets approximately 95% of its electricity from burning coal. The burning of large amounts of coal creates air emissions with environmental and human health impacts, and the coal combustion waste often contains toxins with associated health risks. It is highly desirable for Kentucky to develop other sources of generating electricity which do not have the health and environmental impacts of coal-fired electricity.

Q. What are some of the main dangers to health posed by coal-fired power plants?

A. Coal-fired power plants emit a wide range of air pollutants whose harmful health effects are well established. These power plants are the nation's major source of sulfur dioxide, nitrogen oxides, and emit tons of fine particulates, arsenic, lead and chromium compounds, as well as hydrogen fluoride and hydrochloric acid each year.[1] Additionally, these facilities are the largest U.S. source of human-made mercury pollution, emitting approximately 48 tons per year. These compounds and chemicals are hazardous to human health, and they also contaminate the environment.

Coal-fired power plants contribute 59% of the nation's sulfur dioxide, 18% of total nitrous oxides, approximately 50% of particulates, and are the largest contributor of mercury.[2] The negative health impacts of these pollutants from coal-fired power plants have been thoroughly studied and documented.

To quote Abt Associates:

> Power plants are significant emitters of sulfur dioxide (SO_2) and nitrogen oxides (NO_x). In the Midwest, power plants are the largest contributors. These gases are harmful themselves, and they contribute to the formation of acid rain and particulate matter. Particulate matter (PM) reduces visibility, often producing a milky haze that blankets wide regions, and it is a serious public health problem. Over the past decade and more,

[1] Natural Resources Defense Council, Coal in a Changing Climate, February 2007, page 13
[2] http://www.sierraclub.org/cleanair/factsheets/power.asp.

> hundreds of studies worldwide have linked particulate matter to a wide range of adverse health effects in people of all ages, including premature death, chronic bronchitis, hospital admissions and asthma. The US EPA developed analytical methods that draw on this health research, combined with estimates of future air pollution emissions and air quality models, to prepare quantified estimates of... avoidable health effects...[3]

Many studies demonstrate that poor air quality results in increased asthma attacks, lung cancer, heart attacks, emergency room visits, and even mortality. One study estimates that every year in Kentucky alone, emissions from power plants cause nearly 1,000 deaths, over 600 hospitalizations, and 19,000 asthma attacks.[4] These costs are paid not only by the families of those who are ill, but by society at large as insurance companies and the government cover their medical costs and their employers suffer from work absences.

Q. How should the Public Service Commission respond to the degradation of air quality form coal-fired power plants and corresponding costs to the public of increased health care costs and premature deaths?

A. The Public Service Commission should consider the costs to the public of increased health care needs and early mortality caused and / or aggravated by pollutants from these power plants in making decisions such as whether to issue Certificates of Public Convenience and Necessity for new coal-fired generation.

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[3] Power Plant Emissions: Particulate Matter-Related Health Damages and the Benefits of Alternative Emission Reduction Scenarios, June 2004, Abt Associates Inc., Bethesda, MD, page 1
[4] Clean Air Task Force, Death, Disease & Dirty Power, Mortality and Health Damage Due to Air Pollution from Power Plants, October 2000, page 6.

Q. Can you provide more detail about these pollutants and their health and ecosystem effects?

A. Yes. We provide in the list below some of the common air pollutants emitted from coal power plants, along with information on how they are produced, the way they affect human and environmental health, and which people and areas are most vulnerable.

1. Mercury

U.S. EPA data confirms that coal-fired power plants are the single largest source of man-made mercury emissions in the United States.[5] In fact, of all air toxics emissions from coal-fired power plants, mercury is of the greatest environmental concern.[6]

The mercury emitted from coal-fired power plants is a hazardous neurotoxin and can be dangerous even in very small amounts. Though it is released into the air, it is ultimately deposited into water bodies downwind of the pollution source. Once in the water, it is converted into methyl mercury, a pollutant which accumulates in living tissues, including fish and any humans who consume contaminated fish.[7]

Mercury Health Effects:

This exposure is very dangerous to human health and can lead to serious birth defects, central nervous system damage, and diminished intelligence.[8]

Vulnerable Populations:

Women of childbearing age and members of communities that regularly eat contaminated fish, including subsistence fishermen and some American Indian populations, are particularly at risk.[9]

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[5] U.S. Environmental Protection Agency, "EPA to Regulate Mercury and Other Air Toxics Emissions from Coal- and Oil-Fired Power Plants." December 14, 2000.

[6], U.S. Environmental Protection Agency, "Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units – Final Report to Congress," 1998. Executive Summary.

[7] "EPA to Regulate Mercury"

[8] *Ibid.*

In fact, U.S. EPA data show that one in six women of childbearing age have high enough blood mercury levels to cause adverse health impacts to a developing fetus if were they pregnant.[10]

2. Sulfur Dioxide

Sulfur Dioxide(SO2) is a highly corrosive, invisible gas that is a natural component of coal. SO2 is produced as a part of the coal combustion process, and can travel long distances from its source. In clouds, SO2 reacts with water vapor to form sulfuric acid, causing rain, snow and fog to become more acidic in downwind areas. Sulfate particles, combined with nitrogen oxide and other molecules, can create small particles, or particulates, which have a variety of detrimental health effects (see below, Small Particulates).[11]

Health Effects:

While most of the health effects of SO2 occur when it forms small particles in the atmosphere, SO2 gas itself can de-stabilize heart rhythms, lead to low birth weights, and cause increased risk of infant death. Exposure to sulfur dioxide occurs from breathing it in the air. It affects the lungs and at high levels may result in burning of the nose and throat, breathing difficulties, and severe airway obstructions. Children who have breathed sulfur dioxide pollution may develop more breathing problems as they get older, may make more emergency room visits for treatment of wheezing fits, and may get more respiratory illnesses than other children. Children with asthma may be especially sensitive even to low concentrations of sulfur dioxide. [12]

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[9] *Ibid.*

[10] U.S. Environmental Protection Agency, "Methylmercury: Epidemiology Update," presentation by Kathryn Mahaffey, PhD at the National Forum on Contaminants in Fish, San Diego, CA, January 25-28, 2004.

[11] Agency for Toxic Substance and Disease Registry ("ATSDR"), **Public Health Statement for Sulfur Dioxide,** updated October 1, 2007, http://www.atsdr.cdc.gov/toxprofiles/phs116.html

[12] ATSDR, updated September 11, 2007. http://www.atsdr.cdc.gov/tfacts116.html

Vulnerable Populations and Ecosystems:

Since sulfur dioxide is primarily present as a gas, the general public is exposed to it mostly by breathing contaminated air. Levels of sulfur dioxide in the atmosphere vary from region to region and are mainly influenced by the intensity of industry and development.[13]

In the United States, roughly 2/3 of all SO_2 comes from electric power generation that relies on burning fossil fuels, like coal. Acid rain occurs when these gases react in the atmosphere with water, oxygen, and other chemicals to form various acidic compounds. The result is a mild solution of sulfuric acid and nitric acid.[14]Ecosystems that are particularly vulnerable to sulfur pollution include lakes, streams and forests that occur in areas where the bedrock is poorly buffered against acidity. Most of the high elevation areas in the Appalachians are vulnerable to sulfur pollution. For more on vulnerable populations, see below in the "Small Particulates" section.

3. Nitrogen Oxides

Nitrogen Oxides (NOx) are a family of chemical compounds including nitrogen oxide and nitrogen dioxide. Nitrogen oxides are formed from atmospheric nitrogen when coal and other fuels are burned.[15] In the United States, roughly 2 1/4 of all NO_x come from electric power generation that relies on burning fossil fuels, like coal. Acid rain occurs when these gases react in the atmosphere with water, oxygen, and other chemicals to form various acidic compounds. The result is a mild solution of sulfuric acid and nitric acid.[16]

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[13] ATSDR, **Public Health Statement for Sulfur Dioxide,** updated October 1, 2007 http://www.atsdr.cdc.gov/toxprofiles/phs116.html

[14] What is Acid Rain, EPA, http://www.epa.gov/acidrain/what/index.html

[15] ATSDR, **Medical Management Guidelines for Nitrogen Oxides,** updated September 24, 2007 http://www.atsdr.cdc.gov/MHMI/mmg175.html

[16] What is Acid Rain, EPA, http://www.epa.gov/acidrain/what/index.html

Health Effects:

Exposure to nitrogen oxides may result in changes of the pulmonary system including pulmonary edema, pneumonitis, bronchitis, bronchiolitis, emphysema, and possibly methemoglobinemia. Damage to, and subsequent scarring of, the bronchioles may result in a life-threatening episode several weeks following exposure involving cough, rapid, shallow breathing, rapid heartbeat, and inadequate oxygenation of the tissues.[17]

Vulnerable Populations and Ecosystems:

Populations that may be particularly sensitive to nitrogen oxides include asthmatics and those with chronic obstructive pulmonary disease or heart disease.[18] Ecosystems that are particularly vulnerable to the acidifying effects of nitrogen pollution are the same as those vulnerable to sulfur pollution: lakes, streams and forests that occur in areas where the bedrock is poorly buffered against acidity, such as most of the high elevation areas in the Appalachians.

4. Ozone

Ozone pollution results when hydrocarbons and nitrogen oxides emitted from motor vehicles and other sources react in the presence of sunlight. Ozone, the principle component of summer smog, is the most pervasive air pollutant in the United States.[19]

Health Effects:

Ozone is a lung irritant and major contributor to asthma in children. In addition to posing a major public health concern, ozone damages plants at relatively low concentrations, causing millions of dollars in losses to agriculture and decreasing the health of forests. Exposure to ozone can result

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[17] ATSDR, **Medical Management Guidelines for Nitrogen Oxides,** updated September 24, 2007 http://www.atsdr.cdc.gov/MHMI/mmg175.html.

[18] *Ibid.*

[19] CDC MMWR Weekly, April 28, 1995 / 44(16);309-312 http://www.cdc.gov/mmwr/preview/mmwrhtml/00036902.htm

in rapid shallow breathing, airway irritation, coughing, wheezing, shortness of breath and can instigate asthma attacks in those suffering from asthma.

Vulnerable Populations and Ecosystems:

Exposure to ozone has been associated with adverse health effects, including hospital and emergency department visits for asthma and other respiratory problems; reductions in lung function; and exercise-related wheezing, coughing, and chest tightness. Children are at higher risk for detrimental effects of ozone than adults because they spend more time outdoors during summer months when ozone levels are higher and because their lungs are still developing.[20]

5. Small Particulates

Small Particles, also called Particulate, is a general term used for a mixture of solid particles and liquid droplets found in the air. Some particles are large or dark enough to be seen as soot or smoke. Others are so small they can be detected only with an electron microscope. When particulate matter is breathed in, it can irritate and damage the lungs causing breathing problems. Fine particles are easily inhaled deeply into the lungs where they can be absorbed into the blood stream or remain embedded for long periods of time.[21].

Health Effects:

Small particulates are a major health hazard. Small particulates that are emitted from coal plants are composed primarily of sulfur dioxide, nitrogen oxides, and soot. The adverse health effects of particulates are linked directly to size, with small particulates, which mostly come from combustion, being the most dangerous. This is because the small particulates can be inhaled deeper into the lungs than larger ones, eventually settling into areas where the body's natural

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[20] *Ibid.*
[21] CDC The Air, http://www.atsdr.cdc.gov/general/theair.pdf

cleaning system cannot remove them.[22] In addition to asthma attacks, small particulates have been shown to acutely cause heart rate variability and heart attacks. Chronic exposure to small particulates results in cardiovascular disease, pneumonia, chronic obstructive pulmonary disease and premature death. [23]

Vulnerable Population:

The elderly, children, and people with asthma are most affected by small particle pollution, particularly in congested urban areas.

6. Carbon Dioxide

One of the primary pollutants from coal-fired power plants is carbon dioxide, a greenhouse gas that contributes to global climate change. A typical 500 MW coal plant emits 3.7 million tons of carbon dioxide into the atmosphere per year, and coal plants that we decide to build today will operate for another 60 years, emitting enormous amounts of carbon.[24]

Health Effects:

CO2 is the most important greenhouse gas responsible for global warming. Carbon dioxide can also cause asphyxiation and death in high concentrations - increasingly a concern as energy companies test methods of storing concentrated CO2 underground. Indirect health effects associated with global warming also include the spread of infectious disease, higher atmospheric ozone levels and increased heat and cold related illnesses. Like other greenhouse gases, CO2 will remain in the atmosphere long after it is released. The cumulative effect of greenhouse gases in the atmosphere requires immediate efforts to begin cutting emissions.

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[22] Western Resource Advocates, http://www.westernresources.org/energy/coal/smallpart.php
[23] *Ibid.*
[24] *Ibid.*

Vulnerable Populations and Ecosystems:

While scientists are only beginning to understand the enormity of the potential consequences of global warming, it is clear that all ecosystems and populations in the world are likely to be seriously affected. Possible effects include rising sea levels, increased incidence of disease in tropical areas, more destructive seasonal storms and the extinction of sensitive species.

Q. How widely recognized are the health risks associated with the proliferation of carbon dioxide and other Green House Gases?

A. An increasing number of major medical associations and public health agencies have formally recognized the risks to human health posed by climate change, and are calling for swift and meaningful action:

The Centers for Disease Control and Prevention (CDC), the nation's leading public health protection agency, has recognized climate change as a serious public health concern. In testimony before the Senate Committee on Environment and Public Works, CDC Director Dr. Julie Gerberding stated that "climate change is anticipated to have a broad range of impacts on the health of Americans and on the nation's public health infiastructure."[25]

In a letter addressed to Senator Barbara Boxer dated October 22, 2007, Dr. David Helmann, Assistant Director-General of Communicable Diseases at the World Health Organization(WHO) states that, "WHO has concluded that climate change " brings major new challenges to health security, and increase the costs and difficulties of disease control."

During its 2007 annual meeting, the Association of State and Territorial Health Officials (ASTHO) unanimously adopted a position statement titled," Climate Change and Public Health," which "recognizes that climate change has serious far reaching implications for the health of this

[25] Testimony of Dr. Julie Gerberding, Director, Centers for Disease Control and Prevention, before the U.S. Senate Committee on Environment and Public Works (October 23, 2007)

and future generations."[26] The National Association of County and City Health Officials (NACCHO), in an official statement of policy very similar to that approved by ASTHO, acknowledged that "climate change has serious far-reaching health implications for this and future generations."[27]

For more than 10 years the American Public Health Association (APHA) has recognized the potential human health consequences of climate change and has recommended "precautionary primary preventive measures to avert climate change, including reduction of greenhouse gas emissions... through appropriate energy and land use policies."[28] In a recent letter sent to Senator Barbara Boxer, APHA Executive Director Dr. Georges Benjamin writes," the public health community has a critical role to play in advocating for both mitigation of climate change and adaptation to the negative public health effects that will result."[29]

Physicians for Social Responsibility has issued a "Call to Action"[30] urging members of Congress to acknowledge the growing health threats posed by global warming and to enact mandatory controls on greenhouse gas emissions. The Call to Action" has been signed by 134 distinguished physicians, including professors from 15 medical schools, a former governor, two Nobel Laureates and former Surgeon General David Satcher. The" Call to Action" is also supported by the American Nurses Association, the American Public Health Association and the Association of Pediatric Nurse Practitioners. Together, these groups represent more than 200,000 physicians, nurses, and public health professionals around the country.

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[26] Position Statement of the Association of State and Territorial Health Officials, Climate Change and Public Health (2007). Available at: http://www.astho.ors/.

[27] National Association of County and City Health officials (NACCHO), statement of Policy: Local Public Health Role in Addressing Climate Change (Adopted July I 1, 2007).

[28] American Public Health Association (APHA), Global Climate Change, Policy Number: 9510 (1995).

[29] Letter from Dr. Georges Benjamin, Executive Director, American Public Health Association to Senator Barbara Boxer, Chair, U.S. Senate Committee on Environment and Public Works (Oct.22,2007).

