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Missouri Public Service Commission

STATE OF MISSOURI
PUBLIC SERVICE COMMISSION

In the Matter of the Joint Application of UtiliCorp United Inc. and Empire District Electric Company for Authority to Merge Empire District Electric Company with UtiliCorp United Inc. and, in Connection Therewith, Certain Other Related Transactions	)	Case No. EM-2000-369

AFFIDAVIT OF RONALD L. LEHR

STATE OF COLORADO)
) ss.
COUNTY OF ARAPAHOE)

Ronald L. Lehr, being duly sworn on his oath, hereby states that he has participated in the preparation of the foregoing Rebuttal Testimony in question and answer form; that the answers in the foregoing Rebuttal Testimony were given by him; that he has knowledge of the matters set forth in such answers; and that such matters were true and correct to the best of his knowledge, information and belief.

Ronald L. Lehr
Ronald L. Lehr

Subscribed and sworn to before me this 20 day of June, 2000.

Notary Public, State of Colorado
County of Denver
My commission expires: My Commission Expires 08/30/2003

Exhibit No:	
Issues:	Merger Impact and Commitment by Joint Applicants (UtiliCorp United Inc. and Empire District Electric Co.) to Provide Energy Efficiency Programs to Customers
Witness:	Ronald L. Lehr
Sponsoring Party:	Missouri Department of Natural Resources Energy Center
Type of Exhibit:	Rebuttal Testimony
Case No.:	EM-2000-369

IN THE MATTER OF THE MERGER APPLICATION OF UTILICORP UNITED INC. AND EMPIRE DISTRICT ELECTRIC COMPANY

REBUTTAL TESTIMONY

OF

RONALD L. LEHR

Q: Would you please state your name and business address?

A: Ronald L. Lehr, 4950 Sanford Circle West, Englewood, Colorado 80110.

Q: What is your professional background?

A: I am an attorney and formerly Commissioner and Chairman of the Colorado Public Utilities Commission (PUC). As a Colorado utilities commissioner from 1984 to 1991, I regulated electric, natural gas, transportation, telecommunications, and water utilities. I recently finished a six year term as Commissioner of the Denver Board of Water Commissioners, a municipal water agency that is the main supplier of water to the Denver metropolitan area, and a producer of hydro electric power. I have extensive professional experience working with energy policy, including energy efficiency, electric resource planning, and renewable energy. I serve on the Board of Directors of an energy service company, Financial Energy Management, Inc. which provides energy efficiency services to clients in the United States.

I practice law and provide consulting services for clients including the National Renewable Energy Laboratory (the lead U.S. Department of Energy renewable energy laboratory), Enron Wind Development Company (a wind turbine manufacturing and wind energy project development firm), and Vulcan Power Company, a developer of geothermal electric generation power. I consult for the National Association of Regulatory Utilities Commissioners (NARUC) and the National Conference of State Legislatures (NCSL) on renewable energy. My work with NARUC and NCSL helps utilities commissioners and staff participate in two DOE renewable energy commercialization efforts, the PV COMPACT ("PhotoVoltaic COllaborative Market Project to Accelerate Commercial Technology") and the NWCC ("National Wind Coordinating Committee"). I serve on the Wind Powering America Strategy Team, helping the DOE implement its initiative to dramatically increase wind energy use in the United States. (See: **www.eren.doe.gov/windpoweringamerica/)**. My resume is attached hereto as Schedule RLL-1.

Q: What is the purpose of your testimony?

A: My testimony states the case for the Missouri Public Service Commission (Commission or PSC) and Utilicorp United to begin investigating and implementing more renewable and alternative energy resources, as a condition of approval of the merger sought in this docket

. *The two main reasons for doing so are to add resource diversity to manage risks and to* meet customer demand. My experience with electric utility customers leads me to believe that they want utilities to diversify to achieve a broader and cleaner mix of generation resources. Emerging markets for electricity generated from renewable resources show that customers will support this strategy with their money. Customer willingness to pay for cleaner energy applies both to their electric rates and to discretionary customer purchases. Utilicorp's diversification toward cleaner resources has started. My testimony addresses many of the steps that the Commission and the company can take to encourage further progress.

To explain the logic for adding renewable and alternative resources to the Utilicorp system, my testimony covers renewable resources, technologies and demonstration projects. It deals with utility green pricing programs, green marketing where customer choice is allowed, and certain transition issues. I discuss reasons to consider adding renewables to the utility rate base. I state my view that renewables are unlikely to be stranded assets in retail choice markets. I discuss certain renewables policy options for decision makers to consider. I present information on customer demand for renewables and recommend Deliberative Polls™ of customer opinion to help define the path forward for Missouri. My testimony supports the goals of the July, 1999 Missouri Department of Natural Resources Division of Energy Integrated Strategic Plan. The goals include: "Strengthen environmentally sound and diverse energy supplies."

Q: What are renewable resources?

A: Renewable resources are a diverse set of energy fuels provided by natural processes that recur depending on the sun or the Earth's heat. Typically, these resources are not depleted by human use, either because they naturally recur, or are part of processes that recharge the resources. Solar, wind, hydro, biomass and geothermal resources are considered renewable. The sun drives solar thermal as well as solar electric technologies. Passive solar building designs, solar shading, and daylighting are solar applications found in the built environment.

The sun drives wind, broadly available for many small electric and pumping applications, and available for commercial bulk electricity sales from sites characterized by high average wind speeds and access to transmission services. The sun also provides the hydrologic cycle, lifting water that can drive both large and small electric power turbines.

Like the diversity of solar, wind and hydro resources and applications, biomass resources and technical approaches for their use vary widely. Crop, animal and food preparation residues can provide opportunities for power production. Landfill and sewage treatment gas resources are associated with human population concentrations and are typically found near urban areas. Wood and other fiber waste, such as manufacturing debris, yard waste, and tree trimmings, can be a substantial energy resource where produced or discarded in quantity.

Geothermal resources include low and high-grade heat sources for geothermal heat pumps and geothermal steam electric generation. Until the geology of steam heat changes in Missouri, I do not contemplate that high-quality geothermal steam resources will be particularly relevant to this testimony. But geothermal heat pumps and earth-sheltered dwellings and structures might be considered passive design features that could use Missouri geothermal resources.

Q: What renewable resources are currently providing electricity in, or for Missouri?

A: Utilicorp United discovery response provided the following information: "Missouri Public Service owns 8% of a 1.5 MW wind generation project, consisting of two 750 kW (kilowatt) or .75 mW turbines. At full capacity these two turbines could serve 550 households. The energy produced by this resource is sold to MPS customers under a special tariff. MPS also burns shredded tire refuse at its Sibley generating station. In 1999, approximately 10,000 tons (approximately .6% of total fuel consumed) were burned. MPS has no other planned or proposed alternative resource-based electric facilities." There is also a hydro resource in the Empire system, consisting of the 16 MW Ozark Beach facility (direct testimony of Robert W. Holzwarth, Schedule RWH-4, Page 6 of 6).

