BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Application of Wisconsin Public Service Corporation for a Certificate of Public Convenience and Necessity for Construction of a Large Electric Generating Plant with Associated Facilities, Known as Weston Unit 4, at its Existing Weston Generating Station Located in Marathon County	)	**Docket No. 6690-CE-187**

Testimony of

Donald Wichert

On behalf of

RENEW WISCONSIN

June 25, 2004

Q. PLEASE STATE YOUR NAME AND YOUR ADDRESS.

A. My name is Donald Wichert. I live at 1810 Keyes Avenue in Madison, Wisconsin 53711.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The intent of my testimony is to bring to the attention of the Commission and to Wisconsin Public Service Corporation (WPSC) a unique and possibly least cost way to use a renewable fuel (wood) at the proposed Weston 4 coal plant.

Q. WHAT ARE YOUR QUALIFICATIONS FOR PRESENTING TESTIMONY IN THIS CASE?

A. I have worked professionally in the renewable energy field in Wisconsin since 1980. I began my energy career in Wisconsin in 1980 as an air permit engineer for the State of Wisconsin's Department of Natural Resources. I was involved in the permitting of the Northern States Power French Island wood fired power plant as well as many other industrial processes and fuel changes. In 1981 I was employed by the Department of Administration's Division of Energy (DOE) as an analyst and began to cover biomass and many other topics. For the next 23 years at the DOE I was the primary analyst, program manager, energy statistician and provider of public information related to renewable energy in Wisconsin. From 1986 to 2003, I directed and supervised the annual production of the Wisconsin Energy Statistics. Beginning in 1981, I managed the Energy Development and Demonstration Program, in 1986 the Waste-to-Energy Program, in 1990 the Renewable Energy Assistance Program, and in 1998 the Focus on Energy Renewable Energy Pilot. During my career at DOE, I was also involved in many

additional federal, state and local programs and projects. Currently, I am director of the Focus on Energy Renewable Energy Program and am an employee of the Wisconsin Energy Conservation Corporation (WECC), the primary administrator of this program. I have written a number of published papers on biomass topics such as air pollution and resource availability, and co-led a national conference on biomass in 1998 in Madison, which attracted 523 biomass professionals primarily from the United States and Canada. I served as Wisconsin's manager of the US Department of Energy's (DOE) biomass energy program from 1985 to 2004 and was chair of the Interstate Renewable Energy Council's biomass committee. Currently I serve on the board of directors of the Biomass Energy Resource Center; a Vermont based non-profit organization, which promotes sustainable biomass applications primarily in the institutional sector and farms. Recently, I was appointed to the Governor's Forestry Council's Woody Biomass Task Force. I am a licensed professional engineer in Wisconsin and have undergraduate degrees in Geography (Western Illinois University), Thermal & Environmental Engineering (Southern Illinois University) and a master's degree in Land Resources with an Energy Analysis & Policy certificate (University of Wisconsin-Madison). In general, I believe I am one of the most qualified persons in Wisconsin, if not the country, to make some reasoned statements and observations on the use of biomass energy at the Weston 4 proposed plant.

Q. ARE YOU BEING FINANCIALLY SUPPORTED TO PREPARE THIS TESTIMONY?

A. My current employer, WECC, graciously allocated a few hours of my time to seek out partners, a coordinator and to seek funding for a more in-depth analysis of the Weston 4 co-burning options. Unfortunately, I was not aware of the timelines for the Weston 4 case and was not able to prepare an acceptable proposal for PSCW approved intervener financing and was unable to receive financial support from a number of organizations which I had approached. I prepared this testimony on my own time, without pay and based primarily from resources I have cultivated over my career and through professional contacts. I am providing this pro bono testimony because I believe Weston 4 presents a very unique and long-lasting opportunity to utilize a local renewable fuel that should not be missed.

Q. WHAT IS THE CO-BURNING PROPOSAL YOU THINK SHOULD BE CONSIDERED BY WPSC BEFORE THE COMMISSION APPROVES A CONSTRUCTION PERMIT AT THE WESTON 4 SITE?