[30] Physicians for Social Responsibility, Medical Leadership on Global Warming: A Call to Action (2007)

Q. Having discussed some of the main health problems associated with coal-fired power plants, is it possible to put dollar amounts on the morbidity and mortality resulting from the use of coal to generate electricity?

A. Yes, researchers and economists have developed heath cost estimates for the operation of coal-fired power plants.

A number of landmark studies by the Harvard School of Public Health and others firmly established the linkage between power plant emissions, premature mortality, asthma attacks, and other health issues such as cardiovascular impacts.[31]

Abt Associates built on that work, using the data from the research studies to develop the expected number of deaths, hospitalizations, and asthma attacks which can be attributed to the increase in emissions from each additional coal-fired power plant.[32]

Researchers and economists have combined the information about death and disease from power plants with cost data for such impacts to develop heath cost estimates for the operation of power plants. Many studies demonstrate that poor air quality results in increased asthma attacks, lung cancer, heart attacks, emergency room visits, and even mortality. One study estimates that every year in Kentucky alone, emissions from power plants cause nearly 1,000 deaths, over 600

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[31] See Estimating the Mortality Impacts of Particulate Matter: What Can Be Learned from Between-Study Variability?, Jonathan I. Levy, James K. Hammitt, and John D. Spengler, Harvard School of Public Health, Boston, Mass.; Environmental Health Perspectives • Volume 108, Number 2, February 2000;

Modeling the Benefits of Power Plant Emission Controls in Massachusetts, Jonathan I. Levy, and John D. Spengler, Harvard School of Public Health, Boston, Mass.; Journal of the Air & Waste Management Association, Vol. 52, January 2002; and

The Importance of Population Susceptibility for Air Pollution Risk Assessment: A Case Study of Power Plants Near Washington, DC, Jonathan I. Levy, Susan L. Greco, and John D. Spengler; Department of Environmental Health, Harvard School of Public Health, Boston, Mass.; Environmental Health Perspectives, Volume 110, Number 12, December 2002

[32] Power Plant Emissions: Particulate Matter-Related Health Damages and the Benefits of Alternative Emission Reduction Scenarios, June 2004, Abt Associates Inc., Bethesda, MD.

hospitalizations, and 19,000 asthma attacks.[33] Using the EPA's recommended figure of $6 million per mortality,[34] that equals a cost to Kentucky of $6 billion every year of premature deaths alone. The costs of the hospitalizations and asthma attacks are an additional cost each year. 745 premature deaths annually in Kentucky can be attributed to particulates alone, with the other pollutants contributing additional death and disease.[35]

In the study Premature Mortality from Proposed New Coal-fired Power Plants in Texas, MSB Energy Associates performed an analysis using the Environmental Protection Agency's published methodology for calculating the health benefits of air quality improvements.[36] The emissions figures used for the analysis were collated by Public Citizen's Texas office and the Sustainable Energy and Economic Development (SEED) Coalition from the permit applications filed for each power plant or unit.

This study found that 240 premature deaths per year could be expected for emissions of 67, 730 tons of SOx and 33,521 tons of NOx from the 19 proposed coal-fired power plants in Texas. (That is 0.00237037 deaths per ton of pollutant). They developed economic values for those premature deaths using a figure of $6 million per premature death, which they obtained from EPA papers.[37]. Using that value, the annual cost in mortality of the proposed plants is $1,439,140,000 per year. ($1.439 billion). The cost over the expected lifetimes of the plants is

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[33] Death, Disease & Dirty Power, Mortality and Health Damage Due to Air Pollution from Power Plants, Clean Air Task Force, October 2000, page 6.

[34] Environmental Protection Agency, *Guidelines for Preparing Economic Analyses,* (September 2000). Http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html/$file/Guidelines.pdf.

[35] Dirty Air, Dirty Power: Mortality and Health Damage Due to Air Pollution from Power Plants, Conrad G. Schneider, MSB Energy Associates, Mount Vernon Printing, June 2004

[36] U.S. Environmental Protection Agency Internal Memorandum, Bryan Hubbell to Sam Napolitano, July 2, 2001.

[37] The DSS Management Consultants' Ontario study showed a standard EPA value of $7.9 million per premature death. Op cit., page 22, with reference to US Environmental Protection Agency (EPA). 2005. Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical information OAQPS Staff Paper, Second draft, January, 2005. Office of Air Quality Planning and Standards, Research Triangle Park, NC. http://www.epa.gov/ttn/naaqs/standards/pm/data/pm_staff_paper_2nddraft.pdf

nearly $72 billion.[38] That is a dollar cost of $14,222 per ton of pollutant from just these two pollutants. It does not include the adverse health impacts from fine particulates or mercury. The Cost Benefit Analysis study by DSS Management Consultants Inc. for the Ontario Ministry of Energy in April 2005 included the cost of long-term exposure to emissions from coal-fired plants, although only including data for exposure to ozone and fine particulates. The study did not include the effects of lead, arsenic, chromium compounds, hydrogen fluoride and hydrochloric acid. It found that the exposures to ozone and fine particulates do cause premature deaths, hospital admissions, emergency room visits, and minor illnesses. It also found that the costs from long-term exposure were more than six times those from premature deaths alone. Using the levelized financial cost of electricity, the study found that the environmental and health costs accounted for 77% of total generation costs, i.e., $0.126 /kWh [CAD 2005 dollars] out of total net present value cost of $0.164 CAD/kWh for coal-fired generation in Ontario. (Shown as $164 CAD/MWh in Table 1-1). The health cost portion of this net present value cost is $0.113/kWh.[39] This study is very significant, because Ontario decided to phase out all coal-fired generation as a result of it.

Q. Are there particular health impacts on children?

A. The Minnesota Center for Environmental Advocacy (MCEA) released a study in June 2006 that quantified environmental-related childhood disease. The study applied actual Minnesota data on rates of disease and costs whenever those data were available, extrapolating from national data when not. The researchers used Landrigan's "environmentally attributable

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[38] Premature Mortality from Proposed New Coal-fired Power Plants in Texas. A research brief by Public Citizen's Texas Office and the Sustainable Energy and Economic Development (SEED) Coalition, November 2006

[39] Cost Benefit Analysis: Replacing Ontario's Coal-Fired Electricity Generation, by DSS Management Consultants Inc., April 2005, for Ontario Ministry of Energy. Page 3.

fraction" methodology to estimate the portion of costs for these childhood diseases that could conservatively be attributed to environmental pollutant exposures.

The study states:

> "These *cost estimates are very conservative*, so the impacts on individuals, society and taxpayers are likely much greater. This information has *value for public policy because it requires that we account for long-term costs to society, a perspective too often left out of policy analyses.* Since environmental contributors to childhood diseases are largely preventable, public policies that prevent exposures and pollution provide significant benefits for individuals and for society. We recommend the implementation of policies to reduce or eliminate some of the key environmental contributors to childhood illnesses in Minnesota..." *(emphasis added)*[40]

The study points out that not only is there a moral obligation to protect our children from preventable disease, but that it also makes good economic sense.[41] The enormous economic costs from environmental pollution include not only the health care costs, but lost productivity for parents and other affected adults as well. The calculated cost estimates are:

- certain childhood environmental diseases cost the U.S. as a whole an estimated **$54.9 billion/year** in 1997 dollars;
- Washington State estimated environmental diseases cost $1.875 billion;
- Massachusetts estimated $1.6 billion for childhood diseases; and
- Montana, which included adults, estimated $404.6 million/year.

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[40] The Price of Pollution: Cost Estimates of Environment-Related Childhood Disease in Minnesota, Minnesota Center for Environmental Advocacy, June 2006, p. 3.

[41] *Ibid.*, p. 3.

- Minnesota estimated costs total $1.569 billion per year42

Q. What are some of the environmental factors which should be incorporated in good full-cost accounting?

A. One of the primary adverse environmental impacts of our coal-fired electricity system is the damage from coal mining.

Coal mining can cause irreparable harm to the natural landscape, both during mining and after. Coal is mined from the earth by one of two mining techniques. Surface mining, which is used for coal that is relatively near the surface of the ground, involves scraping away earth and rocks to access coal seams buried below. Underground mining is used for coal that is buried deep in the earth, and usually involves a system of tunnels and underground rooms. Trees, plants, and topsoil are cleared from the mining area, destroying forests and wildlife habitat, encouraging soil erosion and floods, and stirring up dust pollution that can cause respiratory problems in local communities. Underground mining, including an intensive method known as longwall mining, leaves behind empty underground spaces which can collapse and cause the land above to sink. Known as subsidence, this process can cause serious structural damage to homes, buildings, and roads when the land collapses beneath them. Mining can also lower the water table and change the flow of groundwater and streams.

Studies show that aquatic communities downstream of surface coal mining operations and valley fills are affected by mining. Chemical parameters (sulfates, specific conductance, selenium) are elevated downstream of mining or valley fills in some streams and waterways. Stream reaches below mining and valley fills may have changes in substrate particle size distribution from increased fine material due to sedimentation. For example, the Kentucky Division of Water's

[42] *Ibid,* p. 4 and page 12, also citing many other studies too numerous to list on page 16.

2006 Section 303(d) List of Impaired Waters reports that 27 miles of the Big Sandy River in Lawrence County in eastern Kentucky is impaired for aquatic life due to sedimentation/siltation and the suspected source of the sediment/silt is resource extraction. Similarly, the Section 303(d) Listing states that 710 acres in the Carr Fork Reservoir in Knott County is impaired as a result of sediment and silt due to surface mining.

Coal mining causes a variety of serious and harmful impacts. It can cause cracking of foundations and walls of nearby houses and buildings. Coal mining contaminates water supplies. In 2004, coal mines reported the release of more than 13 million pounds of toxic chemicals to landfills or directly to streams, including emissions of ammonia, arsenic, chlorine, chromium and lead. Coal-mining waste, acids and toxic metals can kill stream life and make water supplies undrinkable. Acid mine drainage from waste coal and other rocks that are cast aside during mining and from abandoned mines that fill with water that becomes acidic and mixes with heavy metals and minerals combines with groundwater and streams, causing water pollution and damaging soils.

Acid mine drainage can harm plants, animals, and humans. Water contamination also arises from wastes generated by the processing and combustion of coal. Across the country, coal ash and sludge is dumped into landfills and old mining pits, where it can leach toxic materials into the groundwater. In Appalachia, a form of surface mining commonly referred to as "mountaintop removal" has leveled many hills and filled valleys with the resulting debris. Between 1985 and 2001, mountaintop mining polluted or completely buried more than 1,200 miles of streams and destroyed 7 percent of the region's forests. According to EPA analysis, if mountaintop mining continues unchecked, it will destroy more than 1.4 million acres of land and harm wildlife and disrupt dozens of communities. Mountaintop removal is widely recognized, even by government agencies that regulate it, as one of the most environmentally devastating practices allowed under U.S. law. According to the U.S. Environmental Protection Agency:

> "The impact of mountaintop removal on nearby communities is devastating. Dynamite blasts needed to splinter rock strata are so strong they crack the foundations and walls of houses. Mining dries up an average of 100 wells a year and contaminates water in others. In many coalfield communities, the purity and availability of drinking water are keen concerns."

This is occurring right at the heart of one of the nation's main hotspots of biological diversity. Eastern Kentucky and the surrounding area contain some of the highest levels of biological diversity in the nation.

The major governmental report on mountaintop removal issued by the Environmental Protection Agency reported significant environmental impacts from mountaintop removal. Here are some of the impacts and concerns expressed in the final EPA report:

* More than 7 percent of Appalachian forests have been cut down and more than 1,200 miles of streams across the region have been buried or polluted between 1985 and 2001.
* Over 1000 miles of streams have been permitted to be buried in valley fills. (for scale, this is a greater distance than the length of the entire Ohio River).
* "... studies found that the natural return of forests to mountaintop mines reclaimed with grasses under hay and pasture or wildlife post-mining land uses occurs very slowly. Full reforestation across a large mine site in such cases may not occur for hundreds of years."
* "Because it is difficult to intercept groundwater flow, it is difficult to reconstruct free flowing streams at mountaintop removal sites."
* "Stream chemistry monitoring efforts show significant increases in conductivity,

> hardness, sulfate, and selenium concentrations downstream of [mountaintop removal] operations."

In addition to the environmental impacts of strip mining mountains and burying streams with mining waste, coal mining often requires the building of giant sludge dams, which can hold billions of gallons of toxic coal sludge behind un-reinforced earthen dams. These slurries are necessary because coal requires extensive washing to separate the coal from debris and residues. As of 2000, there were more than 600 sludge impoundments across the coalfields. Chemical analyses of this sludge indicate it contains large amounts of arsenic, mercury, lead, copper, and chromium, among other toxins, which eventually seep into the drinking water supply of nearby communities. Even worse than this seepage, however, is the threat of a dam break.

The most recent major sludge dam breach was in Martin County, Kentucky, in 2000, which the EPA called the worst environmental disaster in the history of the Southeast. When the sludge dam breached, more than 300 million gallons of toxic sludge (about 30 times the amount of oil released in the Exxon Valdez oil spill) poured into tributaries of the Big Sandy River, killing virtually all aquatic life for 70 miles downstream of the spill.

In addition, many local residents are dependent on groundwater, which can be fouled by mining waste or "lost" as a result of mining.

Other types of pollution are also caused by coal mining, including different types of air pollution. Explosives used during underground and surface mining release carbon monoxide pollution, a health threat for workers.

Coal mining is also harmful to the health of the coal miner. Besides the dangers of accidental disability or death, mining and coal washing both stir up small dust and coal particles, which combine with other chemicals in the air and can cause serious and potentially fatal respiratory problems to mine workers. A report released in August 2006 by the Centers for Disease Control and Prevention (CDC), the nation's leading public health protection agency, showed an alarming resurgence of occupational lung disease, commonly called Black Lung, in coal miners in the Appalachian area, with many miners developing a progressive form of Black Lung at a much higher rate than expected.

Q. What are human costs of mining coal that should be included as externalitites, even if they can not be adequately quantified?

A. A consideration of the externalities resulting from the use of coal to produce electricity must include establishing prices for human costs beyond just health care. For example, a partial list would include deaths, injuries, and mental anguish resulting from inadequate enforcement of laws regulating the weight, speed and aggressiveness of coal trucks.

Q. What are coal waste products from combusting coal in electric generating plants?

A. "... wastes include parts of the coal that do not fully burn during generation like fly ash (from the smokestacks) and bottom ash (from the bottom of the boiler).[43] They also include the particles and chemicals trapped by air pollution controls, like scrubber sludge or flue gas desulfurization sludge. Finally, they include many "low-volume"wastes, including runoff from coal reserve piles and liquid wastes that are formed during cleaning and routine operations.[44]

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[43] U.S. Office of Surface Mining, Mid-Continent Region, "CCB Information Network Website," accessed May 2007 at http://www.mcrcc.osmre.gov/ ccb/ The treatment of coal waste presented here is directly taken from *The Dirty Truth About Coal: Why Yesterday's Technology Should Not Be Part of Tomorrow's Energy Future.* http://www.sierraclub.org/coal/dirtytruth/report/

[44] 111 U.S. Environmental Protection Agency, "Report to Congress: Wastes from the Combustion of Fossil Fuels Volume 2," 1999.