Q: What renewable resources are available in Missouri?

A: There are solar, wind, hydro, biomass, and geothermal resources available in Missouri. The first step in using more of Missouri's indigenous renewable resources is to find out more about the location and quality of the resources that are available. The MDNR is willing to enter into partnership with the PSC, its Staff, Office of Public Counsel (OPUC), Utilicorp and other Missouri utilities, and other stakeholders who are interested in learning more about the renewable and alternative resources that are available in the state. The partnership that MDNR proposes would use the capabilities of a wide variety of stakeholders. These include the PSC and its staff; Missouri utilities; federal, state, and local governments; colleges, universities, and technical institutions; the non-profit sector; Missouri businesses; and interested individuals to review data currently available that describes Missouri renewable and alternative resources. The partnership that MDNR proposes would also plan and implement additional data collection, where required, to achieve a thorough understanding of the resources that might be used to provide Missouri-based renewable and alternative sources of energy.

Fortunately, there are resources available to help this effort. For example, the U.S. Department of Energy (U.S. DOE) **www.eren.doe.gov/wind** supports utility involvement with renewable energy through its financial support of the Utility Wind Interest Group (UWIG) See: http://www.uwig.org/. UWIG helps the DOE implement the Utility Wind Resource Assessment Program (UWRAP). A similar utility-focused effort demonstrates the use of Photovoltaic (PV) in utility and customer applications. The Utility Photovoltaic Group (UPVG) is a good option for Missouri utilities that want to learn more about PV. (See: http://www.ttcorp.com/upvg/) The US DOE also supports an extensive national laboratory system, and significant support for resource assessment is available from research personnel at the Pacific Northwest Laboratory (PNL) and Sandia Laboratory, as well as from the National Renewable Energy Laboratory (NREL). Information from these institutions and work in a Missouri-based collaborative process can provide baseline information and broaden understanding about renewable and alternative resources available for use as energy or energy efficiency resources in Missouri. Establishing this baseline is a necessary first step toward using more of these indigenous resources.

Q: What are reasonable approaches to renewable resource assessment?

A: After review of presently-available Missouri resource information, additional resource assessments can help to justify use of additional renewable resources, and help those who wish to develop these resources understand how best to do so.

Solar

Solar resources can be estimated from data available from the U.S. DOE. Solar heat contributes to the requirement for summer cooling loads in buildings. Solar heat adds to the build up of heat in urban areas. Use of solar-wise lot and building orientations in land development and approval processes, planting trees for shading, and passive solar building designs are solar strategies that can help avoid requirements for summer cooling loads on the utility electric system, thereby reducing customer cooling season electric costs and increasing customer comfort. A cogent strategy for urban forestry can have benefits for electric distribution system reliability, as well as reducing cooling loads and providing more attractive, valuable properties and communities. Having detailed solar resource studies is probably not required to implement these common sense solar strategies, since such measures can be implemented without great additional costs. Passive solar measures for buildings and solar-wise development and forestry strategies are examples of working smarter up front, rather than investing more for equipment or technology solutions.

Other solar technologies, such as solar water heating and solar electric technologies using photovoltaic cells or solar dish-Sterling hybrid technology do involve more capital outlays. So these technology approaches will benefit from calculations of the incident solar resource available at the site proposed for use of these technologies. Where such data is required, the assistance of the NREL and Sandia Laboratory should be sought.

Wind

Wind resources can be estimated based on meteorological data that has been cumulated and reported by DOE and its national laboratory system. Estimated data, coupled with common-sense approaches may be sufficient for small wind installations, while on-site data monitoring with wind logging devices mounted on towers is advisable for locating wind resources of sufficient vigor to justify the investments required for bulk wind electric production from large turbines. If wind monitoring data is desired, there are programs like UWRAP that help with monitoring and are available from the US DOE.

The DOE data reports that class three wind areas are found in southwestern Missouri associated with the Ozark Plateau. Class three wind areas are suitable for commercial wind development. Finding wind sites with the best wind resource that are environmentally suitable and have transmission access nearby should be a high priority for Utilicorp, the Commission, and the DNR. With information about the specific resource and development issues in hand, the economics of wind development in Missouri can be understood on the basis of known facts. See: **http://rredc.nrel.gov/wind/pubs/atlas/chp3.html#s_central**.

Missouri utilities should consider participating in the UWIG and the UWRAP to take advantage of the collective intelligence now resident within the utilities that are already developing their wind resources and participating in these groups. Many utilities with interests in developing wind resources also belong to the American Wind Energy Association (AWEA), the wind industry's trade group. AWEA maintains extensive information resources to assist with understanding and developing wind projects, including periodical publications, vendor lists, and active participation in issues affecting wind energy development. Private sector vendors, consultants, and service providers can also assist in collecting and analyzing wind resource necessary data. AWEA is a good resource for identifying these firms. See: **http://www.awea.org**.

Biomass

Biomass resources should be a high priority for assessment in Missouri, given the state's population base in cities and towns and its prominence in the agricultural and forestry industries. Since there is some experience with co-firing waste tires at the Sibley generating station, there may be interest in co-firing wood and other biomass waste streams that are currently destined for landfills. Landfill gas resources and sewage treatment plant gas production are of interest to private sector developers in many parts of the country, since these renewable resources are inevitably associated with urban areas and have interesting safety and environmental benefits. Since anaerobic digestion of biomass and landfill waste produces methane gas, a powerful green house gas, capturing the gas and producing electricity from it represents a very beneficial environmental strategy. Landfill gas can migrate underground, posing a safety risk to adjoining properties. The EPA often requires landfills that produce methane to be piped and the gas they produce to be pumped. The gas must be safely flared or allowed to dissipate in the atmosphere, so producing electricity from these resources takes advantage of an otherwise wasted resource opportunity, turning pollution into production.

Since agricultural and forestry biomass resources need to be harvested or collected and shipped to generation locations on a sustained and predictable basis, the underlying status of the business that gives rise to the biomass must be carefully considered, along with the geography of these resources. Experience elsewhere suggests that consistency of supply and shipping costs can be crucial factors in the successful development of these resources.

Hydro

Hydro resources of magnitudes capable of producing tens of megawatts of electricity have usually already been developed, or present unacceptable environmental impacts, making new large-scale hydro development problematic in most cases. However, smaller hydro resources attendant to agricultural irrigation and municipal water supplies can provide opportunities to develop hydro-electric projects with acceptable environmental burdens. The potential for reworking existing hydro sites to be more productive and environmentally acceptable should be investigated. Where water is being moved from one location to another for use, or where pressure relief is required to balance pressure in various zones of a water service system. One critical factor in the success of these smaller projects is the transaction cost of identifying these opportunities and developing them into successful projects. See: **http://www.epa.gov/outreach/lmop/index.htm** for information about the U.S. Environmental Protection Agency's program to assist development of these resources.