A. I believe WPSC should build a biomass gasification plant that is capable of supplying 5 to 20 percent of the energy to whatever size coal plant may be approved by the Commission at Weston 4. The fuel would come from local sources with wood waste, regional silviculture operations and woody crops grown by local farmers. A 25 MW wood-fired co-burning plant would create 2,500-3,000 local job years in employment and would reduce air pollutants of carbon dioxide, sulfur dioxide, nitrous oxides and mercury.

Q. FIRST, DESCRIBE A GASIFIER TECHNOLOGY THAT SHOULD BE CONSIDERED.

A. The gasification process that seems best suited to the Weston 4 situation is a technology developed by Energy Products of Idaho (EPI). The process takes a wide variety of biomass fuels and converts them to biomass gases with a heating value of 175 Btu per cubic foot (natural gas is typically about 1,000 Btu per cubic foot) and provides this gas to the coal combustion chamber where the wood gas would co-burn with coal. The process uses a simple, single-stage, fluidized-bed technology. A 6 MW unit has been operating in Cedar Rapids, Iowa since 1998 and sells its power to Alliant Energy .[1] The detailed description of the EPI process and technology can be accessed at the EPI website.[2] The EPI technology has been publicly supported by Black & Veatch, the engineering company designing the Weston 4-coal plant.[3] There are other separate plant biomass technologies that may be adaptable and less costly than the EPI unit which could be used for co-burning (such as the Whole Tree Energy developed by Energy Performance Systems). These should be thoroughly considered by WPSC as well before a CPCN is granted.

Q. DESCRIBE WHY SEPARATE BIOMASS COMBUSTION TECHNOLOGY APPEARS TO BE SUPERIOR TO OTHER BIOMASS CO-BURNING TECHNOLOGIES.

A. The EPI gasification technology has three advantages over co-burning via a process that mixes the wood and coal in the combustion zone of the boilers.

[1] See http://www.biofuels.com/profile.html for a description of this plant
[2] See http://www.energyproducts.com/EPITechPapers.htm
[3] See http://www.energyproducts.com/EPINewsPage.htm

1. It separates the wood feed system from the coal system and allows, if necessary, the coal system to function independently, allowing for additional fuel flexibility.
2. It allows the wood ash to remain separate from the coal ash, allowing the coal ash to be sold in coal ash markets and the wood ash to be recycled back on the land as a fertilizer.
3. It allows the gasification unit to utilize a wide variety of locally available wood fuels.

Q. HOW IS THIS TECHNOLOGY DIFFERENT FROM THE OTHER BIOMASS GASIFIERS THAT HAVE BEEN CONSIDERED ELSEWHERE?

A. There are many different types of gasification that have been considered by other companies and research institutions for over 100 years. However, the failed systems all tried to create and clean a gas before going into a turbine or an engine of some type. This is extremely difficult and to my knowledge has not been commercially developed. The system offered by EPI is simple and focuses on providing a gas that can be burned cleanly in the coal combustion area rather than an engine. It could be considered as a modern day version of the city gas units that provided cooking and lighting gas to residences before natural gas was discovered and distributed. Similar to the currently operating EPI system in Iowa, these simple systems ran continuously for many years.

Q. HOW MUCH WOOD FUEL WOULD BE NEEDED AND WHERE WOULD IT COME FROM?

A. The amount of wood fuel needed would depend on determining the optimal size of the co-burning operation, which depends on the amount and price of wood within a 50-mile radius of the Weston 4 site. The 25 MW gasification unit modeled by EPI in the study mentioned in footnote 2 projected a need for 600 tons a day or 220,000 tons per year of a 30 percent moisture mix of wood fuel. If the 500 MW Weston 4 coal plant was approved and built, this unit would supply five percent of the energy supplied to the steam boilers and turbine. A 50 MW plant would double the fuel requirement while supplying 10 percent of the fuel. I believe it is worthwhile to evaluate in detail the availability and price of wood resources in the 50-mile radius to support either of these power options.