Q. Are problems associated with coal waste products likely to increase or decrease?

A. … [t]he amount of wastes and their toxicity are expected to grow significantly every year as dirty old coal-fired power plants are forced to clean up and install modern pollution controls that convert air pollutants to solid wastes.[45]

Q. What are the health and environmental impacts of the waste products of coal combustion?

A. To quote the National Research Council:

> … [l]eaking coal wastes and polluted runoffs can be extremely toxic and dangerous. Containing elements like lead, mercury, and arsenic in toxic doses,[46] coal combustion wastes and their pollution have been shown to cause illness and death in plants and animals. Direct exposure to these toxins and others causes lower rates of reproduction, tissue disease, slower development, and even death.[47] These damages are significant both individually and collectively, where coal waste contamination has been linked to changes in wildlife concentrations and disruptions in entire ecosystems. Vegetation growing on or nearby coal waste disposal sites also exhibit signs of damage, including reduced growth and die offs.[48] These toxic compounds can accumulate in exposed animals and plants, causing the toxics to make their way up the food chain when they are eaten.[49]

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[45] Thomas J. Feeley III, "Coal Combustion Products—Challenges to Increased Utilization," presentation to EUCI's Coal Combustion Product Optimization Conference, August 31- September 1, 2005.
[46] National Research Council, "Managing Coal Combustion Residues in Mines," Washington DC, 2006.
[47] *Ibid.*
[48] *Ibid.*
[49] *Ibid.*

The same toxics that harm plants and wildlife also pose serious health risks to people.[50] People are exposed to these wastes through contact with contaminated soils, inhaling polluted dust, and eating plants and animals that have been exposed.[51] Some coal combustion wastes are applied directly to agricultural fields, and evidence suggests that subsistence farmers and their families may have greater risks of exposure than other people.[52]

However, the single greatest threat of human exposure is from polluted groundwater and drinking waters sources.[53] The toxins found in coal wastes have been linked to organ disease, increased cancer, respiratory illness, neurological damage, and developmental problems.[54] Additionally, children who are exposed to coal combustion waste toxins are more likely to experience adverse reactions than adults.[55] In the mid-90s, the EPA estimated that more than 21 million people, including more than six million children, lived within five miles of a coal-fired power plant,[56] a daunting figure considering that water wells have had to be closed due to groundwater contamination from coal combustion waste.[57]

McKeown wrote in 2007:

> A significant factor in coal combustion waste pollution is the lack of stringent federal regulations and safety requirements. In 2000, the EPA reaffirmed a 20 year old decision not to regulate coal combustion wastes as hazardous, choosing

[50] U.S. Environmental Protection Agency, "Report to Congress: Wastes from the Combustion of Fossil Fuels Volume 2," 1999.
[51] *Ibid.*
[52] *Ibid.*
[53] Ibid.
[54] National Research Council, "Managing Coal Combustion Residues in Mines," 2006.
[55] U.S. Environmental Protection Agency, "Report to Congress: Wastes from the Combustion of Fossil Fuels Volume 2," 1999.
[56] *Ibid.*
[57] U.S. Environmental Protection Agency, "Chisman Creek Case Study," March 1999, accessed at http://www.epa.gov/superfund/programs/recycle/success/casestud/chiscsi.htm

to continue sidestepping meaningful protections by classifying them as "special wastes." One indication of the inadequacy of this approach is that many of these waste facilities continue to operate without any type of lining to prevent leakage, including about half of the landfills and over three fourths of the impoundments.[58] Furthermore, most states do not require groundwater monitoring, and many do not require waste facilities to obtain state permits....[59] Most coal combustion wastes are stored indefinitely, and may continue to jeopardize the environment and humans for generations to come. Ironically, rather than returning neatly to its buried origins, coal that has passed through this life cycle is in the end converted into something more dangerous—and perhaps longer lasting.

Q. What are some economic costs which should be included in full cost accounting beyond the factors that have historically been incorporated in rate setting and certificating of new generation?

A. One major factor which must be incorporated is the expected regulation of greenhouse gas emissions.

Q. How will regulation of greenhouse gases affect the cost of electricity?

A. The emission of greenhouse gases, including carbon dioxide, is a primary contributor to climate change. Coal-fired power plants account for nearly 40% of the nation's carbon dioxide emissions.[60] The regulation of global warming gases, including carbon dioxide, will significantly increase the cost of coal-fired power and the rates passed along to utility customers.

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[58] U.S. Environmental Protection Agency, "Report to Congress: Wastes from the Combustion of Fossil Fuels Volume I," 1999.

[59] U.S. Environmental Protection Agency and Department of Energy, "Coal Combustion Waste Management at Landfills and Surface Impoundments: 1994-2004," August 2006.

[60] Sierra Club, The Dirty Truth about *Coal*, June 2007, page 3.

All observers agree carbon dioxide, as a significant contributor to climate change, is certain to be subject to regulation in the near future. Members of Congress and the Senate have introduced numerous bills, amendments, and resolutions to address global warming. Utility companies and state regulatory agencies have acknowledged looming carbon dioxide regulation. Experts convened by the Coalition for Environmentally Responsible Economies (CERES) recently produced an action plan with a series of specific steps by investors to address the growing risks and opportunities from climate change. The plan included: "Encourage Wall Street analysts, rating agencies and investment banks to analyze and report on the potential impacts of foreseeable long-term carbon costs, in the range of $20 to $40 per metric ton of CO2, particularly on carbon-intensive investments such as new coal-fired power plants, oil shale, tar sands and coal-to-liquid projects..."[61] Pacificorp has forecast a 50% probability of carbon regulation by 2010 and a 75% likelihood by 2011.[62] Investors and financial management companies are recognizing the risk carbon dioxide poses[63]. James Rogers, CEO of Duke Energy testified before the Senate, "[I]t's impossible to build new coal baseload power plants since the economics cannot be determined without knowing what requirements the plant will face on carbon."[64] Michael Morris, chairman and chief executive of American Electric Power recently

[61] Ceres, U.S. and European Investors Tackle Climate Change Risks and Opportunities, http://www.ceres.org/NETCOMMUNITY/Page.aspx?pid=838&srcid=705

[62] Direct Testimony of Schlissel and Sommer before the South Dakota Public Utilities Commission, May 2006, page 9.

[63] Citigroup, Coal: Missing the Window, *Downgrading on Stubborn Stockpiles, Hostile Politics*, July 18, 2007, page 3 (In support of its decision to downgrade Coal stock across the board, "[P]rophesies of a new wave of Coal-fired generation have vaporized, while clean Coal technologies such as IGCC with carbon capture and Coal-to-Liquids remain a decade away, or more."), Schlissel, page 4, quoting James Rogers, CEO of Duke Energy, "[I]n private, 80-85% of my peers think carbon regulation is coming within ten years."

[64] Schlissel, page 4.

acknowledged that carbon dioxide emissions curbing could result in power price increases of 50% or more.[65]

Some of the companies believe that there is a high likelihood of federal regulation of greenhouse gas emissions within their planning period. For example, Pacificorp states a 50% probability of a CO_2 limit starting in 2010 and a 75% probability starting in 2011. The Northwest Power and Conservation Council models a 67% probability of federal regulation in the twenty-year planning period ending 2025 in its resource plan. Northwest Energy states that CO_2 taxes "are no longer a remote possibility."

While cost estimates for carbon regulation vary, it is certain that carbon dioxide regulation will add significant costs to coal-fired power production. Recently PacifiCorp dropped plans for two coal-fired power plants in Utah, citing the many unknowns in assessing the costs and objections on global warming grounds from a major customer: the city of Los Angeles.

Three of the nation's largest investment banks announced on February 4, 2008, that they had developed new environmental standards to help lenders evaluate risks associated with investments in coal-fired power plants. Citigroup Inc., JPMorgan Chase & Co. and Morgan Stanley said they had produced 'The Carbon Principles' that will make it more difficult for new U.S. coal-fired power plants to secure financing. The focus of the principles will be to steer power companies away from plants that emit high levels of carbon dioxide -- a greenhouse gas -- and to focus on new, cleaner and renewable technologies.

Some thoughtful work on the question of anticipating CO2 costs has been done by Synapse Energy Economics in Cambridge, Massachusetts. Their analysis supports a mid-range projection of $25/ton in 2020, with a low case of $10, and a high case of $40, with the cost continuing to

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[65] Wall Street Journal, *Burning Problem: Inside Messy Reality of Cutting CO2 Output* by Rebecca Smith, July 12, 2007, page A1.

rise rapidly thereafter.[66] It seems clear that every $10 of CO2 cost will add about $11 to electric generation cost per MWh.

It is widely expected that future CO_2 regulations will take the form of a "cap-and-trade" system, similar to the national law for controlling the sulfur dioxide (SO_2) emissions that cause acid rain. Such a system would establish a national cap on CO_2 emissions, and power plant operators would have to own an "allowance" for each ton of CO_2 they emit. Operators could buy and sell these allowances for a price established by market forces. Economists believe such a cap-and-trade system would provide the flexibility and incentives to meet a given CO_2 cap at the lowest cost. Utilities are increasingly quantifying the risk they face from future CO_2 allowance costs in their planning documents. Financial institutions are increasingly concerned about the potential future costs associated with CO2 emissions from power plants as they rate the financial soundness of utilities.

Q. Have any other researchers developed levelized costs per KWh that we can expect once carbon emissions are regulated?

A. An MIT study suggest that carbon trading might sell at $30 - $50 per ton of carbon-dioxide equivalents, translating into $0.02 to $0.04 per kilowatt-hour and increasing consumer bills by 25-50%.[67]

Q. What factors should be considered in evaluating the cost of carbon emissions control?

A. The long term impact of carbon emissions and the costs of carbon dioxide which should be addressed by utilities and the Public Service Commission include:

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[66] Climate Change and Power: Carbon Dioxide Emissions Costs and Electricity Resource Planning, Synapse Energy Economics.

[67] Wall Street Journal, page A1.

1. The volume of greenhouse gases emitted by the existing and proposed facilities;

2. Whether it is possible to reduce those emissions beyond those currently contemplated:

3, Whether or how greenhouse gases will be collected and stored;

4. Whether there is equipment available that would permit the collection and storage of greenhouse gases;

5. The potential cost of collecting and storing greenhouse gases, and the impact of these costs on the project;

6. Whether the adoption of a requirement that greenhouse gases be reduced or captured would affect the technology selected;

7. Whether a geologic investigation of storage potential on the site should be required before certification of a generating facility;

8. Whether there exist potential opportunities for multi-pollutant emissions reductions associated with CO_2 controls; [and]

9. Whether and to what extent the construction and operation of the project will effect a reasonable balance between the need for the facility and the impacts on air and water quality, fish and wildlife, water resources, and other natural resources of the state resulting from the construction and operation [of the facility.]

Q. Are the fuel costs and life cycle costs of electricity produced from coal rapidly increasing?

A. The cost of coal on the market is itself rapidly escalating. According to a February 5th *Forbes* article, coal prices may double within the next year.[68]

[68] *Coal Prices May Double In Coming Year.* Vivian Wai-yin Kwok, 02.05.08, Forbes. http://www.forbes.com/2008/02/05/coal-supply-pressures-markets-comm-cx_vk_0205markets01.html?partner=email

Q. Are there other factors rapidly increasing the life cycle costs of electricity produced from coal?

A. Yes. The rising cost of complying with the Clean Air Interstate Rule and mercury regulations are just two examples of the regulations which produce increasing costs associated with fossil-fuel generation of electricity. The cost of mercury controls is now uncertain due to the recent Supreme Court decision striking down the Clean Air Mercury Rule as incorrectly formulated, but there is a reasonable expectation that the replacement mercury regulations will be at least as expensive for coal-fired plant operators as the rejected CAMR would have been.

Q. Are there additional factors which can be expected to increase the life cycle costs of electricity produced from coal?

A. Yes. There is every reason to expect that more of the negative externalities of electricity produced from coal which are not currently monetized and internalized, such as many of those listed above, will be required to have dollar values set on them and their costs included in full-cost and life cycle calculations.

Q. Environmental Costs: What is the traditional definition of life-cycle analysis, and what would be a more proper definition which incorporates environmental externalities in full cost accounting for coal-based electric generation?

A. By the traditional definition, life cycle cost analysis

> … consists of an evaluation of potential environmental impacts of a product through its life cycle "from cradle to grave". Traditional LCA involves a complete inventory of resource inputs and outputs in all steps of the production including resource exploration and production, fuel processing, transportation, use, waste treatment, storage and disposal. In addition, indirect emissions originating from

materials manufacturing, the provision and use of infrastructure, and from energy inputs can be incorporated. The second step of traditional LCA is the environmental assessment of the impacts. This can cover burdens on the environment and impacts of resource depletion.[69]

A full list of environmental cost of using coal to produce electricity would have to include the following:

a. Restoring the aquifers disrupted by blasting for mountain top removal and valley fill (MTR/VF), including feed to lakes, streams and wells.
b. Providing the water retention and purification services formerly provided by the forest and mountaintops removed by MTR/VF.
c. Providing the carbon sequestration service formerly provided by those forests.
d. Providing flood control for the rapid discharge of waters from the valley fill.
e. Providing for removal by use or disposal of the fines and washings of coal in the coal fields,
f. Providing repair of damage to public roadways used by coal hauling trucks.
g. Providing repair to residences and other non-coal production structures damaged by blasting during mining.
h. Providing repair to sewage piping and tank systems, and water supply piping.
i. Providing restoration of riparian biota to creeks, streams, and lakes damaged by discharge of coal, coal fines, other mining sediment, or overburden material.
j. Removing from the exhaust of coal-fired facilities all materials that are <u>indirectly</u> toxic or hazardous to plants or animals in the air-shed, such as CO2.

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[69] "ENERGY POLICY AND EXTERNALITIES: THE LIFE CYCLE ANALYSIS APPROACH." P A R I S , 1 5 - 1 6 N O V E M B E R 2 0 0 1 http://www.iea.org/dbtw-wpd/Textbase/work/2001/externalities/BACKGR.PDF

k. Restoring communities of plants and animals that are damaged directly by the mining activity.

l. Removing, by use or safe disposal, the ash left from coal combustion.

m. Compensating for the local micro-climate impact of the massive release of water vapors from cooling towers at coal-fired electrical generators.

n. An appropriate share of the real cost of maintaining roadbed for railway transport of coal from mine to point of use.

o. An appropriate share of the real cost of maintaining locks and dams for the water transport of coal from mine to point of use.

p. A share of the impact on river and riparian biota from using rivers as barge ways.

q. Dredging and other sediment control and removal efforts in rivers fed by the mining area for the excess sediment carried into it from the more rapid water discharge from mined areas compared to pre-mining.

r. Restoration of biota in streams and rivers where mining is in the watershed that is damaged by such excess sediment.

Conclusion

We submit that the PSC Should Set Standard Values for External Costs to be Included in electric utility IRP development, and to be used in Certificate of Convenience and Necessity proceedings.

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

AN INVESTIGATION OF THE ENERGY AND REGULATORY ISSUES IN SECTION 50 OF KENTUCKY'S 2007 ENERGY ACT	))))	CASE NO. 2007-00477

AFFIDAVIT

STATE OF KENTUCKY)
)
COUNTY OF JEFFERSON)

Wallace McMullen being duly sworn, states that he has read the foregoing prepared testimony and that he would respond in the same manner to the questions if so asked upon taking the stand, and that the matters and things set forth therein are true and correct to the best of his knowledge, information and belief.

Wallace McMullen

Subscribed and sworn before me on this 27 day of February, 2008.

Notary Public

My Commission expires: 07/02/2011

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

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AN INVESTIGATION OF THE ENERGY AND REGULATORY ISSUES IN SECTION 50 OF KENTUCKY'S 2007 ENERGY ACT	))))	CASE NO. 2007-00477

Direct Testimony of Andy McDonald

On Behalf of the Sierra Club

February 29, 2008

Q. Please state your name and address for the record:

A. Andrew S. McDonald, 2235 Gregory Woods Rd., Frankfort, KY 40601.

Q. What is your formal education?

A. B.A. Philosophy, University at Buffalo; M.Sc. Sustainable Systems, Slippery Rock University of Pennsylvania.

Q. What is your background pertaining to the issues which are addressed in this case?

A. I have been employed by the non-profit organization Appalachia - Science in the Public Interest (ASPI) since 2003 and have been the Coordinator of their project, the Kentucky Solar Partnership (KSP), since 2004. I have been actively engaged in studying and working with energy policies throughout this time period, with an interest in understanding strategies for increasing the use of energy efficiency and renewable energy resources. I have been an active member of the Energy Efficiency Working Group since its inception several years ago (this is a collaborative, volunteer effort between environmental and public interest organizations, electric and gas utilities, state agencies and other interested parties). I have served on the Governor's Task Force for Energy Efficiency and have contributed comments to the Governor's office during the development of Governor Fletcher's state energy policy.