Geothermal

Geothermal resources using the stability of the temperature gradients underground can provide attractive opportunities for use of geothermal heat pumps for heating and cooling and for earth sheltered buildings (See: http://www.ghpc.org/). Assessment of these resources is typically uniform and straightforward, although advances in geothermal heat using technologies and sealing earth sheltered buildings from water damage provide interesting challenges.

Q: What is your current view of the state of technologies that use renewable resources to produce electricity?

A: In my view, the best recent work that characterizes renewables technologies is provided by a joint report from the Electric Power Research Institute (EPRI) and US DOE in their December, 1997 "Renewable Energy Technology Characterizations" report, (EPRI TR 109496). The explicit goals of this work were to describe the technical and economic status of the major emerging renewable options and to offer projections for their future performance and cost. The objective of the report was to provide an objective assessment and description of the renewable power technologies for use by the electric industry and energy and policy analysts and planners. There are sources of information about these technologies that are both more and less optimistic than the EPRI and DOE work. In my view, the EPRI and DOE characterizations for renewables should be accepted as middle of the road. I rely on them in the following comments about the renewables technologies.

Solar

The EPRI and DOE report deals with solar in two categories: photovoltaics and solar thermal. Photovoltaic technologies are further subdivided into residential, utility-scale flat-plate thin film, and utility-scale concentrators. Solar thermal subcategories include solar power towers, solar parabolic troughs, and solar dish engines. Passive solar designs, solar heating of building air by solar walls, solar thermal hot water heating technologies do not result in electric power generation, so EPRI and DOE do not include these approaches to building orientation and design in their characterizations.

Photovoltaics

In general, photovoltaic technologies are commercially useful and available today, although at costs that limit their cost-effective applications to a large number of very different niche markets. Solar photovoltaics (PV) had its first success powering spacecraft. It is currently cost effective for many remote applications and in circumstances where it can power small loads cheaper than running new wires to connect to the utility electric system. These cost savings are based on the comparative capital costs of PV versus the grid, rather than on kWh costs. For example, the capital cost of adding a half mile or so of distribution wire to power a small load can be uneconomic when compared to providing power to such loads with PV. In these circumstances, it is the capital cost, rather than the per kWh cost that makes PV economic.

PV has also been successfully demonstrated in a number of green markets where customers voluntarily pay its extra costs. PV supplies power for several utility green pricing programs where customer demand exceeds supply. PV is a popular product for installation on residential rooftops in utility green pricing programs. And PV has been successfully added to green power products that include a mix of resources in markets where customers chose their generation supplier. Distributed applications of PV are an emerging market where PV's relationship to peak utility loads is beginning to be understood. Since PV generally produces its power best on sunny days when utilities experience their peak loads, and it can be located on buildings at the load site, the benefits of PV used as distributed generation can be captured.

PV costs have generally been declining, and the EPRI and DOE technology characterization for PV modules shows prices dropping from about $3.00 per watt in 1997 to about $2.00 per watt in 2005. Generally PV module costs are about half the installed price of a PV system. PV has no moving parts and can work almost anywhere direct sun is available. It enjoys terrific customer acceptance and holds great interest for schools. A group of almost 100 electric utilities, has been working in the UPVG to help utilities understand and use currently cost effective PV, and to demonstrate the use of PV in high-value applications. The Missouri PSC should encourage Utilicorp to participate actively in the UPVG.

<u>Wind</u>

Technologies for making electricity from wind turbines have improved over the last twenty years, with prices for wind power dropping from around 40 cents per kWh in 1980 to 3.5 to 4.5 cents per kWh today in energetic wind areas. EPRI and DOE describe the wind technologies that are suitable for large wind farm applications. They predict major improvements in cost and performance being likely in the future, base on the considerable operating experience being gained primarily in California, but also in Minnesota, Hawaii, Texas, Iowa, Wyoming, Colorado, Oregon, Pennsylvania, and Vermont. Advances in the ability of developers to design, site, install, operate, and maintain wind turbines and improved manufacturing methods, and continued public and private sector research and development also support the trend toward lower costs. Variable speed generators, larger rotors and advanced airfoils, higher hub heights and advanced control systems are cited as some of the technical improvements to wind turbines that are in prospect that will contribute to the lower costs EPRI and DOE project in the future.

Wind's primary utility market is as a fuel saver whose output must be used when available. It displaces energy and variable operating expenses that otherwise would have been provided by conventional resources. Because wind is intermittent, additional value beyond fuel savings and variable operating expenses depends on the wind resource and its relation to utility loads. The capacity value of wind depends on how much conventional generation wind can replace. Improvements in the ability to forecast wind will add to its value as a utility resource. Capital cost of wind is projected by EPRI and DOE to decline from about $1000 per installed kW in 1997 to $720 in 2005.

Wind is a successful product in many utility green pricing offerings across the country and in markets where customers can chose their electric generation provider. In addition to investor owned utilities developing successful wind projects, municipal, public, and cooperative utilities are participating in these markets, along with aggregators and marketers. Wind has great customer appeal. Along with solar, wind is what most people think of when they think about renewable power.

Since the best wind resources are found in areas that are remote from loads, transmission access, cost, and availability are key economic factors for developing wind. Likely sites for wind development combine good wind resources with access to transmission. Research by the Pacific Northwest Laboratory suggests that market penetration for wind is not likely to be constrained by wind resource availability within ten miles of available transmission lines. Missouri can look to its own wind resources and to resources available in adjacent states. Wind is compatible with farming and grazing, making it a new crop for rural areas that often need economic development. Proper siting for wind turbines requires attention to avoiding bird habitats and to visual impacts.

Biomass

Biomass generation of electricity is a proven utility option, with about 500 plants around the country contributing 7 GW of generating capacity, representing about 1% of total electricity generating capacity, the largest non-hydro renewable energy contribution. Burning forestry residues, municipal solid wastes, and agricultural wastes for electric generation has been undertaken for many years. Where coupled with steam loads at larger scale, these electric generation operations have provided reliable power at reasonable cost, particularly in the forestry industry.

EPRI and DOE characterize projects that burn biomass to produce power without steam loads as having "acceptable technical performance and marginal economics." Marginal economics for these projects are due to small plant sizes, fuel shortages, and high fuel prices. These factors can result in consequent high operating costs and low efficiencies, leading to costs in the 8 to 12 cents per kWh range. Larger size projects at 50 MW or more are found economic where fuel costs are in the $1 per MMBtu range and where steam loads are used in conjunction with electric production. EPRI and DOE estimate year 2000 costs for direct fired biomass at about 7.5 cents per kWh, while gasification-based biomass projects for the same year are estimated at about 6.7 cents per kWh.