Q. SPECIFICALLY, WHERE DO YOU THINK THE WOOD FUEL WOULD COME FROM?

A. The wood resources in Marathon and surrounding counties are substantial. I suggest the wood could come from urban tree management, local wood residues generated by the local forest and other industries, logging residues and woody crops grown specifically for the plant.

Q. COULD YOU DESCRIBE THE URBAN FORESTRY MANAGEMENT WOOD SUPPLY SOURCE?

A. The Wausau metro area could provide some of the fuel from its municipal tree-cutting program, similar to the process used to supply wood fuel at the St Paul District Energy System. At St. Paul, the urban metro area provides about a third of the fuel needed for the 25 MW plant. Although the Wausau metro area would provide much less wood than the Twin Cities metro area, the St. Paul wood

energy system example does indicate that the collection can be done in cooperation with metropolitan governments, creating an enviable private/public energy partnership.

Q. WHERE WOULD THE INDUSTRIAL WOOD RESIDUES COME FROM?

A. According to the DNR, the Weston 4 site is surrounded by over 2.5 million acres of timberland within a 50 miles radius.[4] Marathon County alone is host to over 30 wood products industries that generate wood waste.[5] There are approximately 75 companies producing wood residues within 50 miles of the Weston site.[6] Another study conducted by DNR[7] identified nearly 450,000 tons of residues per year produced (not including sawmills) in the Central District, which roughly falls within a 50 miles radius of the plant. Much of this wood residue is already dry and would make an excellent fuel source. A study conducted by the US Forest Service identified 1,000,000 green tons of wood residues at primary wood-using mills in the Central region.[8] A study done by a WPSC in 1999 identified over 65,000 tons of wood residues per year at prices less than $10 per ton, which is less expensive than the likely coal fuel cost, even without considering future CO2 taxes or federal tax credits.[9]

Q. WHAT ABOUT FOREST RESIDUES AS A WOOD SUPPLY?

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[4] Spreadsheet provided by Vern Everson, DNR Forest Products Specialist, June 2004.
[5] Wisconsin Department of Natural Resources, Directory of Wood Residue Generators in Wisconsin, (October 1993). p 23 - 25.
[6] Ibid., p 21, 23, 24, 40, 46, 56, 57, 59
[7] Wisconsin Department of Natural Resources, Wisconsin Wood Residue Study, (October 1993). P 11.
[8] Reading, R. and Whipple, J., Wisconsin Timer Industry-An Assessment of Timber Product Output and Use, 1999, US Forest Service, Resource Bulletin NC-218. p 90.
[9] Olsen, Andy, Co-Burning Opportunities in Wisconsin, A Strategic Assessment, Prepared for the Division of Energy, Department of Administration, (June 2001). p 3-31.

A. Forest residues are created as a byproduct of current logging practices. In general, about half of the tree biomass is left in the forest, which creates a significant fire hazard. The US Forest Service estimates about 422,000 wet tons of forest residues are produced each year in the Central District, much of which is left in the forest.[10] It's possible that forest management (thinning) practices could also provide a wood energy resource that can be dedicated to the plant, while improving the eventual quality of the existing forest.

Q. HOW COULD ENERGY CROPS BE USED TO FUEL THE WESTON 4 PLANT?

A. A significant amount of research has been conducted in the United States and in Wisconsin on growing such woody crops as hybrid poplars and hybrid willow bushes specifically for energy production. Local farmers would be encouraged to grow these energy crops on marginal cropland, land registered under the Conservation Reserve Program, and riparian areas. About 42 percent of the area within 50 miles of the Weston 4 plant, encompassing more than 2,000,000 acres, qualifies as agricultural land and can be considered capable of supporting energy crops or other crop residues.[11] The Oak Ridge National Laboratory has assembled a data base of likely volumes and cost of biofuels by county. According to this data base, in the seven counties surrounding Weston (Langlade, Lincoln, Marathon, Portage, Marathon, Waupaca, Wood), there are approximately eight million dry tons a year that could be grown on pasture and cropland, harvested and loaded in a trailer at the farm gate for an estimated cost of $39 to $60 per ton

[10] Reading, R. and Whipple, J., op.cit. p 88.
[11] Olsen, A., op.cit. p 4.