In 2007 I was co-Chair of the Frankfort Mayor's Task Force on Energy Efficiency and Climate Change. In January 2007 I participated in a training provided by Al Gore concerning climate change science and politics and public education about the issue and I have made numerous public presentations about climate change since that time.

Through the KSP I have developed a low-interest loan program available to Eastern Kentucky residents for solar water heater purchases (in partnership with the Mountain Association for

Community Economic Development). In partnership with the Energy Center at the University of Louisville I developed and managed a pilot rebate program for solar water heaters in 2006- 2007. I am the co-author (with Joshua Bills) of The Kentucky Solar Energy Guide (2006). I am the co-author (with Susan Zinga) of A Portfolio of Energy Efficiency and Renewable Energy Options for the East Kentucky Power Cooperative (2008).

Q. Please discuss the issues in this case set forth in Section 50 of the Kentucky 2007 Energy Act that pertain to

2. Encouraging *Diversification Of Utility Energy Portfolios Through The Use Of Renewables and Distributed* Generation

Q. Does the PSC presently have any statutes or regulations which encourage diversification of utility energy portfolios through the use of renewables and distributed generation?

A. To our knowledge the Kentucky PSC does not have policies which explicitly or implicitly encourage the diversification of utility energy portfolios through the use of renewables and distributed generation. This serves as an impediment to the diversification of Kentucky's energy portfolio and the use of renewables. While the PSC follows a mandate to ensure the efficient and cost-effective provision of energy to Kentucky ratepayers, it has no explicit mandate to encourage the use and development of renewable energy and distributed generation. The effect is that, at best, all energy sources are considered equivalent apart from their financial costs, and those costs are defined very narrowly in a manner which overvalues fossil fuels and undervalues renewables (a point which we elaborate on in Section 3, concerning Full Cost Accounting).

A. This situation fails to recognize the multiple societal benefits offered by renewables and distributed generation (discussed in section 2.2.). These benefits are so numerous and powerful that it would be appropriate for the PSC and Legislature to develop statutes and policies that would not only encourage but mandate the diversification of utility energy portfolios through the use of renewables and distributed generation.

Q. What are the benefits to Kentuckians and society of diversified energy portfolios employing greater use of renewables and distributed generation?

A. Section 3 of this testimony documents the various costs to society and the environment presented by Kentucky's fossil fuel power plants. As we describe, these costs are externalized from the resource planning process and the PSC's procedures for reviewing the practices of the state's electric energy utilities. Renewable energy presents a direct solution to many of the numerous external costs of coal fired power plants, by using technologies which reduce the demand for coal combustion and mining. Replacing electricity from coal burning pow er plants with renewable energy such as solar, wind, hydroelectricity, and biomass:

- Improves air quality, reducing public exposure to numerous air pollutants;
- Protects public health by reducing the amount of air pollution, water pollution, and mercury contamination of waterways and the food chain;
- Reduces emissions of carbon dioxide, the primary greenhouse gas linked to global warming and climate change;
- Reduces Kentucky's vulnerability to the Federal regulation of carbon emissions by increasing the diversity of the state's energy supply.

Reducing the demand, and therefore use of coal would have direct benefits to the environment, by reducing the rate of mountaintop removal mining and the damage it causes to soils, forests, mountains, waterways, and communities in Eastern Kentucky. By reducing emissions of carbon dioxide, renewables directly support efforts to limit the extent of global warming and climate change, something which has benefits for Kentuckians and people throughout the world.

Climate change presents numerous risks to Kentucky and the world. Kentucky's current energy portfolio, being so heavily dependent on coal combustion, gives Kentucky both a share in the responsibility for the effects of climate change, and leaves us vulnerable to its consequences. The PSC should not regulate Kentucky's energy utilities as if Kentucky exists in a vacuum, disconnected from the rest of the world. The energy choices made in Kentucky impact the entire world, and feed back to affect Kentucky, in turn. As the public agency responsible for regulating the state's energy utilities, the PSC has a special responsibility for understanding the public interest and ensuring that the state's energy supply is satisfied in a manner that serves the public interest. Climate change presents grave threats to the public interest and the well-being of the Commonwealth. Actions should therefore be taken, and rapidly, to reduce the State's contributions to climate change and our emissions of carbon dioxide. The diversification of the state's energy supply through renewable energy directly serves this purpose.

The large scale development of renewable energy resources would also reduce the state's vulnerability to some of the risks of climate change. The historically low price of energy in Kentucky has resulted in a great deal of inefficiency in the use of energy throughout the state and within all sectors. The result is that despite some of the lowest electric rates in the country, Kentuckians pay some of the highest monthly utility bills. We also have a variety of very energy intensive industries in the state. It is widely expected that federal regulation to control carbon emissions will be presented in the near future, driving up the cost of energy from fossil fuel sources. When this happens, Kentuckians will be hit by rising rates and higher utility bills. This will happen while other forces, such as the need to improve the grid infrastructure, will also be driving up energy costs.

National concerns about climate change and the risks associated with coal-fired power plants have already impacted efforts to build new coal power plants. According to the Center for Media and Democracy, plans for 59 proposed coal plants were either cancelled, abandoned, or put on hold in 2007. (www.sourcewatch.org). On February 4, 2008 the Wall Street Journal reported, "Three of Wall Street's biggest investment banks are set to announce today that they are imposing new environmental standards that will make it harder for companies to get financing to build coal-fired power plants in the U.S."[1]

A dominant factor in the discussion about the future of coal power plants is their capability to capture and permanently store carbon emissions. While the technology to do this does not yet exist, it is widely expected that the requirement to control carbon (as well as other pollutant) emissions will significantly increase the cost of building and operating any new coal-fired power plants. What will those costs be? What effect will they have on rates? How will demands to regulate (and reduce) carbon emissions in the near, medium, and long-term affect the price of energy in Kentucky?

The development of a diversified energy supply that is increasingly reliant on renewable energy would help to protect Kentuckians from the risks presented by our present dependence on coal.

[1] "Wall Street Shows Skepticism Over Coal," Ball, Jeffrey, Wall Street Journal, Feb. 4, 2008

Q. What renewable energy resources are available in Kentucky and what is their potential for meeting the state's energy needs?

A. There are a variety of renewable energy resources available to the people of Kentucky and the electric utilities that serve them. These include mature technologies that are in widespread use in other parts of the United States and the world, such as wind, hydroelectric, solar photovoltaics, solar water heating, and biomass. Concentrating solar power (CSP) is also being used to generate electricity at a large scale in some regions, has been in use for decades in the American Southwest, and may have potential applications in Kentucky, as well.

With the possible exception of hydroelectric, the potential for developing each of these energy resources is almost completely undeveloped in Kentucky, and there remains a great deal of undeveloped hydroelectric, as well. In light of the many good reasons for diversifying Kentucky's energy portfolio and reducing the use of coal, we are fortunate that we have a great untapped potential for renewables.

Wind Energy

The following passage from *A Portfolio of Energy Efficiency and Renewable Energy Options for East Kentucky Power Cooperative* (February 2008) addresses the status of the wind industry in the U.S. and its potential for providing electricity to Kentucky.

> "As of September 2007, there were 16,819 MWs of installed wind capacity in the United States with 3,506 more MWs under construction. Nineteen percent of that installed capacity was built in 2006, demonstrating the rapid increase in the popularity of this generation source which has been driven largely by state renewable energy portfolio standards and its increasing cost-effectiveness compared to fossil fuels. Texas alone has over 4,356 MWs of installed wind-powered generating facilities. All states bordering on

Kentucky have developed or are in the process of constructing wind resources. Appalachian Power Company, a subsidiary of American Electric Power(AEP) in West Virginia recently signed a 20-year power purchase agreement for 75 MW of wind energy from the 150 MW Camp Grove Wind Farm in Illinois. During August 2007, AEP also announced that Indiana Michigan Power, another of its subsidiaries, had entered into a long-term agreement for 100 MWs of capacity from Fowler Ridge Wind Farm in Indiana. Illinois has a total of 699 MW of installed wind power generating facilities with another 108 MW currently under construction.

"Adding 100 MW of wind energy to an EKPC renewable energy portfolio would provide conservatively at least 192,720 MWhs of clean energy to EKPC member cooperatives each year at a cost of approximately $0.035 per kWh.[2] These wind projects could be developed at suitable sites in Kentucky or in other states, as many other utilities have done."[3]

With nearly 3,200 MW of wind capacity installed nationwide in 2006, this report's target of 100 MW of wind energy (to be installed over ten years) is very modest and represents a fraction of the energy that could potentially be provided to Kentucky from this renewable resources. One commonly hears that Kentucky has poor wind resources, with the exception of the mountaintops in Eastern Kentucky. While this may generally be true, those mountains may offer a substantial number of viable wind energy sites. Further, the interconnectivity of the electricity grid would allow Kentucky utility companies to develop wind sites in other states and

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[2] A 22% capacity factor is assumed on a purchased power agreement at $0.06 per kWh less $0.025 per kWh for the "green tag," that is the income EKPC's green pricing program, Envirowatts. We are assuming 0.25 cents per kwh of the Envirowatts program would go to administrative costs.

[3] *A Portfolio of Energy Efficiency and Renewable Energy Options for East Kentucky Power Cooperative*, Susan Zinga, Andy McDonald, February 2008, Sierra Club, Kentuckians for the Commonwealth, and the Kentucky Environmental Foundation, p. 31

transmit the power to Kentucky for sale. We note that Dominion Electric, based in Virginia, has recently announced it is building a wind farm in Indiana. Kentucky utilities could also pursue developing wind generation in Indiana and West Virginia.

Small Scale Hydroelectric

A Portfolio of Energy Efficiency and Renewable Energy Options for East Kentucky Power Cooperative also addresses the potential for small scale hydroelectric generation for EKPC. The report looked at sites which could be developed without damming rivers or creating reservoirs, and states:

> "Kentucky's abundance of rivers has the potential to provide clean and economical power from a proven technology. Yet, many of these sites remain undeveloped. The Kentucky River Authority owns sites with estimated generation capacity of 19.5 MW while sites controlled by the Army Corps of Engineers could account for an additional 172 MW, bringing the total to 191.5 MW of power waiting to be tapped. To construct hydroelectric generation at all undeveloped sites in Kentucky would cost between $455 and $550 million.[4] With capacity factors ranging from 45-55%, these sites combined could produce a total of over 842,000 MWhs annually at a median cost of $0.036 per kWh."[5]

Appendix A-5 of this report provides a list with detailed information for each of these sites.

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[4] Identification of potential hydroelectric generation sites, development costs and capacity factors prepared by David H. Brown Kinloch of Soft Energy Associates, Louisville, KY.

[5] Ibid, p. 30. Includes operation and maintenance expenses of $0.017 per kWh over the 30-year lifetime of the generation facility based on an average of O&M for Georgia Power hydroelectric generating plants as reported in the Federal Energy Regulatory Commission Form 1 filed for 2006.

Solar Photovoltaics and Solar Water Heating

Solar energy is an important renewable resource in Kentucky whose potential remains almost entirely unrealized. Kentucky receives an average of 4.5 Sun-Hours per day (one Sun-Hour equals 1 kW/m^2), enough to make solar energy a valuable resource with many applications and significant potential for reducing our dependence on coal. Kentucky's annual average solar radiation is only ten percent less than parts of Florida, a state with a very active solar industry (4.5 SunHours per day versus 5.0 SunHours per day in Jacksonville, Florida).[6] When you consider that Kentucky's solar resources are considerably superior to Germany's (whose average daily SunHours are comparable to Alaska's), and that Germany is leading the world in solar PV investment and installations, you realize that solar energy could become a major renewable energy resource for Kentucky.[7]

Solar Photovoltaics

There are a variety of different solar energy technologies. Solar photovoltaics (PV) generate electricity when exposed to sunlight. PV panels typically carry 20 year warranties and have an expected operational life of 40 years or more. They have no moving parts and are very reliable and low-maintenance. The technology has matured in recent decades and is now mass produced by numerous manufacturers around the world. The global PV market has expanded at an annual rate of 20 – 25 percent over the past twenty years.[8] In recent years this growth has been largely driven by major investments being made in Germany, Japan, and more recently, Spain.[9]

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[6] U.S. Department of Energy, National Renewable Energy Laboratories, *Atlas for the Solar Radiation Data Manual for Flat Plate and Concentrating Solar Collectors*, http://rredc.nrel.gov/solar/old_data/nsrdb/redbook,
[7] Rhone Rhesch, "Outlook for Solar Energy – Power Point Presentation," 2007, Solar Energy Industries Association.
[8] Solar Energy Industry Statistics: Growth, www.solarbuzz.com/StatsGrowth.htm,
[9] MARKETBUZZ™ 2007: ANNUAL WORLD SOLAR PHOTOVOLTAIC INDUSTRY REPORT, 2007 World Industry Report Highlights, March 19, 2007, www.solarbuzz.com/Marketbuzz2007-intro.htm.

While Germany led the world in PV installations in 2006, the industry grew very rapidly in the US, as well. The US solar PV market is being led by California and New Jersey, the states with the strongest financial incentives. California's Million Solar Roofs Initiative is investing over $3 billion to create 3,000 Megawatts of solar electricity by 2017.[10] These investments support the US Department of Energy's efforts to make solar PV cost-competitive with conventional power by 2015.[11]

Solar Water Heating

Solar water heating technologies have been in widespread use for the past century. Countries such as Israel and Japan have witnessed a consistently increasing use of the technology. Tokyo had over 1.5 million solar water heaters in use as of 1991 and Israel now requires solar water heaters in all new buildings.[12] In 2004, the International Energy Agency reported that the global installed capacity of solar thermal systems was equivalent to 69,320 MW (the equivalent of over three hundred 200-MW coal power plants).[13] In 2005, the global market for solar water heating grew by 14 percent, "with worldwide installations reaching 46 million homes using technology that is mature and well-established."[14]

As stated in *A Portfolio of Energy Efficiency and Renewable Energy Options for East Kentucky Power Cooperative:*

> "Solar water heating systems serve as a source of distributed power generation and a load reducing, demand-side-management tool...Solar water heating systems are well-suited for residential domestic water heating, space heating, and many commercial,

[10] http://www.gosolarcalifornia.ca.gov/csi/index.html
[11] http://www1.eere.energy.gov/solar/solar_america/
[12] *The Kentucky Solar Energy Guide,* Joshua Bills and Andy McDonald, 2006, Appalachia - Science in the Public Interest.
[13] Ibid, p.35.
[14] *A Portfolio of Energy Efficiency and Renewable Energy Options for East Kentucky Power Cooperative,* Zinga and McDonald, p.26.

institutional, and industrial water heating applications. Common non-residential applications include swimming pool heating, laundromats, hotels, dormitories, multi-family dwellings, restaurants, food processing facilities, schools, and fire stations.

"Systems typically operate for at least 25 years. A solar water heater provides the owner with a fixed cost for water heating energy, providing security against future energy price increases. This is especially important for customers of utilities like EKPC that face an extraordinary "carbon risk" when greenhouse gases are eventually regulated.

"Solar water heating systems in Kentucky can typically meet 50 – 80% of a home's domestic hot water needs on an annual basis. Systems are normally installed with a back-up heating system to ensure that hot water is always available. Systems are also designed with freeze protection so they can operate through the winter without trouble. For larger, non-residential (or multi-family/dormitory) facilities, the portion of energy provided by the solar thermal system will depend upon the system design and economic considerations, and can range from 25 - 80%, depending upon the circumstances. In both residential and commercial applications, solar water heaters offer the highest demand savings in the summer, during the utility's peak demand periods on hot afternoons. At these times solar water heating systems are operating and avoid the use of electric heating elements."[15]

Solar water heating systems represent an important source of distributed generation which, if implemented at a wide scale, could make a significant contribution to the state's energy needs.