EPRI and DOE technology characterizations deal with biomass in three separate technologies, gasification-based biomass, direct-fired biomass, and biomass co-firing. Of these, biomass co-firing with coal appears to offer the emissions reductions and productive use of biomass waste streams with very low incremental capital and operation and maintenance costs, where appropriate biomass waste streams are available. DOE recently announced that it is awarding $675,000 to five universities to study small-scale burning of biomass mixed with coal in utility or industrial boilers. University on-campus heating plants will be used for this research. More information is available at: **http://www.doe.gov/news/releases00/junpr/pr00151.htm**>. DOE leads the federal government's Bioenergy Initiative, working on technology advances that will foster an integrated and competitive bioenergy industry. See the Bioenergy Initiative Web site on EREN at: <**http://www.eren.doe.gov/bioenergy_initiative/**>.

Biomass gasification and electric production in combustion turbine or combined cycle electric generation plants is being developed and demonstrated. Clean-up of the gas fuel to avoid turbine damage appears to be among the most important issues this technology faces. Biomass gasifiers are being developed at the University of Missouri at Rolla for the Institute of Gas Technology. Flanigan, V.J., O.C. Sitton, and W.E. Huang, "The Development of a 20-inch Indirect Firect Fluidized Bed Gasifier," University of Missouri at Rolla, Rolla, Missouri, for Pacific Northwest Laboratory, Richland, Washington: March 1988. Report PNL-6520/UC-245.

Biomass resources can also produce methane gas in landfills and sewage treatment plants. Electric generation technologies that use these resources have not been characterized in the EPRI and DOE work. Because they are associated with urban areas, these resources should be investigated in Missouri. The managers of large landfill operations and sewage treatment plants can be contacted to determine their interest in producing electricity from the methane produced by their operations. There are also developers who specialize in these projects who also might be interested partners.

Hydro

Technology for producing electricity from hydro resources is well-known and extensively used in the United States Hydro resources can be among the lowest cost of all resources, which accounts for the relatively complete development of available domestic hydro sites. It is uncommon to find an environmentally acceptable, undeveloped, large-scale hydro opportunity. If the Commission approves the proposed merger, Utilicorp will be acquiring the Empire 16 MW Ozark Beach Hydro facility in the proposed merger.

The MDNR has proposed that a partnership be established to review all potential renewable and alternative resources available in Missouri. This review should include the potential for development of low impact, environmentally benign hydro sites, but experience in other states suggests that the larger the hydro site under consideration, the greater the chances that environmental constraints will be encountered. This fact of life suggests that smaller hydro sites might provide the best combination of resource availability and project feasibility for review in Missouri. In California and in the Northwest, where large-scale hydro has encountered concerns about endangered salmon runs, "low-impact" hydro facilities and electric production is being certified so that production from low impact facilities can be marketed successfully. The criteria for these certification programs might provide important benchmarks for consideration in reviews of Missouri hydro resource potential.

Early in June, the San Francisco based non-profit Low-Impact Hydropower Institute certified the first "Low Impact" hydroelectric generation facility. The certification was of the Fall River Rural Electric Cooperative Island Park Hydroelectric Project located in Ashton, Idaho. The Institute's certification program seeks to apply criteria for evaluating the environmental impacts of hydropower facilities. The Institute's certification criteria include eight aspects of hydropower operations, ranging from water flows to fish impacts to recreational uses. Certification depends on evidence submitted by local resource agencies and regulators. Certification information is available at the Institute's website: **www.lowimpacthydro.org**.

Geothermal

The technologies for using geothermal steam and hot water resources is well known and demonstrated at sites with total capacity of 2800 MW. Technologies for producing electricity from hot dry rock geothermal resources require creation of a permeable reservoir by hydraulic fracturing, so that water from the surface can be pumped through fissures to extract heat from the rock. Hydro thermal projects are commercial today, while projects to create electricity from hot dry rock are not. For Missouri, further review of the potential for using geothermal energy in ground source heat pump applications and for earth-sheltered buildings will probably more relevant than review of the electric generation technologies.

Q: What are the costs and benefits of renewables for electricity?

A: Renewables projects have many costs and benefits that are similar to conventional projects. These projects have capital and operations and maintenance costs like any other projects. They must be planned, located, financed, constructed, operated, and, presumably, eventually decommissioned, like any other projects. They produce electricity and useful BTUs.

Renewables projects also differ from conventional projects in some important ways. The costs of using renewables for electricity include capital costs that are generally above those of fossil fuel projects. The additional capital costs can represent the price paid up front for freedom from fuel costs over the long term. Since renewable resources tend to be spread out over the landscape, the geographic scale and location of renewables projects tends to be less concentrated than fossil fuel projects. Some of the renewables technologies are new, so technology risks are different. Solar and wind renewable resources are intermittent, driven by diurnal and weather factors, and not subject to conventional dispatch. Electricity from renewable resources is a relatively new idea in many parts of the country, so there are costs getting up the learning curve. Renewables projects are typically smaller sized than fossil units, so there may be more transaction costs per unit of installed capacity or production.

Renewables benefits can also be distinguished from those of conventional resources. Solar and wind do not require fuel. They diversify and manage the risks of fuel price and availability. Renewables generally do not pollute, or pollute less than fossil projects, so they do not add to risks of changes in pollution regulations. They enjoy widespread public support. Unexpected customer support is emerging in circumstances where utility green pricing and green marketing offer renewables to customers. Renewables technologies are typically different than conventional technologies, so they provide diversity of technological approach and manage technology risks.

Some renewables can be conveniently located at or near customer loads, so they carry the benefits of distributed resources, including fewer line losses, transmission and distribution investment offsets, and improved distribution-level power quality. Renewables costs are less risky than fossil fuel costs, since there is not generally a need to rely on fuel cost projections.

The technologies that use renewable resources are typically products that are manufactured in factories and shipped to the sites where they will be used. This feature distinguishes them from coal and nuclear plants that are constructed on site. It also means that they share with gas turbine technologies the economies of manufacturing scale that drives costs down as more units are produced. These declining costs are apparent in the cost curves for PV and wind technologies and support the trend toward continued cost improvements for these technologies.

Q: Why should renewable demonstration projects be undertaken?

A: Utilicorp has a very modest commitment to renewables and alternative energy at this time. Demonstration projects are a good way to learn more, while keeping risks low. Demonstration projects can attract support from governmental and private sector partners. They can lay the base for larger efforts.

Q: What are some reasonable approaches to get demonstration projects going?