($2.5 to $3.75 per million Btu)[12]. These crops have been studied extensively by the U.S. Forest Service at Rhinelander and at UW-Madison at the Arlington Agriculture Research station.

Q. HOW WOULD THE FUEL BE DELIVERED TO THE PLANT SITE?

A. The wood could best be delivered by both semi-trailer trucks and by rail. The urban tree trimmings and industrial residues would most likely be delivered by truck and could be coordinated by a wood energy aggregator or broker. Forest residues and energy crops could be gathered by truck and brought to a processing facility located near a rail spur and delivered by rail. Special gathering, processing and storing methods are improving for each of these wood supply options and can be optimized for the fuels of choice.[13] A 25 MW plant using 600 tons a day would require 24 semi trucks carrying 25 tons per load or one per hour. Conversely, one 36-car rail delivery could deliver enough fuel for three days at 50 tons per car. It's likely that both rail and trucks would be used as location and prices reach equilibrium.

Q. DID WPSC ADEQUATELY CONSIDER THIS TECHNOLOGY IN ITS ASSESSMENT OF THE WESTON 4 COAL OPTIONS?

A. I don't think so. However, it is difficult to determine exactly what was considered in the information provided in the draft Weston 4 EIS under the biomass scenario. It appears that the only option studied was a stand-alone biomass plant, which is

[12] The information is available on the internet at: http://bioenergy.ornl.gov/pubs/resource_data.html

[13] For example, Energy Performance Systems has developed a harvesting system for energy crops that can produce 100 tons an hour at a fully loaded cost of $2.30 per dry ton. The technology and assumptions are described in : "Economic and Technical Feasibility of Modifying the Minnesota Valley Power Plant to Utilize Whole Trees as the Primary Fuel Source," report to Xcel Energy by Energy Performance Systems, Inc., May 2003.

not as cost-effective as the separate gasifier described in this testimony. If WPSC did study this technology and fuel delivery options, I would like the opportunity to have the analysis peer-reviewed to assess the assumptions and specifics of the energy system.

Q. WHAT TYPE OF ADDITIONAL VALUE DO YOU THINK A CO-BURNING PLANT LIKE THIS MAY PROVIDE FOR WPSC RATEPAYERS?

A. The co-burning option reduces fuel supply and price risk and it is likely to offer more value than just relying on the coal plant by itself. Dual-fuel options are inherently more price-stable than units dependent on a single fuel. Potential fuel switching options allows the plant operation to purchase and use fuels based on current market price and availability. In addition, the wood energy unit would create the potential for emission credits or reduced air pollution technology costs from reduced SOx, NOx, Mercury and CO2. The likely increase in WPSC's requirement to fulfill their Wisconsin RPS requirement at a 10 percent level will create a need for an additional 700 million to one billion kWh per year by 2015.[14] For comparison, a 25 MW wood gasification plant operating at 85 percent capacity would produce 186 million kWh per year.

Q. WHAT WOULD BE THE ESTIMATED MACRO ECONOMIC IMPACT ON THE LOCAL ECONOMY FROM USING 220,000 TONS OF LOCALLY AVAILABLE WOOD PER YEAR AS A REPLACEMENT FOR IMPORTED COAL?

[14] Estimate by WPSC submitted to Renewable Energy Sub Committee meeting of the Governor's Task Force on Energy Efficiency and Renewable Energy (and received by the author on June 23, 2004) considering a 10 percent RPS for Wisconsin.