Q. What is the Potential Market for Solar PV and Solar Water Heating in Kentucky?

The potential market for solar electric and solar water heating in Kentucky is enormous. There are 1.7 million electricity customers in Kentucky. A 2007 report from the US Department

[15] Zinga and McDonald, p.26.

of Energy's National Renewable Energy Laboratory describes two estimates for the availability of rooftops for solar PV systems nationwide. One study estimated "that 22% and 65% of total roof area is available on residential and commercial buildings respectively. Other studies estimate between 30% and 45% of all residential buildings are suitable for PV deployment."[16] The smaller size of solar water heating systems suggests that even more buildings would be accessible to solar water heating. Denholm estimates that in the South East, about 40% of residential buildings and 60% of commercial buildings have rooftops available for solar water heating. Thus, in very broad terms, there are hundreds of thousands of existing residential and commercial buildings in Kentucky available for solar PV and hot water installations. With PV there is also the potential to install the units away from buildings – on parking lot structures, on racks in fields, along highways or railways, etc.

As Table 2 summarizes, 100,000 residential scale (2.5 kW each) PV systems would cover only a portion of the available rooftops in the state and would equal 250 MW of installed PV capacity. (A 2.5 kW PV array would require approximately 250 square feet of PV panels.) Altogether these units would generate approximately 316 million kWh per year (or 0.32% of Kentucky's annual net generation in 2006 of 98.8 million MWh).[17]

The installation of 5,000 commercial scale PV systems (50 kW each) would achieve another 250 MW of PV distributed across the Commonwealth and would generate another 316 million kWh per year. This would bring the state's total PV generation to 0.64% of Kentucky's annual net generation. (A 50 kW PV array requires about about 5,000 square feet of PV panels. The Perfetti Van Melle candy factory near Covington has a PV array of this size. Considering all

[16] Denholm, P., *The Technical Potential of Solar Water Heating to Reduce Fossil Fuel Use and Greenhouse Gas Emissions in the United States*, National Renewable Energy Laboratory, Technical Report NREL/TP-640-41157, March 2007.
[17] The EIA reports that Kentucky used 98.79 million MWh in 2006. USDOE Energy Information Administration, Kentucky Electricity Profile, November 2007, http://www.eia.doe.gov/cneaf/electricity/st_profiles/kentucky.html.

of the flat roofed shopping centers, factories, schools, government buildings, and parking lots in Kentucky, it's easy to imagine 5,000 locations where these could be sited. Clearly, the limitation for PV development is not the availability of locations to site the panels.)

How much energy could be generated with solar water heating? If these units were installed on 100,000 homes, their summer demand savings would be an estimated 112 MW and they would save utility customers an estimated 245 million kWh per year.

Installing 10,000 medium-sized commercial-scale solar water heaters (an average 320 square feet per system) would provide 70 MW of summer electric demand savings and would save customers 175 million kWh per year. With all the schools, hotels, fire stations, restaurants, laundromats, and other such buildings in Kentucky with significant hot water demands, 10,000 installations would just begin to meet the potential demand.

Table 2 summarizes this information on the potential markets for solar PV and solar water heating in Kentucky. {Note: This analysis prepared by Andy McDonald, Coordinator of the Kentucky Solar Partnership, for this briefing.}

As this analysis shows, there is enormous potential for developing solar energy resources in Kentucky. The limitations to this development are neither natural nor technical - there is adequate solar energy, the technology is mature, established, and reliable, and there are sufficient rooftops and surfaces with adequate solar exposure. Global experience has shown that the use of solar energy is not limited to the sunniest climates, and that it is capable of making a significant contribution to meeting the world's energy needs.

Table 2 – Potential Markets for Solar PV and Solar Water Heating in Kentucky

Technology/sector	# of installations /	Total Generating	Total Annual Generation for PV	% of Ky Total Annual Generation*

	individual unit size	Capacity	(kWh) or kWh Savings (SWH)	
PV- Residential	100,000 / 2.5kW each	250 MW	316 million kWh	0.32%
PV – Commercial	5,000 / 50 kW each	250 MW	316 million kWh	0.32%
SWH – Residential	100,000 / 40 square feet	112 MW	245 million kWh	0.25%
SWH – Commercial	10,000 / 320 square feet	70 MW[a]	175 million kWh	0.18%
Totals		682 MW	1,052 million kWh	1.07%

*Kentucky annual net generation in 2006 = 98.8 billion kWh

a. Commercial solar water heater electric demand savings could be substantially less than this amount if a large portion of the commercial water heating displaced uses natural gas. The associated gas savings would have societal benefits, but this analysis doesn't go into that detail. The actual energy savings would be unchanged, although the savings would be in terms of therms or Btus rather than kWh. A deeper analysis could break out the number of SWH that would be replacing gas water heaters vs. electric water heaters.

Q. What is the Potential for Concentrating Solar Power (CSP)

A. Concentrating Solar Power (CSP) facilities can be operated at a large scale to generate megawatts of power to supply the utility grid. They use reflective surfaces to concentrate sunlight, which is typically used to generate steam to power a turbine. A variety of CSP technologies are in use in the U.S. and around the world and they represent the least expensive technology for generating solar electricity at a large scale. Until recently these technologies were only developed in regions with very high daily and annual solar radiation, such as the American desert southwest. However, in 2007 Florida Power and Light entered into an agreement to build a series of CSP facilities in Florida which would generate a total of 300 MW of power. As noted earlier, Florida's solar resources are only moderatley superior to Kentucky's. This development suggests the potential for the development of CSP facilities in Kentucky and neighboring states.[18]

Biomass

Biomass can be used in various forms to reduce the demand for coal-generated electricity. Wood waste from the timber industry can be used in some existing coal power plants to reduce the amount of coal required. Small-scale power plants dedicated to burning biomass can be developed and serve as a source of distributed generation. Such facilities can be supplied by sustainably managed willow plantations, grown on nearby farmland to minimize transportation costs. Kentucky has a very large potential for generating biomass to be used for these purposes, including a timber industry that generates a great deal of wood waste and large areas of farmland capable of producing fuel crops.

[18] "FPL Unveils Plans for a solar plant", St. Petersburg Times, ASJYLYN LODER and CRAIG PITTMAN, September 27, 2007.

Q. What are the present costs for renewable energy resources, how are these costs expected to change in the future, and how does this compare with the cost of fossil fuel generation?

A. Table 3 summarizes estimates for the life-cycle cost per kWh for each of the renewable energy technologies discussed. Estimates for wind, hydroelectric, and solar water heaters are taken from *A Portfolio of Energy Efficiency and Renewable Energy Options for East Kentucky Power Cooperative*. Solar PV costs are based on present-day installation costs of $8 - $10 per installed Watt, annual generation of 1,200 kWh/installed kW, and a 30 year operational life.

Table 3 – Cost per kWh for Renewable Energy Technologies	
Renewable Energy Resource	**Cost ($/kWh)**
Wind-Powered Generators	$0.035
Hydro-electric Power	$0.036
Commercial Solar Water Heaters	$0.053
Residential Solar Water Heaters	$0.075
Solar PV	$0.22 - $0.28
Concentrating Solar Power	Not available
Biomass	Not available

Note that the prices per kWh for wind, hydroelectric, and solar water heating systems are equal to or less than the retail residential rates many people are presently paying in Kentucky. In the case of EKPC, these renewable energies are cheaper than the average retail residential rates for all of their member coops. These energy technologies do not consume fuel. Their costs are embedded in the equipment that generates the power and the operations and maintenance costs they will require over their lifetime. When market forces and carbon regulation cause the cost of coal power to rise in the years to come, the effective rates for power from these technologies will remain constant.

Solar PV stands out as the most expensive technology among those for which we have costs. The cost of PV has declined substantially over the past 20 years, but it stills remains three to five times more expensive than current electric rates in Kentucky. However, the cost of coal-generated power is certain to rise and that rise may be very substantial. In comparing the costs of renewables to coal-generated electricity, we should not look backward to what the cost of coal has been, but forward, to what the cost of coal-generation will be in the years to come. At this time, we should understand renewables to be in competition with future power plants. Will Kentucky pursue new coal-fired generation or renewable power (or a mix)? Will a PV system installed today still be more expensive than coal-generated power in ten or fifteen years? It seems very likely that the other renewables discussed will only become more economical as the years go by. It is likely that the same will be true for PV, as well.

One must also consider the risks of each alternative. Coal generation is subject to very dramatic risks from impending carbon regulation, as well as the forces that may be imposed by climate change itself. We may think today that the U.S. government will place a certain limit or tax on carbon emissions in the next few years, but what if another event such as Hurricane

Katrina occurs that excites public concern over climate change to new levels? Such events could create political pressure to impose carbon limits that are presently unthinkable.

Meanwhile, our renewable resources stand insulated from such risks, as they have no carbon emissions. Furthermore, as markets for renewable energy credits and carbon markets develop, these will provide additional income for renewable energy generators, at the same time as fossil-fuel based generation's costs are increasing.

Q. Do Kentucky policies related to net metering and interconnection present any barriers to renewables and distributed generation?

A. Kentucky's net metering law and interconnection practices present a number of obstacles to those seeking to use renewable energy.

a. The current law allows each utility to develop their own rules governing interconnection and net metering. This makes things more complicated for solar installers because they have to learn multiple sets of procedures and rules when they work in the territories of multiple utilities. It makes buying a net-metered PV system more difficult for consumers because their installers may not know the rules for their particular utility. It also presents greater possibilities that a utility's unique rules could present unwarranted barriers to interconnection.

Uniform net metering standards for all of the state's power companies would be an improvement for solar companies and consumers. The Interstate Renewable Energy Council (IREC), a national non-profit that supports the renewables industry, advocates for uniform net metering and interconnection standards across the US and within states. They have published a guide on this issue and have model net metering and interconnection standards that Kentucky could reference. Additionally, the Federal Energy Policy Act of 2005 directed state regulatory authorities and certain non-regulated utilities to consider adopting an interconnection standard based on IEEE 1547 and current best practices.

b. The current law is limited to solar PV. This should be changed to make it available to other renewable energy sources, such as wind, micro-hydro, biomass, and Combined Heat and Power (CHP).

c. There is presently a cap on the total installed capacity of PV that utilities are required to net-meter within their territory (0.1% of their peak demand). We should be encouraging expanded use of solar, not placing limits on its growth. A cap should only be used if there are technical reasons related to the operation of the grid which justifies limiting the capacity of distributed generation. In such a case, the cap should be based on this limit.

d. The present net metering law only applies to PV systems under 15 kW. There are many potential sites for larger PV systems. This limit should be removed to encourage the installation of larger PV systems. IREC recommends allowing net metering for systems up to 2 MW and providing uniform interconnection standards for larger generators.

e. Net metering is a subset of the larger topic of interconnection. Our understanding is that interconnection rules are variable across the state, presenting similar difficulties to those we find with net metering.

f. Kentucky's municipal electric utilities and those within TVA's distribution area are exempt from Kentucky's net metering law. If possible, it would be best to have the state's net metering and interconnection rules apply to them as well.

In sum, we believe that Kentucky should have uniform net metering and interconnection rules that apply to all utilities (including the municipals and TVA distributors) throughout the state. We recommend that IREC's model standards be used as the basis for Kentucky's standards.

IREC's Model Interconnection Standards and Model Net Metering Rules can be downloaded at http://www.irecusa.org/index.php?id=31.

Q. How could the PSC encourage the diversification of utility energy portfolios through the use of renewables and distributed generation?

A. The PSC should establish policies that support the development of renewables and diversification of the state energy supply, reflecting a new priority on renewables versus coal-fired power plants. The Commission should recognize the numerous social and environmental benefits of renewables, and the many external costs of fossil fuels, and act to make renewables the preferred energy supply option in the state. Acknowledging the externalized costs of coal would be a major step in this direction and the Commission should implement policies to ensure that full-cost accounting is incorporated into their process for evaluating plans for meeting future energy needs (see Section 3 for more comments on full-cost accounting).

Two important strategies that are used to develop renewables in other states are a Renewable Portfolio Standard (RPS) and a Public Benefits Fund (PBF). An RPS could include a solar set-aside that would provide a very strong push for utilities to invest in solar energy.

An RPS requires a state's electric utilities to meet a specified percentage of their electricity from renewable sources by a target date. Eleven states include a 'solar set-aside,' specifying that a certain percentage of this renewable energy must come from solar electric (PV) or solar hot water systems. The solar set-asides are intended to catalyze rapid development of the solar industry in those states. Among the states with solar set-asides are North Carolina (0.2%), Maryland (2%), Delaware (2.005%), Pennsylvania (0.5%) and New Jersey (2.12%) (the figures reflect the percentage of the state's total annual generation).[19]

The use of solar set-asides demonstrates that other states have already established ambitious goals for deploying solar energy systems. For Kentucky to aim for achieving 1% of our electricity needs from solar PV and solar hot water would be ambitious but not unprecedented. It's important to note that the states mentioned all have similar (or worse) solar energy resources as compared to Kentucky. If it can be done in Pennsylvania and North Carolina, it can be done in Kentucky.

Public Benefits Funds (also known as Systems Benefits Funds or Clean Energy Funds) are used by many states to finance incentives programs for renewables and energy efficiency. At least 19 states currently have such Funds and they are usually financed through a small surcharge on electric utility bills. Various methods can be used to calculate the surcharge. It can be expressed as a flat fee on each utility bill (ie. $1.00/month), a percentage of each utility bill (i.e. 3%), as an added charge per kWh used (i.e. $0.001/kWh), or by other means. To illustrate how much could be generated for the Fund annually, a charge of one-tenth of one cent per kWh ($0.001/kWh) added to every electric customer's monthly bill would generate $98 million per year, while adding about $1.00/month to the average residential customer's utility bill. (Kentucky's Net Electricity Generation in 2006 was 98.8 billion kWh).

A Public Benefits Fund would provide a dependable stream of resources to finance state wide investments in renewable energy and energy efficiency. Programs that could be supported by such a Fund could include (but would not be limited to):

1. Low-income home weatherization programs.

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[19] Update from DSIRE: Solar Policy News and Trends, Susan Gouchoe, North Carolina Solar Center, IREC Annual Meeting, Long Beach, CA, 9-24-07; Power Point Presentation.

2. Energy efficiency in State and local government buildings and school facilities.

3. Low-interest loans for renewable energy and energy efficiency projects.

4. Financial incentive programs (such as rebates) for residential and commercial renewable energy investments such as solar, wind, and hydro.

5. Financial incentive programs for Energy Star/energy efficient appliances, lighting and equipment.

6. Financial incentives for Energy Star home and commercial building construction.

6. Public education programs to raise awareness of energy efficiency, renewable energy, conservation, and related issues.

When used together, a Public Benefits Fund and Renewable Portfolio Standard can create a powerful force to advance the use of renewables, efficiency, and diversification of the state's energy supply.

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

AN INVESTIGATION OF THE ENERGY AND REGULATORY ISSUES IN SECTION 50 OF KENTUCKY'S 2007 ENERGY ACT	))))	CASE NO. 2007-00477

AFFIDAVIT

STATE OF KENTUCKY)
)
COUNTY OF Franklin)

Andrew S. McDonald, being duly sworn, states that he has read the foregoing prepared testimony and that he would respond in the same manner to the questions if so asked upon taking the stand, and that the matters and things set forth therein are true and correct to the best of his knowledge, information and belief.

Andrew S. McDonald

Subscribed and sworn before me on this 27 day of February, 2008.

Francine H Poe
Notary Public

My Commission expires: Nov. 30, 2008 Francine H. Poe

Affidavit.notv

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

AN INVESTIGATION OF THE ENERGY AND REGULATORY ISSUES IN SECTION 50 OF KENTUCKY'S 2007 ENERGY ACT	))))	CASE NO. 2007-00477

Direct Testimony of Richard M. Clewett, Jr.