A: The lowest cost, most feasible approaches are to join with other utilities that are demonstrating renewables projects in the UPVG and UWIG. Fortunately, there is no need to reinvent the wheel. There is a need for Utilicorp to assign staff, consider and approve budgets, and to make commitments. The first step is to learn more about the resources available in Missouri, working with stakeholders in the state (including the Commission, staff, OPUC, and MDNR). Working together, Utilicorp can define reasonable demonstration projects and work with other stakeholders to develop these projects.

Q: What are the salient characteristics of utility green pricing programs?

A: Utility green pricing programs offer renewable products to utility customers under Commission-approved tariffs. Customer acceptance is voluntary. Monthly prices for blocks of renewable power in addition to metered electric usage are typically cost-based, or at least reference cost of service even if they depart from strict cost of service principles.

Participating customers bear the costs of renewables that are above the utility's avoided power cost. Service is based on voluntary residential customer commitments to stay on the program, typically for a year or for three years for commercial customers. No utility green pricing program is known that threatens to shut electric service for non-payment of the voluntary green pricing rate.

Utility marketing of these programs varies from enthusiastic to modest to truly pathetic. In many cases customer demand for these products has consistently outpaced the willingness of utilities to supply renewables to meet customer demand. In some cases, usually where active marketing is missing, these programs have not met expectations for customer response. Utilicorp has taken a unique approach to subscribing customers for its green pricing program, a lottery in which the winning customers get to subscribe and pay for the MPS share of two turbines in Kansas. Generally speaking, lottery winners do not give, but rather receive. A Utilicorp spokesman stated in an August 25, 1999 MPS press release that "Offering Missouri customers a Green Power option is the foundation of Utilicorp's effort to grow renewable energy programs in the U.S." In my opinion, starting the "foundation to grow renewables" with a lottery where the winners pay suggests one of the reasons why the DNR believes that the Commission should condition the Utilicorp merger on a more serious effort to move forward on renewables in Missouri.

Q: What are the features of green pricing programs that are successful?

A: The most successful utility green pricing programs feature low cost, abundant resources, high-level utility executive support, and broad-based community-focused marketing. They are based on careful market research, thoughtful product design and development, and build on renewables commitments that the sponsoring utilities have made for all ratepayers. Offerings from utilities that have committed shareholder funds to renewables for all ratepayers have credibility with customers who seek to buy renewables from a company that "walks its talk." The most complete information on utility green pricing programs is available at: http://www.eren.doe.gov/greenpower/ pricing.shtml.

The best of these programs feature the environmental improvements attributable to increased use of renewable resources. They provide consistent, reliable, and informative communications of the impacts customers have had getting renewables going in their area, and by periodically feeding back this information to customers. The best products are positioned for competitive markets, responding to customers' desires for choices, rather than as donations. A successful customer offering will be easy for customers to understand and easy for them to get. Repeated customer exposure to the idea of purchasing renewables is required for success. Projects that are visible to customers are easier for them to understand. Locating projects near customers is not required, although it can be helpful. Public Service Company of Colorado has made arrangements for its wind project to be featured on the leading TV weather report in the Denver market.

Q: What is the role of renewables in retail customer choice markets?

A: A remarkable new concept is growing in markets where customers have a choice of their electric suppliers. Since the early 1990's when the first utility offered a customer option of contributing to money for renewable energy development, a radical change has appeared in electricity markets. More than a dozen companies are marketing green power to customers. In Pennsylvania and California, significant numbers of customers have made a choice to purchase green power at a premium over competitive offerings. In a development that was unanticipated at the opening of these markets, significant numbers of commercial, institutional, and governmental customers are purchasing large amounts of green power. Where electric markets are regulated, more than 50 utilities now offer, or plan to offer, "green pricing" to their customers. By the end of 2000, about thirty percent of U.S. electricity consumers will be able to purchase green power.

These are striking developments, given that, at the beginning of green pricing and green marketing only three or four years ago, skeptics denied that **any** customers would spend more to buy the value propositions at the heart of green power transactions. Some utility green pricing programs have enrolled about 5% of their customers (Madison Gas and Electric 4.7%, Holy Cross Electric 4.1%), but more typical rates for participation right now are at the 1-2% level for utility programs. See, http://www.eren.doe.gov/greenpower/topten.shtml.) In green markets, As of September 30, 1999, approximately 85% of the 162,000 direct access residential and small commercial customers in California were being served with green power. **http://www.eren.doe.gov/greenpower/dereg_ca.shtml.**

In the Pennsylvania market, a recent report by PennFuture cumulates customer acceptance of green power in the state's restructured electricity market. After one year of competition, PennFuture reports that about 80,000 customers switched to cleaner electricity options with about 30,000 of these customers choosing a green power product, having 50% or more renewables content. About 16% and 6%, respectively, of the approximately 500,000 customers that switched suppliers as of January 2000 chose these cleaner power options. PennFuture also reports on availability and pricing of green power products, environmental benefits of purchasing green power, and suggests that energy efficiency improvements can be used to offset higher prices of some green power products. The goal of PennFuture's customer education campaign in Pennsylvania is that 10% of electricity be generated from renewable energy resources by 2010. For more information, see: **ttp://www.eren.doe.gov/greenpower/dereg_pa.shtml.**

U.S. retail electricity market revenues approach $340 billion per year. One possibility is that customers will continue to respond to green pricing and green marketing options on the trends apparent today. If they do, or if their response accelerates, then there is the potential that enough investment in renewables projects and technologies will result in renewables manufacturing and deployment scale economies dropping costs significantly, even if green products only capture 5 to 10% retail market share. As these market and cost trends continue to play out, utilities that envision a competitive future, but are on the sidelines on renewable energy, risk losing the green market to competitive firms. These firms grasp the implications of the customer data that is available from early market experience and customer research.

For more customer research information, see:
http://www.eren.doe.gov/greenpower/farhar_26148.pdf

Q: What are transition issues and options for moving from green pricing to green marketing?

A: Missouri customers, decision-makers, and market participants will face transition issues as generation service markets are opened to customer choice. Customers who have one voluntary choice under green pricing tariffs will face a variety of choices if retail markets are correctly structured. Customers need time and information to learn about what is at stake in their choice among generation suppliers. If periodic disclosure of utility prices, generation resources, and environmental performance is required prior to, and as a condition of, opening retail generation choice markets, then customers will have opportunities to become informed in advance of making their choice among generation providers. If Missouri's version of restructuring includes funds for consumer education prior to and coincident with opening retail markets for choice, customers will have additional opportunities to educate themselves. The market for customer choice of generation supplier will only operate well when participants have access to information.

Green marketing firms have taken the position in other states that utility green pricing should not be allowed, since it gives utilities an unfair market advantage on the eve of restructuring. This concern depends on the assumption that utilities can capitalize this presumed marketing advantage. To make judgments about whether utilities are in a good position to corner the green market with products developed, in part, to meet regulatory concerns, one must review the product development and marketing capabilities of monopoly electric utilities. While these capabilities among utility firms vary a great deal, it is fair, in my judgment, to start the analysis keeping in mind that monopoly firms do not need marketing, since they own the entire market by definition. Turn over among utility marketing personnel can be another key indicator of utility marketing success.

Q: What are the reasons for including renewables in utility rate base?

A: The main reasons for including renewables in utility rate base are to secure the benefits of renewables I have listed above:

- Solar, wind, geothermal, and hydro do not require fuel.
- Renewable energy resources diversify and manage the risks of fuel—uncertain price projections, consumer price volatility and fuel availability.
- Renewables generally do not pollute, or pollute less than fossil projects, so they protect public health.
- Renewables do not add to risks of changes in pollution regulations.
- The public supports renewables.
- Renewables technologies help to manage technology risks.

- Renewables can provide the benefits of distributed resources—more efficiency from reduced line losses; smaller, more modular projects, improved environmental performance, and diversity to maintain reliability.
- Renewable technologies exhibit economies of manufacturing scale and declining costs.

In addition, utilities may wish to consider adding renewables to the rate base because development of green markets in customer choice states suggests that mastery of renewables capabilities could advantage firms that invest in renewables within the regulatory construct.

Q: Are renewables likely to be stranded assets in retail choice markets?

A: Public support for renewables and alternative resources remains strong. In numerous instances, successful green pricing and green marketing have led to difficulty supplying adequate renewables to meet customer demand. Decision-makers are willing to support renewables with system benefit charges and renewable portfolio standards. Government and industry are turning toward clean energy resources to meet their voluntary commitments to mitigate pollution and climate change. Markets for trading green credits separate from energy purchases are starting to emerge. Given these trends, I think that renewables investments made at today's best prices are highly unlikely to be stranded assets in retail choice markets.

There is not "a market" for electricity against which all projects can be measured to determine whether they are stranded or not. Rather there are "electricity markets." Some of these markets are for low-cost, relatively dirty power. Some of these markets are for higher-cost clean power. The markets for clean power appear to be willing to support the additional costs of providing the environmental and diversity value of utility renewable projects. Therefore, these projects are unlikely to become stranded assets when utility markets are restructured.

Q: What are renewables policy options for decision makers to consider?

A: Decision-makers must consider a plethora of issues in deciding whether, and on what terms, to open markets for retail choice. Some observers may feel that these issues are not directly relevant to the merger proceeding. In the merger proceeding, the Commission will neither accept nor reject these policies. I am testifying about them because, without keeping them in mind, it will be impossible for either the companies or the Commission to judge fairly whether to condition the merger on more attention to renewables and alternative energy, or not. Electric industry restructuring is happening, whether Missouri adopts customer choice or not. Restructuring is what Utilicorp and its merger partners are doing in proposing their merger—restructuring their ownership. Other states that have restructured in a manner that allows customers to chose their generation supplier have considered, and adopted policies that impact on renewables and alternative energy resources. My testimony briefly addresses three policies related to renewables and restructuring—"getting the competitive policies right," Renewables Portfolio Standards, and System Benefits Charges. I also address net metering and interconnection policies, which should be adopted by Utilicorp whether their proposed merger, or customer choice, goes forward in Missouri.

"Getting the Rules Right"

Green marketers that compete in states that allow generation choices emphasize that "getting the rules right" is critical to their ability to compete. If the utility price for generation service is set too low, then there are few incentives for any one to choose a new generation supplier. This is the lesson of the California approach to restructuring. If utility generation prices are set high enough, customers can save money by switching providers. This is the lesson of the Pennsylvania approach to restructuring. In California, green marketers have a tough sell in the market place, since the underlying economic incentives for customers to switch to a new provider to save money are weak. In Pennsylvania, green marketers can offer green products at a premium associated with their cost, and still save money for customers who switch from the incumbent provider.

Renewables Portfolio Standard

The Renewables Portfolio Standard (RPS) is a market-driven policy that ensures that a minimum amount of renewable energy is included in the portfolio of electricity resources and, by increasing the required amount over time, can put the electricity industry on a path toward increasing sustainability. Because it is a market standard, the RPS relies almost entirely on the private market for its implementation. Market implementation will result in competition, efficiency and innovation that will deliver renewable energy at the lowest possible cost.

Renewable Energy Credits are central to the RPS. A credit is a tradable certificate of proof that one kWh of electricity has been generated by a renewable-fueled source. Credits are denominated in kilowatt-hours (kWh) and are a separate commodity from the power itself. The RPS requires all electricity generators (or electricity retailers, depending on policy design) to demonstrate, through ownership of credits, that they have supported an amount of renewable energy generation equivalent to some percentage of their total annual kWh sales. For example, if the RPS is set at 5%, and a generator sells 100,000 kWhs in a given year, the generator would need to possess 5,000 Credits at the end of that year.

Investors and generators make all decisions about how to comply, including: the type of renewable energy to acquire, which technologies to use, what renewable developers to do business with, what price to pay, and which contract terms to agree to. Generators decide for themselves whether to invest in renewable energy projects and generate their own credits, enter into long-term contracts to purchase credits or renewable power along with credits, or simply to purchase credits on the spot market. Only the bottom line is enforced: possession of a sufficient number of credits at the end of each year. The credit system provides compliance flexibility and avoids the need to "track electrons." Because the RPS applies equally to all generators, it is competitively-neutral.

Under the RPS, no renewable energy project is guaranteed a place in the market. Each project must continually compete to keep its place in the market created by the standard. Least-cost compliance is encouraged through the flexibility provided to generators who are subject to the standard: they can compare the cost of owning a renewables facility to the cost of a credit/renewable power purchase package and to secondary-market credits. Those who are most efficient at generating renewable power will end up producing it, and those who cannot efficiently produce it will purchase credits on the competitive market. This fosters a "competitive dynamic" that is not achieved with policies that involve direct subsidies to renewable generators without involving the rest of the electric industry.

System Benefits Charges

System Benefits Charges have been adopted by several states. This policy places charges on the distribution wires portion of the electric utility business that remains a monopoly under regulation to support benefits of the traditional utility business that would otherwise be stranded after restructuring. The states that have adopted these policies have included support the levels of energy efficiency, low-income customer needs, customer education, environmental improvements, and renewables that were already in rates prior to restructuring. Wisconsin has adopted the wires charges without restructuring, in an innovative program known as "Wisconsin Reliability 2000." See: http://www.ucsusa.org/energy/view.rely2k.html. In some cases, large amounts of money have been directed toward support for renewables in these policies.