On Behalf of the Sierra Club

February 29, 2008

Q. Please state your name and address for the record?

A. Richard M. Clewett, Jr., 225 Aberdeen Dr., Lexington, KY 40517.

Q. What is your formal education?

A. I received my post-secondary education at The University of Chicago, where I received three degrees in English Language and Literature: B.A. ('66), M.A. ('67) and a Ph.D. in 1970.

Q. What is your background pertaining to the issues which are addressed in this case?

A. I have been an active member of the Cumberland Sierra Club's Energy Committee since it was formed in 2006. I was part of the Sierra Club's intervention team in the 2007 EKPC generation and rate cases conducted by the PSC and have been involved in the efforts of a coalition of environmental groups to work with EKPC to increase the scale and efficacy of its energy efficiency and renewable energy programs. I have also been active in the Kentucky Energy Efficiency Working Group, to which the regulated utilities in the state and a number of environmental groups belong.

Q. Please discuss the issues in this case as set forth in Section 50 of the Kentucky 2007 Energy Act: and stated in the Commission Order of November 20, 2007:

1. Eliminating impediments to the consideration and adoption by utilities of cost-effective demand-side management strategies for addressing future demand prior to Commission consideration of any proposal for increasing generating capacity.

Q. What are some of the main categories of such impediments that currently prevent the Public Service Commission from the consideration and encouragement of cost-effective demand-side management strategies for addressing future demand prior to Commission consideration of proposals for new generating capacity?

A. Current impediments to effective demand-side management and energy efficiency programs can be considered as falling into the following categories:

1) Statutory impediments

2) Regulatory impediments

3) Impediments resulting from habits and conventional mindsets within the PSC, electric utility companies and the industry more generally

4) Impediments resulting from lack of public education on subjects to do with energy, energy efficiency, renewable energy sources, and the total societal costs of burning coal.

5) Miscellaneous impediments

We will consider these kinds of impediments in the order set forth above.

1.1 Statutory Impediments

Q. Is the state statute governing the operation of the Public Service Commission adequate?

A. Most of the provisions in Kentucky Revised Statute 278.040 governing the Public Service Commission, its jurisdiction and regulations are probably adequate. Of key importance is how narrowly or broadly some of its key provisions are interpreted. Thus, section 3 states that:

> [t]he commission may adopt, in keeping with KRS Chapter 13A, reasonable regulations to implement the provisions of KRS Chapter 278 and investigate the methods and practices of utilities to require them to conform to the laws of this

state, and to all reasonable rules, regulations and orders of the commission not contrary to law.[1]

This would seem to give the PSC considerable latitude—bounded essentially by "what is reasonable."

On the other hand, at the Energy Efficiency Conference held in Frankfort on November 16th of 2007, the current PSC chair expressed the opinion that, as a "strict constructionist," he did not feel the commission had much room for exercising discretion or innovation in its proceedings. The section of the statute the PSC chair fairly clearly had in mind was Kentucky Revised Statute 278.285:

> "**Demand-side management plans -- Review and approval of proposed plans and mechanisms.** The commission may determine the reasonableness of demand-side management plans proposed by any utility under its jurisdiction."

While the section goes on to enumerate a variety of factors to be taken into consideration and then states that the commission is not limited to these consideration in making a determination, it does seem to limit the PSC's power to either approving or disallowing DSM plans proposed by utilities.

Either the relevant statute needs to be revised to enlarge the PSC's ability to encourage or require regulated utilities to move more effectively in the direction of serious energy efficiency programs as a central part of their business practice, or the Attorney General or the commission itself needs to come forward with an interpretation of this section of the statute that would have the same result.

[1] http://www.lrc.state.ky.us/krs/278-00/chapter.htm

Q. Are there any other problems with the statute controlling the operations of the PSC?

A. Yes. Section 3 of Revised Kentucky Statute 278.285 states:

> **Demand-side management plans -- Review and approval of proposed plans and mechanisms -- Assignment of costs -- Home energy assistance programs.**
> (1) The commission may determine the reasonableness of demand-side management plans proposed by any utility under its jurisdiction. Factors to be considered in this determination include, but are not limited to, the following:
> . . . .
> (3) The commission shall assign the cost of demand-side management programs only to *the class or classes of customers which benefit from the programs. The commission* shall allow individual industrial customers with energy intensive processes to implement cost-effective energy efficiency measures in lieu of measures approved as part of the utility's demand-side management programs if the alternative measures by these customers are not subsidized by other customer classes. Such individual industrial customers shall not be assigned the cost of demand-side management programs.[2]

Given that the report issued by the Kentucky Pollution Prevention Center in the fall of 2007 found by far the greatest need for energy efficiency programs to be in the industrial sector, it seems inappropriate and imprudent to leave large industrial uses of electricity completely to their own devices.

The KPPC report found that

> cost-effective (minimally aggressive) investments in energy efficiency can save Kentucky industries an estimated 15.5% of electricity use by 2017, resulting in a cumulative cost savings of up to $1.7 billion. The energy savings that could be achieved with these minimally aggressive energy efficient cost-effective

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[2] Ibid.

investments are approximately 26 tBtu annually, with a cumulative energy savings of 139 tBtu by 2017.[3]

According to the KPPC study, 81% of the energy savings that could be realized according to the minimally aggressive scenario would come from the industrial sector.[4]

Neither the Commission nor any of the Commonwealth's utility companies has ever defined the meaning of "energy intensive processes" or "cost-effective energy efficiency measures." For example, the claim has been made that any industrial customer whose electric bill is higher than a certain threshold must have an "energy intensive process," even if its energy costs represent only a small percentage of its total costs. The Commission and utility companies have never asked industrial companies to provide any documentation that they have in fact implemented their own cost-effective energy efficiency measures. The result in practice has been that any and all industrial customers have elected to opt out, and they have been permitted to do so. Utility companies (for example, E.ON) then immediately drop any plans to develop DSM programs for the industrial sector. The entire industrial class has consequently been deprived of the opportunity to participate in utility-assisted DSM programs. For a state such as Kentucky, in which the industrial sector accounts for a relatively high percentage of the state's total energy use, this situation is extremely unfortunate.

Because a large percentage of the Commonwealth's electricity is used in industrial processes, it is a public policy issue of major importance that these processes be energy efficient. A revision of the stature may well be required to accomplish this end.

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[3] *AN OVERVIEW OF KENTUCKY'S ENERGY CONSUMPTION AND ENERGY EFFICIENCY POTENTIAL*. Kentucky Pollution Prevention Center, University Of Louisville; American Council For An Energy-Efficient Economy, Prepared for: Governor's Office Of Energy Policy August 2007, p. 18.

[4] Ibid. P. 3.

1.2. Regulatory Impediments

Q. What are the main regulatory impediments to the development of appropriately scaled and designed energy efficiency programs?

A. One of the main impediments in this category is what is often call the "throughput incentive." In conventional "cost plus" utility regulation, as we have here in Kentucky, utility revenues and profits are linked to unit sales (kWh, mcf or therms). Under this system, loss of sales due to successful implementation of energy efficiency programs will lower utility profitability, and the effect may be quite powerful. For example, a 5% decrease in sales can lead to a 25% decrease in net profit for an integrated utility. For a stand-alone distribution utility, the loss to net profit is even greater. This basic sales incentive/efficiency disincentive is a barrier to investing in cost-effective energy efficiency. Regulatory policies can, however, instead align utilities' profit motives with acquisition of all cost-effective energy efficiency. We will discuss an alternative rate design that would help accomplish this goal in our response to question #4.

Q. How adequate are the regulations embodied in 807 KAR 5:058 that currently control the integrated resource planning of regulated electric utilities?

A. Without making an across-the-board evaluation of the regulations currently governing the IRP process, we would like to raise some questions and express concern about the possible effects of some provisions of these regulations.

Q. What is your first concern with the IRP regulations?

A. The opening paragraph on "Necessity, Function, and Conformity," specifies:

> This administrative regulation prescribes rules for regular reporting and commission review of load forecasts and resource plans of the state's electric utilities to meet future demand with an adequate and reliable supply of electricity at the lowest

possible cost for all customers within their service areas, and [to] satisfy all related state and federal laws and regulations.[5]

While reasonable on the surface, this provision, if narrowly construed can act as an impediment to responsible planning. Unless state law or regulation mandates that adequate attention be paid to probable future factors that will influence the price and effects of electric generation, then this provision impedes companies from fully factoring future impacts into their planning, and can have the effect of giving them an undesirable orientation toward just the "lowest possible cost" service in a short planning horizon. Global warming regulation is an example of a future factor which might be undervalued by a focus on lowest possible cost in the short term.

Another problem with the language of this key enabling paragraph is that "lowest possible cost for all customers" on its face, at least, precludes a full consideration of the health, environmental, and other external costs that are not paid by the current electrical consumer but by other current members of the community, future members of the community, and the impacts on the ecosystem that sustains all of these.

Q. What is another possible weakness in the regulations currently governing the IRP process?

A. Section 10 of 807 KAR 5:058 states that "(4) A utility shall respond to the staff's comments and recommendations in its next integrated resource plan filing." It would seem appropriate and, indeed, important for the PSC staff's concerns to receive timely responses. Requiring a response to what is perceived as a serious weakness, but allowing it to come more than two years later does not seem like a serious way of doing business. [6]

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[5] **807 KAR 5:058. Integrated resource planning by electric utilities,** STATUTORY AUTHORITY: KRS 278.040(3), 278.230(3)
http://www.lrc.state.ky.us/kar/807/005/058.htm

[6] Ibid.

Q. Are there any further problems with the regulations currently governing the IRP procedure for electrical utilities?

A. Yes. One key weakness of the current IRP process is that the staff's recommendations have no force. The utility simply is mandated to respond to questions and criticisms in the next IRP. The can lead to a lack of resolution of important issues. Thus, the PSC staff a few years ago commented in critique of a utility's IRP that they had not performed the "societal test" or fully considered the full cost of their coal-based electric generation. When the utility submitted its next IRP, PSC staff once again commented on exactly the same failings.

Simply noting inadequacies in company's planning submission year after year does not seem like a serious or reasonable process for safeguarding the wellbeing of customers or the citizens of the Commonwealth.

3. Incorporating full-cost accounting that considers and requires comparison of life-cycle energy, economic, public health, and environmental costs of various strategies for meeting future energy demand

Q. How much agreement or uniformity of usage is there with reference to the term "full cost accounting"?

A. Historically the phrase "full cost accounting" has been used to refer to more than one concept. One traditional definition of "full cost accounting" is:

> … the costs derived from the process of assigning and allocating the total historical costs recorded in the utility's accounting books and records to individual products, services, or business operations using cost accounting,

> engineering, and economic standards. Full cost accounting also includes a return on investment.[7]

On the other hand, the phrase "full cost accounting" has frequently been used in recent years to refer not only to the processes described in the traditional definition but also to both negative and positive costs (and benefits) that have accrued born been born by parties other than the producer and immediate consumer of a product, in this case electricity. The range of factors that can be considered under this wider definition is suggested by the following statement from the Georgia "Governors' Energy Policy Council Staff Research Brief":

> Externalities arise when the private costs or benefits to the producers and purchasers of goods or services differ from the total social costs or benefits entailed in producing and consuming those goods or services. Pollution is a classic example cited as an externalized cost. Within the limits of the law, manufacturers may emit pollutants into the air or discharge effluents into waterways without accounting for the effects of those by-products on the health or well being of people living downwind or downstream. If any cost arises as a result of that pollution, that cost is usually borne by individuals that were harmed, not the emitting facility.
>
> Many argue that electricity production generates considerable costs that are not fully reflected in the electricity marketplace. A number of studies have addressed this issue. Based on this literature, the range of possible external costs includes the impact of ground-level ozone, particulate matter, acid deposition and hazardous air pollutants. Other costs may be the economic impact of companies

[7] Colorado PUC Decision No. C02-485 DOCKET NO. 02R-238EG http://www.dora.state.co.us/puc/DocketsDecisions/decisions/2002/C02-0485_02R-238EG.pdf

leaving the state or choosing not to locate in Georgia because of nonattainment status or air pollution concerns, and decreased patronage at national and state parks due to impaired visibility and global warming effects.

An examination of externalities could include both positive and negative externalities, or externalized costs and benefits.[8]

Q. What are some of the reputable studies that have attempted to calculate life-cycle and external cost of coal-based electricity production?

A. Some of the Kentucky regulated electric utilities have testified that they were not aware of any research materials or industry publications issued relating to variables and methodologies to consider full-cost accounting concepts for meeting future energy demand. However, such a literature exists and is growing rapidly.

The ExternE project, jointly developed by the European Commission and the U.S. Department of Energy has put out a number of extensive writings. The [State of] Georgia Energy Policy Council describes the effort thusly:

> The ExternE project is the first comprehensive attempt to use a consistent 'bottom-up' methodology to evaluate the external costs associated with a range of different fuel cycles. The European Commission (EC) launched the project in collaboration with the U.S. Department of Energy in 1991. The EC and U.S. teams jointly developed the conceptual approach and the methodology and shared scientific information for its application to a range of fuel cycles.
>
> ExternE proved that the cost of producing electricity from coal or oil would double, and the cost of electricity production from gas would increase by 30% if

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[8] Georgia *Governors' Energy Policy Council Staff Research Brief: Full Cost Accounting* http://www.gefa.org/Modules/ShowDocument.aspx?documentid=37

external costs such as damage to the environment and to health were taken into account. Currently, the generation of electricity costs about 4 cents per kWh. ExternE includes the impact of pollution on human health, agriculture, materials and ecosystems and how the resultant ecosystem changes affect our actual, potential and future possibilities to use them (recreation or transportation) or the importance we may attach to conserving them (biodiversity).

For the purpose of quantifying the human health impacts of pollution, ExternE analyzed impacts on the general population and on sensitive sub-populations, including asthmatics, elderly (65+) and children. Like other such studies, ExternE used particular public health studies to develop exposure response functions by which their model would estimate health impacts.[9]

In 1999, the Canadian-based International Institute for Sustainable Development (IISD) partnered with The Energy and Resource Institute (TERI) in India and two other international energy/development organizations to promote the TERI-Canada Energy Efficiency Project. This project included a Green Budget Reform initiative, which promoted full-cost accounting for electricity production in Canada and India.

The Canadian study provides an estimate of the public health and global warming costs associated with fossil fuel combustion in the thermal power sector of Eastern Canada (for this study, "thermal power" includes coal, natural gas and oil-fired electrical generation). This study

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[9] Ibid. Description of current ExternE methods and studies can be found at: ENERGY, EXTERNALITIES: Adding up the 'true' cost of energy http://ec.europa.eu/research/headlines/news/article_05_10_21_en.html. See also *ExternE: Externalities of Energy Update: 200. http://www.externe.info/.*

differs from earlier Canadian full-cost accounting analyses in that it incorporates the impact pathway methodology used in the European Commission's ExternE project. The study's authors also incorporated findings of the Canadian National Climate Change Process study, "The Environmental and Health Co-benefits of Actions to Mitigate Climate Change."

The study offers the following estimates for coal fired, gas-fired and oil-fired electricity generation, in dollars per kilowatt-hour format.