As in the case of Renewables Portfolio Standards, these policies will have impacts on Missouri utilities, whether the state decides to allow customer choice or not. Support for renewables in other states will expand the market for renewables technologies. Expanded markets will lead to increased manufacturing of renewables equipment, refinement and expansion of renewables development expertise, improved access to lower cost financing, and broader public understanding of the role of the technologies—and to lower costs. Lower costs will make these technologies more competitive in Missouri, and will further increase customer demand. So, in my judgment, these policies bear scrutiny by Missouri decision-makers, first as to whether to implement them in Missouri, and second as to their economic and market impacts on Missouri renewables projects.

Net Metering

Whether Missouri restructures or not, Utilicorp and the Commission should investigate and implement net metering for customer-owned renewable resources. As national concerns about reliability and power quality are increasingly felt locally, and as the technologies for on-site generation proliferate and improve, Missouri customers will be taking advantage of their option to become energy producers, as well as energy consumers. Net metering simply allows customers to run their watt-hour meters backwards, rather than going to the expense and trouble of obtaining a separate meter. Net metering is advisable as a transition mechanism to keep metering of customer generation simple. About thirty states have adopted some form of net metering, usually including a limit on the installed capacity of customer-owned generation equipment that can be net metered. For more information, see: **http://www.eren.doe.gov/distributedpower/index.html**and see: http://www.nrel.gov/wind/ab_24527.html.

Interconnection Policies

In addition to net metering, customers who chose to interconnect their own sources of generation to the utility grid should be able to take advantage of interconnection policies that are reasonable, predictable, and appropriate for the size of their facility. Smaller facilities should be easy to interconnect. Everyone is familiar with the common telephone "jack". Interconnection policies address the same set of barriers and opportunities for hooking up equipment to the electricity grid as the telephone jack addressed for telephony. The Missouri Commission should adopt and Utilicorp should implement national technical standards that have been developed by national technical standards-setting bodies, like the Underwriters Laboratory ("UL-listed"), IEEE, and the National Electrical Code. These standards define what equipment can be interconnected to the grid safely, and eliminate hassles, both for customers and for the utility.

In addition to adopting national technical standards for interconnection, the Missouri Commission should adopt simplified interconnection standards for the non-technical aspects of interconnections—simple contracts, defined procedures for interconnection decisions, reasonable liability provisions (including insurance requirements), and specifications for when utilities can require expensive and time consuming special studies. These non-technical barriers to interconnection can be as frustrating to many customer applications of new on-site generation technologies as the technical standards. See: **http://www.eren.doe.gov/distributedpower/pages/issue_other.html**. See also "Making Connections: Case Studies of Interconnection Barriers and their Impact on Distributed Power Projects" NREL/SR-200-28053, May, 2000.

Q: What do we know about customer demand for renewables?

A: A great deal of customer demand information is available in publicly available literature. One of the best resources summarizes findings from almost 600 reported polls and surveys over the last 15 years that asked about customer preferences on energy and environment. This extraordinary accumulation of information is found in Dr. Barbara Farhar's "Trends in Public Perceptions and Preferences on Energy and Environmental Policy" (NREL/TP-461-4857, February, 1993). Dr. Farhar's "Willingness to Pay for Electricity from Renewable Resources: A Review of Utility Market Research NREL TP-530-26148 (July, 1999) deals with both what customers say they will pay and what they actually will pay. Not surprisingly, customers say they will pay more than they will actually pay. Market results show that there is sufficient customer demand to support significant expansion of renewables projects in a wide diversity of utility and market circumstances. The relevant literature is available at the DOE EREN web site: http://www.eren.doe.gov/greenpower/library.shtml #research

Q: What do Deliberative Polls™ reveal about customer electric resource preferences?

A: Deliberative polling is a technique to determine informed public opinion. The essential question is, "What would the target population think if they were given an opportunity to read about, discuss, and ask questions concerning the issue under consideration?" The key difference between deliberative polling and standard opinion polling is the difference between raw opinion and informed opinion. The key difference between deliberative polling and focus groups is the ability to extrapolate Poll results to the entire population.

Deliberative polling was developed by Jim Fishkin, Chairman of the Government Department at The University of Texas. It was first tried internationally with two experiments funded by Channel 4 in Great Britain. The first considered crime in Great Britain; the second considered international issues. The first U.S. trial in January, 1996 was the National Issues Convention featuring presidential aspirants and broadcast coverage by the McNeil Lehrer news organization on PBS. The first utility applications took place in the summer of 1996 in Corpus Christi with subsequent polls conducted in Abilene, Shreveport, El Paso, Houston, Beaumont, Dallas and Amarillo.

In each of the utility town meetings, the utility companies brought together 200-250 of their customers selected at random in a scientific sample. These customers were chosen from among those who completed the baseline telephone survey. In the town meetings, customers deliberated the tradeoffs in generation resource planning and responded to the company with their concerns. Advocates for all resource options and experts who helped to inform the customers participated in the experiment. All of the utility polls were successful from the view of the customers, the regulators, and the companies.

Deliberative polling works best on complex issues when there is a range of diverse viewpoints. Over a period of one to two days, the customer sample deliberates the issues and questions experts on the merits of various options. Customers become informed on the issues and respond on a questionnaire with their opinions. The closing survey repeats the baseline telephone survey, with questions added that determine customer reactions to the Poll process. Texas customers reported extraordinary satisfaction with their experience in the utility Polls. Generally, customer opinion before and after the exercise changes dramatically.

Q: What are the steps in a Deliberative Poll ?

A:

- Draw a scientific sample of the target population and gauge their raw opinion with a questionnaire carefully reviewed by a broad-based advisory committee that oversees the entire Poll process.
- Recruit participants from the large sample for a one to two-day deliberation exercise.
- Provide participants with complete and balanced information presenting a range of options and viewpoints on the issues under consideration.
- Bring the participants together for the deliberation.
- Alternate between small groups led by professional moderators and large groups where participants are given an opportunity to question panels of experts.
- At the end of the exercise, measure opinion of the sample again and compare before and after results.
- Maintain contact with the sample for future and follow-up research.

Q: What are the benefits of Deliberative Polling?

A:

- Deliberative polling is a constructive way to involve public officials and decision makers.
- Deliberative polling is constructive way to involve competing interest groups.
- Deliberative polling is an excellent opportunity for positive media coverage. Participants like the process.
- Deliberative polling has a noticeable impact on the sponsoring organizations. It is a rare opportunity to see a scientific sample in person.
- Deliberative polling provides the ability to get out front on an issue. It provides information on the way public attitudes will evolve as customers gain more information.
- Deliberative polling is an intense exercise but it is over quickly and the results are available within a day or two.
- The results of deliberative polling can be extrapolated to the target population as whole (within the statistical confidence levels built into the experiment).

To the great surprise of almost everyone involved, the two thousand Texans who participated in the Texas Deliberative Poll Town Meetings showed conclusively that ordinary citizens and utility customers want more renewable energy and energy efficiency in the resource mix offered to them by utilities. For example, 81% of Central and Southwest utility system (CSW) customers who participated in the poll said they would pay a dollar more a month for adding renewables to the CSW system. CSW subsequently issued a renewable RFP and built a major wind power plant in rate base, adding about 25 cents a month to the average residential electric bill. 56% of TXU Electric (formerly TU Electric) customers preferred that the company pursue renewable technologies as the first option. In response to the Polls, TU Electric issued an RFP for renewable energy and contracted for a large wind plant.

Utility executives, who prior to the Polls recited the litany of usual reasons utility executives give for not including renewables in their responsibilities—too expensive, not dispatchable, doesn't work—found themselves trying hard to understand and explain to their organizations that their companies were going to implement renewables because **that is what the customers want**. The Texas Public Utilities Commission, lead by a self-styled "Texas conservative, appointed by George W. Bush" reversed course on renewables, from a position that renewables did not matter, to one of support for renewables, because **that was what the customers wanted in the Polls**.

The Missouri Public Service Commission, Utilicorp, and the Missouri Department of Natural Resources should collaborate with other stakeholders to use Deliberative Polling to determine whether electric industry restructuring in Missouri should proceed, and if so, what policies should address renewable energy issues within restructuring. Find out what the customers want when they have had a chance to learn more and deliberate on their preferences. Believe the customers and give them what they want.

Q: What is your conclusion about renewable energy?

A: This testimony stated the case for the Missouri Public Service Commission and Utilicorp United to begin investigating and implementing more renewable and alternative energy resources to add diversity to manage risks and to meet customer demand. Customers want utilities to diversify to achieve a broader and cleaner mix of generation resources. Emerging markets for electricity generated from renewable resources show that customers will support renewables with their money.

Q: What are you asking the Missouri PSC to do?

A: The Commission and the company should join with the Missouri Department of Natural Resources and a broad range of stakeholders to assess the state's renewable and alternative resources. They should develop demonstration projects, review and implement policy and market options (including adopting net metering and interconnection policies), and put the questions to customers in a Deliberative Poll™. Then it should listen to the customers; let them show Missouri the path forward.

Q: Does that conclude your testimony?

A: Yes, it does.

Resume

RONALD L. LEHR
ATTORNEY
4950 Sanford Circle West
Englewood, Colorado 80110-5127
303 504-0940 TELEPHONE
209 856-3264 FACSIMILE
rllehr@msn.com **email**

CURRICULUM VITAE

May 26, 2000

Educational Background

1969	Dartmouth College, University of Sheffield, England, BA cum laude, distinction in major field of study: history
1974	University of Colorado, College of Law, Juris Doctor

Work History

Current Attorney and Consultant, energy and telecommunications law, regulation, and business

Current assignments for clients include work for the National Renewable Energy Laboratory on national and state regulatory barriers and opportunities for photovoltaic commercialization in utility markets; for the National Conference of State Legislatures, the National Association of Regulatory Utility Commissioners, and Resolve, Inc. on the National Wind Coordinating Committee, the national collaborative for commercialization of wind energy technology; and for Enron Wind Development Corporation, a wind energy company, on public policy issues.

1984-91 Commissioner, Chairman 1985-87, Colorado Public Utilities Commission

While Chairman and Commissioner of the Colorado PUC, responsibilities included carrying out state constitutional and statutory mandates for regulation of telephone, electric, gas, water, and transportation utilities in Colorado, oversight of the Commission's staff and budgets, and accountability to the Governor, Legislature, and the people and utility customers of Colorado. Additional assignments included membership on the Energy Conservation, Communications, and Executive Committees of the National Association of Regulatory Commissioners (NARUC); as a member of the Federal Communications Commission's Joint Board in Docket Nos. 78-72, 80-286, and 87-339 (dealing respectively with national telephone access charges, national telephone industry accounting and financial separations, and reporting on the impact of federal subscriber line charges); and as founder and first Chairman of the US West Regional Oversight Committee and of the Western Conference of Public Service Commissioners Telecommunications Committee.

Through these additional assignments, and in dealing with the oversight of about $5 billion dollars of annual utility revenues under regulation in Colorado, broad knowledge was gained about the regulated industries, as well as specific technical expertise in law, and substantial acquaintance with accounting, finance, engineering, management, economics, and policy as well as management of the course of very highly disputed public interactions.

1981-84 Attorney, private practice in corporate law and business litigation

Representative clients included firms active in real estate development and construction, distribution and sales, ski lift manufacturing, manufacturing, and corporate mergers and acquisitions. Handled holding company diversification into North American primary energy resources (oil and gas, coal, and uranium), hydropower, and cogeneration fields for the Electrowatt, Ltd., the largest privately owned Swiss electric utility company.

1977-81 Director, Energy Conservation, Planning and Policy Divisions, Colorado State Office of Energy Conservation

Responsibilities included legislative and regulatory policy and issues, including solar and renewable energy tax credits, low income and elderly energy tax credits, solar easements, state procurement on life cycle cost analysis, building codes and standards, and training of building code officials; economic analysis, focused particularly in measurement and evaluation of energy conservation programs; state energy and development policy and planning, including the relationships between local land use planning and transportation planning and energy policy; and responsible for implementation of the Colorado State Energy Conservation Plan.

Boards of Directors

1993-1999 Commissioner, President 1995-96, Denver Water Board of Commissioners (Municipal Water utility serving water to over 900,000 people)

1993-present Board of Directors, Financial Energy Management, Inc. (energy service company offering energy efficiency and related services)

1998-present Board of Directors, International Sustainable Technology Business Development Corporation, Inc. (business association developing sustainable businesses located at Denver's Stapleton Airport redevelopment site)

Recent Professional Committees and Associations

Current: Member, Denver and Colorado Bar Associations

Recent Non-profit and Volunteer Activities

1987-94 Chairman, Board member, Volunteers for Outdoor Colorado (volunteer public lands improvement projects)

1992-96 Advisory Committee, Results Center, IRT Environment, Inc. (analyzed and published energy conservation program results)

1993-present Trustee, Johnson Foundation (private Colorado foundation funds primarily social services)

1991-94 Advisory Committee, Natural Gas Assistance Foundation (participates in gas market to raise funds to assist low income natural gas customers)

1997-1998 Member, Renewable Energy Task Force (appointed by Governor to study and report on renewable energy for Colorado's future)

1997-present Trustee, Ruth K. Stoll Trust (educational trust benefiting 22 extended family members)

1998-1999 Member, Colorado Electricity Advisory Panel (appointed by Governor to legislatively-mandated electric industry restructuring study panel for Colorado)

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