(Canadian dollars)	Coal	Gas	Oil
Air quality externalities	$0.0171/kWh	$0.0001/ kWh	$0.0038/ kWh
Global warming externalities	$0.0223/ kWh	$0.0101/ kWh	$0.0180/ kWh
Aggregate externalities	$0.0394/kWh	$0.0102/kWh	$0.0218/kWh[10]

These estimates take into consideration only "the public health costs caused by emissions of sulphur and nitrogen oxides (SOx and NOx) and volatile organic carbon (VOC) in Eastern Canada, and the marginal climate change damages caused by the emissions of greenhouse gasses (GHGs) in Eastern Canada." Still, The central estimate of coal externalities from this study ($0.0394/kWh) is about 50 per cent higher than the marginal cost of production of electricity from coal(~$0.026/kWh). Excluding global warming damages, the central estimate of the public health externalities alone ($0.0171/kWh) is about 65 per cent of the marginal production cost.[11]

It is worth noting that ExternE externality figures for the same pollutants in the United Kingdom have been as much as twice as high as those reported in the eastern Canadian study. "The

[10] The Full Costs of Thermal Power Production in Eastern Canada Henry David Venema and Stephan Barg July 2003 http://www.iisd.org/pdf/2003/energy_fca_canada.pdf

[11] Ibid., p. 8.

differences can be explained in part by the lower population density in Eastern Canada and hence lower total exposure to air pollutants emitted by the power sector.[12]

Q. Are there important issues frequently ignored when full-cost accounting is being discussed?

A. Yes. One such issue is that calculations of "present value" when assessing the importance of future situations. It is traditional to discount the importance of future events, including the health and wellbeing of our grandchildren and great-grandchildren in proportion to their distance from the present. This practice gives rise to grave questions of inter-generational injustice and simple short-sightedness. When dealing with issues such as global warming and increasing climate instability, too heavily discounting future events can easily have catastrophic consequences.

"Present value" figures are sometimes established by polling that asks the survey population how much a certain good or outcome to be obtained at a given point in the future is worth to them in terms of what they are willing to forego now to get it. When issues are complex and the level of public knowledge of these issues inadequate, this way of establishing present values of future outcomes can easily distort policy making. Indeed, it can easily replace complicated public policy issues with too simply technical formulas. Attempts to use full-cost and life cycle accounting to enhance the wellbeing of Kentuckians, both present and future, must pay serious attention to these problems. It is altogether too easy to let the traditional conventions of accounting inhibit the serious and probing public policy explorations and debates that need to be taking place.[13]

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[12] Ibid. p. 6.

[13] One background source on good life-cycle accounting is: "Green Life Cycle and Accounting Praxis." David M. Boje, October 23, 1999 http://web.nmsu.edu/~dboje/TDgreenlifecycle.html

Q. **What is an example of an actual regulatory situation in which discussion of conflicting concepts of full-cost accounting and present value estimation have come to the fore?**

A. About ten years ago disagreement of the implementation of these concepts became pivotal in a Minnesota Public Utilities Commission case in which the "societal test" of the California Standard Practice Manual was being applied in a very narrow way and "present values" for future outcomes were being determined in ways that distorted procedural outcomes. There is an extensive critique of this problematic use of ill-conceive "present value" figures in a study done by the Center for Energy and Environment.[14]

Q. Is it appropriate for Public Service or Utility Commissions to adopt environmental "adders" for required use by utility companies?

A. Yes. Freeman and Krupnick argue that:

> [o]ne reasonable objective of the PUCs is to ensure that utilities choose an electricity supply portfolio that will minimize societal costs when making future resource acquisition decisions. Thus, it is necessary and appropriate for the PUCs to adopt environmental adders for use by utilities. Requiring utilities to factor in environmental adders ensures that the right price signals are given in the market.[15]

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[14] ACHIEVING ENERGY EFFICIENCY IN A RESTRUCTURED ELECTRIC UTILITY INDUSTRY. *Prepared by:* Center for Energy and Environment, Martha J. Hewett. *Prepared for:* Minnesotans for an Energy Efficient Economy, July 1998 http://www.mncee.org/pdf/util_restructt.pdf.

[15] Freeman, A.M., and A.J. Krupnick (1992). "Externality Adders: A Response to Joskow." *The Electricity Journal.* (5:7) [August/September]. pp. 61-63. Quoted *in Issues and Methods in Incorporating Environmental Externalities into the Integrated Resource Planning Process.* National Renewable Energy Laboratory. A national laboratory of the U.S. Department of Energy. November 1994. http://www.nrel.gov/docs/legosti/old/6684.pdf

Q. Does it take skill and care in applying environmental adders?

A. Yes. As the California Standard Practice Manual states, "[I]f a market discount rate is not used, comparisons with alternative investments are difficult to make.. However, (as the same document says), many economists have pointed out that use of a market discount rate in social cost-benefit analysis undervalues the interests of future generations.[16]

Q. How have some states attempted to institutionalize full cost accounting, including externalities?

A. Some states, such as California, require consideration of environmental factors as part of their planning process. California requires utilities to consider the cost of future carbon reduction regulations in their long-term planning by requiring a "cost adder" for supplies from fossil fuel plants. This means that for resource comparison purposes, utilities increase the cost of fossil fuelbased supplies to reflect the financial risk associated with the potential for future environmental regulation. The rulemaking reflects the idea that including a "cost adder" for a given project's future carbon emissions places fossil fuel plants and clean energy on more equal footing.

Vermont law requires that utilities prepare a plan to provide energy services at the lowest present value life cycle costs, including environmental and economic costs.[17]

The Minnesota Public Utilities Commission has established cost for some externalities and updates these costs periodically. [18]

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[16] *CALIFORNIA STANDARD PRACTICE MANUAL ECONOMIC ANALYSIS OF DEMAND-SIDEPROGRAMS AND PROJECTS.* OCTOBER 2001
http://www.energy.ca.gov/greenbuilding/documents/background/07J_CPUC_STANDARD_PRACTICE_MANUAL.PDF

[17] Georgia *Governors' Energy Policy Council Staff Research Brief: Full Cost Accounting*
http://www.georgiaenergyplan.org/suppmat/Full_Cost_Accounting.pdf

[18] *Minnesota Public Utilities Commission Docket 4727328 (externality costs updated in 2006): https://www.edockets.state.mn.us/EFiling/ShowFile.do?DocNumber=4727328*

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

AN INVESTIGATION OF THE ENERGY AND REGULATORY ISSUES IN SECTION 50 OF KENTUCKY'S 2007 ENERGY ACT	)	CASE NO. 2007-00477

AFFIDAVIT

STATE OF KENTUCKY)
)
COUNTY OF Fayett)

Richard Clewett, Jr. being duly sworn, states that he has read the foregoing prepared testimony and that he would respond in the same manner to the questions if so asked upon taking the stand, and that the matters and things set forth therein are true and correct to the best of his knowledge, information and belief.

Richard M. Clewett Jr.

Subscribed and sworn before me on this 27 day of February, 2008.

Tabatha Jones
Notary Public

My Commission expires: March 24, 2010

COMMONWEALTH OF KENTUCKY

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Direct Testimony of Richard E. Shore

On Behalf of the Sierra Club

February 29, 2008

Q. Please state your name and address for the record?

A. My name is Dr. Richard E. Shore. I also go by Dick Shore.

I reside at 205 Catalpa Rd, Lexington KY.

Q. What is your formal education?

A. My undergraduate degree is a Bachelor of Arts from University of Pacific (AB 1959). I hold a Masters and a Doctorate degree in science from Duke (Ph.D. 1963) and a masters from the College of Business, University of Toledo (MBA. 1974).

Q. Do you have other relevant academic or professional certification?

A. Yes, during the 1990's, based on my work and a nationally administered examination, I obtained certification by the American Society for Quality (ASQ) as a Certified Quality Engineer (CQE).

Q. What is your background pertaining to the issues which are addressed in this case?

A. I have work experience, relevant areas of academic preparation, and teaching experience.

Q. What is the general nature of your work experience?

A. Based on my doctorate I taught at St Louis University and University of Toledo both undergraduate and graduate work in Biology, and was a Research Associate at Oak Ridge National Lab. Based on my MBA I held three major non-academic positions. I served as senior Industrial Engineer for Glass Container Division, and Lily Division, Owens Illinois Corporation; then I served as Senior Industrial Engineer and Process Engineer for Dayco; and finally I served for 19 years as Senior Industrial Engineer for Department of Defense, U.S. Army, at Ft Knox KY.

Q. What was the nature of that work at Ft. Knox?

A. As with the earlier work for Owens Illinois, I found an idea, developed it into a workable business plan including cost recovery and profit projections, and then launched it for others to routinely manage. One project they told me saved us $2 million in the first year of operation. That project is still running more than 15 years later.

Q. What in your academic preparation prepares you to speak knowledgably about Utility Rates?

A. Utility Rates are a specific case of an accounting device designed to recover both the fixed and variable costs of providing goods or services. The work at Duke included a graduate seminar dealing with the General Systems theory, and the operation of complex systems that follow probabilistic rules. My Master's in Business Administration is in Operations Analysis, which is the application of a variety of mathematical analytic tools for understanding, organizing, and controlling business enterprises. That included graduate course work in microeconomics, macroeconomics, cost accounting, and cost recovery. My project in lieu of thesis was a statistical model of perishable inventory control with random supply and random demand.

Q. What work experience have you had that bears on rate structure or cost-recovery?

A. I invested over 25 years in a career as an Industrial engineer, working both for private sector multidivisional firms and for government. As the Senor Industrial Engineer in a manufacturing plant for each of two firms (Owens-Illinois and Dayco), I was responsible for the Standard Cost system. This system is an accounting system that relates the cost we should be incurring for each of the inputs to a product or service, the physical things that go into a product, to the quantity of product produced by the plant. At Owens-Illinois I reported to the Finance and

Accounting Manager and worked directly with those in accounting that were creating the Cost Recovery System. That system was the part of the accounting system that related the price we would charge for our product. It created the price that we showed on our books. It was the only way we had to earn back, recover, the costs we had incurred. This was particularly important for one of those plants because we sold to other plants inside our corporation. That recovery cost was for us the sale price. So I was familiar with the problem of trying to use a "price per widget", in our case price per cup, a rate based on the amount of sales to generate revenues related to the quantity of production or sales, to recover fixed or period costs. When we over- or under- recovered the cost of plant and other period costs, I was one of those involved in devising a remedy.

Q. Have you taught based on your business education?

A. Yes, I taught an introduction to economics for UK at their Elizabethtown campus back when they had one, an upper division course on business analytic tools for University of Kentucky at their Ft. Knox campus, I taught Quality Engineers in preparation for their CQE examination for the local chapter of the ASQ, I taught Business Management for Western KY University at their Elizabethtown campus, and I taught several business courses including an introduction to operations analysis at St Catharine College, Springfield KY.

Q. Do you have other experience that is relevant?

A. Yes, I have been participating in the Energy Efficiency Work Group, an informal working group including representatives of utility companies and several citizens groups. That group spent a work session hearing a presentation by the rate specialist of one of the utilities on how electric rates are set. I was pleased to see that I recognized the structure from my earlier work, that regarding the recovery of fixed and variable costs it was what I was expecting, and could help others understand the presentation.

Q. Please discuss the issues in this case set forth in Section 50 of the Kentucky 2007 Energy Act that pertain to

4. Modifying Rate Structures and Cost Recovery to better align the financial interests of utilities with the goals of achieving energy efficiency and and lowest life-cycle costs to all classes of ratepayers

Q. Why is Sierra Club urging any change to the rate structure?

A. In the current rate structure we have here in Kentucky electric utility revenues are based on unit sales (kWh). A rate is devised to recover three costs, (a) the fixed or period costs (in particular, the cost of plant), (b) the variable costs (in particular the marginal cost of generating each new unit of electricity), and (c) the entrepreneurial cost, sometimes referred to as the owners incentive. The fixed costs will be incurred whether any electricity is sold or not. The entrepreneurial cost is a return on that invested fixed cost. Neither of these are related to the selling of the next additional unit of electricity. So we have a rate that is set assuming a specific level of sales. It is designed to brin in enough revenue for all three of these "costs". But only one of those is in fact variable with sales. Any rise of sales above the level assumed in setting the rate generates excess revenue, more than the PSC contemplated in setting the rate. Any fall of sales below the level assumed in setting the rate generates a loss. That loss is in the revenue to cover the fixed costs, frequently the investment which the firm has borrowed to be able to make. So any significant fall of sales sets the firm on the path to failure to service its debt. A successful DSM program will lessen the sale of electricity. Thus a system that does not modify the rate as sales fall exposes the utility to financial hardship. The utility is out what it spent on administering the DSM and it s out the revenue lost by the effective DSM.

Q. What sort of modification might be needed to address this Issue?

A. The incentive, to maintain or increase sales, is a disincentive, a barrier to investing in cost-effective energy efficiency. Regulatory policies can align utilities' profit motives with acquisition of all cost-effective energy efficiency possible in DSM programming. Since any rate that does not provide revenue simply based on the sales volume may be said to "uncouple" revenue from the unit sales, such alternative rate structures are referred to as "decoupling".

Q. Are all decoupling approaches equally effective?

A. No. There are a variety of decoupling structures that have been dealt with both from a theoretical point of view and with actual case history. David Moskovitz[1] early work is one such published study.

Q. What is the history of electric utility decoupling programs in Kentucky?

A. Decoupling was in effect in LG&E's service territory during the period from 1994 through 1998 for the residential customer class. The decoupling method that the Commission had approved at that time was a formula that included four factors. The factor that related to decoupling was called the DRLS factor, which stood for DSM Revenue from Lost Sales. At the end of each 12-month period, the utility's non-variable revenue requirement (i.e., the total revenue less variable costs) that had been approved for the Residential Rate R in LG&E's most recent general rate case was adjusted to reflect changes in the number of customers and the usage per customer, as follows:

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[1] Moskovitz, David, "Profits and Progress through Least-Cost Planning," November, 1989, prepared for the National Association of Regulatory Utility Commissioners (NARUC), pp. 3-6.] The entire report is available on the web at no charge via the website of the Regulatory Assistance Project, where Moskovitz is employed: http://www.raponline.org/Pubs/General/Pandplcp.pdf

(1) the allowable revenue was made proportional to the number of customers, so if the number of residential customers increased by 1%, the allowable non-variable revenue from the residential class would be boosted by 1%.

(2) the allowable revenue was increased by a growth factor of 1.3% per year, to reflect the assumption that the average customer's energy use would increase at that rate.

The utility's revenue was thus recoupled to the number of customers and to an automatic growth factor. A similar decoupling formula was in effect for Union Light, Heat and Power (ULH&P) in northern Kentucky.

Q. His this what Sierra Club recommends?

A. No. But that experience began to influence both the regulated and regulator communities.

Q. How much did that experience influence the thinking of the PSC and electric utilities in Kentucky?

A. The limited nature of Kentucky's experiment with decoupling probably had the effect of leaving largely unchanged the thinking patterns of many of the executives at LG&E, KU, and ULH&P. Because decoupling applied only to one customer class rather than across the board, and because it was termed a "pilot project," most of the top executives may not have realized that decoupling was acting against the companies' entrenched, decades-old habit of trying to boost sales of electricity at all times. The pilot decoupling project for a subset of the utilities' customers may not have been sufficiently all-encompassing to affect these utilities' corporate cultures. Even if certain executives had been aware of the implications of decoupling, it is possible that this new understanding was not transmitted clearly to the staff in the field, for example, to the members of the marketing and customer service teams. For any given policy change to take hold within a utility company, it needs to be given a high profile by top management, transmitted to staff at all levels of the organization, and bolstered by changes in the personnel policies that determine the incentives employees will receive. To change a habit as firmly entrenched as the policy of boosting electricity sales would require a lot of leadership from top management, consistent effort, and time.

Q. Is there a rate structure that decouples revenues from sales that the Sierra Club can propose that could also eliminate the possibility of disputes over the automatic growth factor?

A. One such method is called statistical recoupling. In his report, *"Statistical Recoupling: A New Way To Break the Link Between Electric-Utility Sales and Revenues,"* Eric Hirst described three types of decoupling: recoupling revenues to determinants of fixed costs (e.g., California's Electric Revenue Adjustment Mechanism, or ERAM); recoupling revenues to the growth in the number of customers, also known as revenue-per-customer decoupling; and recoupling revenues to the determinants of electricity sales, also known as statistical recoupling. The type of decoupling that temporarily existed in Kentucky (for residential customers) was of the second type, revenue-per-customer decoupling.

Q. What problems associated with some types of decoupling would SR solve?

A. Two side-effects that can result from the first two types of decoupling – ERAM and revenue-per-customer decoupling – are that they may cause relatively large fluctuations in rates under certain conditions, and that they also change the allocation of certain risks between the utility and its customers, most notably the risks related to weather and economic recessions. If the weather is severe and energy usage increases, during the next period the decoupling formula will lower the electric rate and require the utility to return some of the revenue to customers.

The formula would give rise to a similar refund if there is an economic boom and energy use per customer increases. Conversely, if the weather is mild and energy use falls, during the next period the decoupling formula will raise the rate per kWh and allow the utility to receive additional revenue from its customers. If there is an economic recession and energy use per customer decreases, during the next period the decoupling formula will raise the rate per kWh. In some cases, such as Maine's and Washington's experience with decoupling in the early 1990s, the rate effects of weather and regional economic conditions dwarfed the rate effects of energy efficiency programs.

SR addresses these issues and reduces the size of the fluctuations in the balancing account and consequently in electric rates. It does so by recoupling the revenues to the main factors that affect the amount of energy consumed. To develop the SR formula, a regression model is developed using the past 10 to 15 years of data, for energy consumption as a function of variables such as heating degree-days, cooling degree-days, the number of customers, the retail price of electricity, and a measure of economic activity in the region such as industrial output. Hirst's SR model also includes a first-order autoregressive term designed to reduce the standard error in the model's other coefficients. The allowable revenues for subsequent years are determined by using the same regression formula in conjunction with each year's variable data.[2] The result is that revenues are decoupled from sales – i.e., the Commission would stop punishing the utility financially for helping customers save energy – and the year-to-year rate fluctuations that can result from changes in weather and economic conditions are moderated. Statistical recoupling appears to be the decoupling approach that would be most beneficial for Kentucky.

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[2] Eric Hirst. *"Statistical Recoupling: A New Way To Break the Link Between Electric-Utility Sales and Revenues," pp. 33-36.*

Q. Is SR sufficient to align all parties' incentives in a way consistent with the utility's lowest-cost plan?

A. No, SR only removes the huge financial disincentive for energy efficiency that now exists. Another necessary element of the rate structure is a positive incentive to induce utility companies to embark on a dramatically different strategy than the familiar pattern we have seen for many decades. Kentucky's DSM statute specifically envisions the option of including a tariff provision that rewards the utility for "implementing cost-effective demand-side management programs." [3]

This incentive take the form of a shared savings element, in order to provide an incentive for the utility to operate cost-effective DSM programs. The shared savings element would preferably be based on actual measured savings, where these can be obtained, rather than extrapolations from engineering estimates. Several utilities in other states are allowed to recover a percentage, often approximately 15%, of the value of the energy savings, as a financial incentive. The actual savings can be measured or estimated using well-known measurement and verification (M&V) protocols.

Q. **How do traditional tariffs create a strong incentive for electric utilities to sell as much electricity as possible?**

A. In his pioneering report cited above, "Profits and Progress through Least-Cost Planning," David Moskovitz described the problem as follows:

1. When rates are fixed (as a result of a rate case), revenues and profits are not fixed. Whenever the marginal revenue from the sale of an additional kWh is higher than the marginal

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[3] KRS 278.285, Section (2).

cost of producing that kWh, which is virtually always the case, a utility can increase its net income by selling more electricity.

2. The fuel adjustment clause enables the utility to raise rates, in effect, if the utility is forced to use a higher-priced fuel to meet peak demands. According to Moskovitz,

> "Utilities even make money when they sell power for what initially appears to be less than it costs to produce. For example, to meet increased demand during peak periods, a utility may crank up a relatively inefficient diesel generator that consumes 10 cents worth of fuel to produce one kWh of electricity. The regulated price of power might be seven cents per kWh, which represents five cents in fixed costs and two cents allotted for the utility's 'average' fuel costs. But the utility can recover the extra eight cents in fuel costs later (that is, the generator's ten-cent fuel cost minus the two-cent average fuel cost) by invoking the fuel adjustment clause to raise rates. In effect, the utility charges customers 15 cents for the kWh, 7 cents now and 8 cents later through the true-up provisions of the fuel clause."

3. In general, incremental sales of electricity to an existing customer add no costs other than the fuel needed to produce the power. But because the price of electricity is fixed by the tariff and includes an element designed to allow the utility to recover its fixed costs, each kWh sold adds to net revenue.

4. The same logic applies to reductions in energy consumption. Each kWh not sold, due to customers' energy efficiency improvements or cogenerators, nonutility power producers, etc., has a powerfully negative effect on revenue and net revenue.[4]

It could be said that this set of financial incentives and disincentives is one of the unintended consequences of the traditional ratemaking approach. Just because certain consequences are unintended or have not been the focus of much recent regulatory attention, however, does not mean they are unimportant. Very often in human affairs, the impacts of the unintended consequences dwarf those of the intended ones.

Q. Is the Sierra Club proposing that the Commission do away with the Fuel Adjustment Clause (FAC)?

A. No. There are other ways to address the unintended consequences that result from the normal operation of the traditional fixed-rate structure combined with the FAC.

The basic points of the analysis described in Moskovitz' report of November 1989 were codified in a Resolution in Support of Incentives for Electric Utility Least-Cost Planning that was approved by NARUC's Executive Committee assembled in its 1989 Summer Committee Meeting in San Francisco. The Executive Committee urged its member state public utility commissions to:

1) consider the loss of earnings potential connected with the use of demand-side resources; and

2) adopt appropriate ratemaking mechanisms to encourage utilities to help their customers improve end-use efficiency cost-effectively; and

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[4] [Moskovitz, David, "Profits and Progress through Least-Cost Planning," November, 1989, prepared for the National Association of Regulatory Utility Commissioners (NARUC), pp. 3-6.] The entire report is available on the web at no charge via the website of the Regulatory Assistance Project, where Moskovitz is employed: http://www.raponline.org/Pubs/General/Pandplcp.pdf

3) otherwise ensure that the successful implementation of a utility's least-cost plan is its most profitable course of action.

Q. Was that the end of the story?

A. No. The Federal Energy Policy Act of 1992 (EPAct92) codified this concept in Federal law in the form of a ratemaking standard that each state's public utility commission was required to consider implementing. This standard is now in effect, is codified in 16 USC Chapter 46, subch II, Sec 2611, subsection d(8), and reads as follows:

> (8) Investments in conservation and demand management
>
> The rates allowed to be charged by a State regulated electric utility shall be such that the utility's investment in and expenditures for energy conservation, energy efficiency resources, and other demand side management measures are at least as profitable, giving appropriate consideration to income lost from reduced sales due to investments in and expenditures for conservation and efficiency, as its investments in and expenditures for the construction of new generation, transmission, and distribution equipment. Such energy conservation, energy efficiency resources and other demand side management measures shall be appropriately monitored and evaluated.

The law was a guideline rather than a requirement; any given public utility commission could choose to implement it in its ratemaking activities or not.

The DSM cost recovery mechanism now in place at E.ON and Duke Energy does not solve the problem identified by Moskovitz, even though it provides for the recovery of DSM program costs, lost revenue, and a shareholder incentive. Because the mechanism leaves revenue coupled to the volume of electricity sales, the rate structure simultaneously rewards DSM and the marketing of more electricity at all times. A complex web of incentives has been created at E.ON and Duke Energy, and the result is counterproductive. These utilities now have a financial incentive to operate DSM programs that may look good on paper but save very little energy in practice. The traditional incentive for these two utilities to sell more electricity at all times remains, unaffected by the DSM cost recovery mechanism that the Commission has put in place.

Q. Do you have a specific alternative rate proposal?

A. Yes, The following material draws very extensively from materials we found in "The Fifth Fuel" section of the Duke Power Responses.[5]

Q. What is the nature of the Argument?

A. The argument for this particular alternative rate structures goes as follows. DSM -- the whole range of Energy Efficiency initiatives -- is a reliable resource. Therefore the cost of providing DSM should be treated as a production cost in the regulatory arena. But as energy savings accrue, electricity sales and generation additions will erode. Therefore the pricing of watts saved should be tied to the utility's avoided cost of producing energy. Pricing these saved watts at a discount to new generation guarantees a discount to customers over the cost of supply only resources. One such discount that has been used is the avoided cost less 10%. Using an avoided cost model ties three traditional components of cost recovery into one simplified approach and puts the risk of performance on the utility. These three components are program cost, recovery of lost margins, and shareholder incentives.

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[5] Duke Response Volume 2 Part D 120707.
On pages 31-42 of 117 pp, internally identified as Attachment STAFF-DR-0 1 -006(d), being a set of briefing slides, which on pg 34 begins a section titled, The Fifth Fuel.

Q. How would you describe an Energy Efficiency Rider Rate Structure?

A. First, this alternative rate structure involves changing the way we think about utilities & energy efficiency. It encourages the use of Renewable Energy sources for 100% of the incremental power and energy requirement. New Generation capacity would be avoided, along with the cost to rate payers of that new generation capacity. The cost of implementing Energy Efficiency programs would be recovered, but only in part. This partial recovery would assure that electric rates would rise more slowly than if new generation capacity were build. For example, 90% cost recovery figures in the NC discussions. Kentucky electric rates are currently below national average, and would remain there.

Q. What Assumption does such a rate structure make?

A. This alternative rate structure makes the following assumptions.

-- In order to meet the growth in customer demand and reduce environmental impacts, energy prices are likely to rise over current rates.

-- Customers need help to better manage their electric bills in a rising price environment. Working with customers to develop new approaches to energy efficiency programs can result in significant customer perticipation at a cost less than that of new generation.

-- The best way to capture the cost of new generation is to use the avoided cost of generation that is subject to Public Service Commission review.

Q. Can you give a more detailed description of the Rider Alternative Rate Structure?

A. Yes, let me describe ingeneral the criteria, the Criteria, the Recover level and the rider itself, and the annual adjustment.

Q. What are the Criteria?

A. The PSC would need to determine an appropriate percentage of this avoided cost of generation that would automatically meet two criteria, (a) produce savings for customers, and (b) provide the utility with enough revenue to cover program costs.

Q. What recovery level is appropriate?

A. A recovery of 90% of avoided supply-side costs may meet these requirements. This takes into account the given supply alternative, the whole list of program costs: education, awareness, and administration measurement & verification, research & development, and finally an appropriate return on the investment.

Q. How does the Rider work?

A. A Rider would be created that would provide for three things (a) a KWh charge for retail electric customers, (b) Third-party verification of results, and (c) an annual adjustment. The adjustment would be based on updated projections of results, projected incremental avoided costs and actual results achieved by the company.

Q. What of the Annual Adjustments?

A. These annual adjustments ensure that the customers pay only for verifiable Energy Efficiency savings. The energy efficiency plan would be updated annually based on the performance of programs, market conditions, economics, consumer demand and avoided costs. This approach ensures the Utility will work to drive results up and costs down.

Q. Can you describe the Operation of such a structure in more detail?

A. In each year the utility would recover for the expenses in that year for the programs being implemented or in effect that year. Each program would have in general a different expected duration, a different set of participants and different costs. For each there would be expected numbers of participants for each year, expected on-going impacts (demand and energy) per participant per year, and expected percentage of "free riders". Therefore there would be an amount of avoided capacity and energy associated with each year of the program that will continue during the life of that particular program. The value of the avoided capacity and energy can be calculated. The Rider would be calculated to recover 90% of these avoided capacity and energy costs over the measure life. In each year additional participants might be added to the programs implemented in earlier years. In addition, there would be the implementation of one or more new programs. The value of avoided capacity and energy associated with these new participants would be calculated. The Rider for each year would be calculated to recover 90% of these avoided capacity and energy costs of BOTH the succeding year of the prior year participants as well as the first year of the newly added participants. An independent third party would verify energy savings. If savings were less than anticipated, the Utility Company would have over collected and a downward adjustment would be made to the rider in the year following the evaluation. If savings were more than expected, Utility Company would have under collected and the appropriate upward adjustment would be made to the Rider the year following the evaluation.

Q. What Benefits do you see to such a structure?

A. This rate structure based on Energy Efficiency would benefit the customers, the public, and the company. It would lower bills for ALL customers, compared to the bills that would result from supply-side only investments. It would provide customers with universal access to energy efficiency. It would produce a portion of needed capacity and energy to meet our customers energy requirements with zero emission. It would provide the company with financial incentive to produce energy efficiency that saves watts. It would foster the creation of new energy efficiency service jobs.

Statute in support of alternative rate structures.

Q. What changes to statute do you see required?

A. The federal law cited above appears to support what we are urging. However North Carolina enacted legislation to provide more specific guidance to their Public Serive Commission. Sierra Club urges PSC to seriously consider implementing a rate structure similar to the one described immediately below, and seeking such additional legislative authorization as may be necessary to do so.

Q. Can you briefly describe the North Carolina Law?

A. In 2007 the State of North Carolina adopted a measure providing for a Renewable Portfolio Standard (RPS) for electric powere generation, and including DSM as one of the qualifying sources of energy[6]. North Carolina thus becomes the fifth state in the US to allow DSM as part of a RPS. The four other of these states – Connecticut, Hawaii, Nevada, and Pennsylvania – have included energy efficiency or demand-side management (DSM) measures as qualifying resources, either to meet an RPS target in conjunction with other renewable energy or to meet a target created for a separate tier or class of resources as part of an RPS."[7] Part of this law creates an alternative rate structure based on an Energy Efficiency Rider.

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[6] NC LAW 2007-397. http://www.ncleg.net/Sessions/2007/Bills/Senate/PDF/S3v6.pdf. **GENERAL ASSEMBLY OF NORTH CAROLINA, SESSION 2007, SESSION LAW 2007-397, SENATE BILL 3.** AN ACT TO: (1) PROMOTE THE DEVELOPMENT OF RENEWABLE ENERGY AND ENERGY EFFICIENCY IN THE STATE THROUGH IMPLEMENTATION OF A RENEWABLE ENERGY AND ENERGY EFFICIENCY PORTFOLIO STANDARD (REPS), (2) ALLOW RECOVERY OF CERTAIN NONFUEL UTILITY COSTS THROUGH THE FUEL CHARGE ADJUSTMENT PROCEDURE, (3) PROVIDE FOR ONGOING REVIEW OF CONSTRUCTION COSTS AND FOR RECOVERY OF COSTS IN RATES IN A GENERAL RATE CASE, (4) ADJUST THE PUBLIC UTILITY AND ELECTRIC MEMBERSHIP CORPORATION REGULATORY FEES, (5) PROVIDE FOR THE PHASEOUT OF THE TAX ON THE SALE OF ENERGY TO NORTH CAROLINA FARMERS AND MANUFACTURERS, AND (6) ALLOW A TAX CREDIT TO CONTRIBUTORS TO 501(C)(3) ORGANIZATIONS FOR RENEWABLE ENERGY PROPERTY.

[7] La Capra et al. 2006. Technical Report, page iii. ANALYSIS OF A RENEWABLE

PORTFOLIO STANDARD FOR THE STATE OF NORTH CAROLINA. Prepared by La Capra Associates, Inc. (Twenty Winthrop S Boston, MA 02110), GDS Associates, Inc, and Sustainable Eneergy Advantage LLC. Provided to PSC as STAFF-DR-O1-006(b)(2)

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

AN INVESTIGATION OF THE ENERGY AND REGULATORY ISSUES IN SECTION 50 OF KENTUCKY'S 2007 ENERGY ACT	))))	CASE NO. 2007-00477

AFFIDAVIT

STATE OF KENTUCKY)
)
COUNTY OF ________)

Richard E. Shore, being duly sworn, states that he has read the foregoing prepared testimony and that he would respond in the same manner to the questions if so asked upon taking the stand, and that the matters and things set forth therein are true and correct to the best of his knowledge, information and belief.

Richard E. Shore

__Richard E. Shore____

Subscribed and sworn before me on this 27 day of February, 2008.

Beth A Jones

Notary Public

My Commission expires: 5-3-2008 ______________________