A. I directed an economic impact study from renewable energy in Wisconsin in 1994, which presents a rough idea of the potential impacts.[15] The study modeled a number of renewable fuel resources and compared them to coal and gas replacement. For a 25 MW wood biomass plant, the study predicted a total of $203 million in total economic output, $59 million in earnings and 2,912 job years would be created from the construction and operation of a wood energy plant over a 30-year period. Although the Wisconsin economy and assumptions have changed since the study was completed, it is likely that using a local fuel, the extensive Wisconsin forestry equipment infrastructure and local labor would create significant positive impacts on the local economy.

Q. WHAT ARE THE PRICE ECONOMICS OF THIS GASIFICATION PROCESS TO PROVIDE ENERGY TO THE PROPOSED WESTON 4 STEAM BOILER?

A. According to EPI, a 25 MW gasification technology costs from $260 to $320 per installed kW or about $8 million to construct. Amortizing the capital cost over the 30-year life of the system would bring the capital cost to about 0.35 cents per kWh. I do not have specific information on operation costs of the gasifier, but one analysis suggests a cost of about 1.5 cents per kWh.[16] Fuel costs will vary depending on the type of fuel and establishment of a new market for the fuel. It is likely that the driest fuels will produce a higher value than wet fuels on a weight basis, but actual fuel prices over the life of a 30-year plant are subject to many uncertainties. Wood energy plants at Ashland and LaCrosse have managed to find enough fuel at low prices to compete with the remaining power producers in

[15] Clemmer, S. and Wichert, D. The Economic Impacts of Renewable Energy in Wisconsin, Wisconsin Division of Energy, Department of Administration, (April 1994). p 54.

Wisconsin's electric power system without any subsidies. This suggests prices for the Ashland and LaCrosse wood plants to be in the range of 50 cents to $1 per MMBtu. Given the abundant supply of woody fuels in the Weston area, there will be adequate competition to hold down prices through normal supply and price mechanisms. An average cost of $1.50 per million Btu delivered to the plant may be a reasonable estimate until an actual RFP for wood fuels in the region is released and market forces are in balance. This fuel price may be equivalent to 1.5 cents per kWh if the heat rate of the boiler/generator is 10,000 Btu per kWh. This delivered wood energy price assumes a mix of urban forestry wastes, industrial wood wastes and the lowest-cost forest residues. The EPI gasifier in Iowa is able to use a wide variety of biomass fuels, and it's possible that other local sources, such as corn stalks and paper mill sludge could also be available at low costs. Therefore, if the capital, operation and fuel costs are added, the delivered energy to the coal boiler tubes would be in the 3.35 cents per kWh hour range.

Q. WHAT REASONABLE ASSUMPTIONS SHOULD THE COMMISSION CONSIDER WHEN EVALUATING IF THIS SYSTEM CAN COMPETE ECONOMICALLY WITH THE COAL UNIT?

A. Potential federal tax credits, emission reductions, a new Wisconsin RPS (and/or an expanded green pricing offering) and potential carbon taxes should make a wood fired system a good investment for ratepayers over the life of the plant. In addition, it may be possible to obtain a significant grant from the U.S. Department of Energy or U.S. Department of Agriculture for a demonstration unit at Weston

[16] Clemmer, S. and Wichert, D. op. cit. p 120.

4. This project would likely be eligible for federal clean coal funds or from the federal biomass energy budget. Targeted funds ("budget marks") from these sources are common for projects in federal legislative districts. The Weston 4 unit is located in U.S. Representative Obey's district. Representative Obey is the minority leader of the House Appropriations committee and is in a position to influence a decision to support a project that has high local and national merit.

Q. DO YOU HAVE ANY CONCLUDING REMARKS CONCERNING THIS CO-BURNING OPTION THAT THE COMMISSION SHOULD CONSIDER?

A. Yes. I think the commission should order WPSC to thoroughly study the wood energy system that I have described, and make a good-faith effort to incorporate wood generation as part of any plant being approved at Weston 4. Many factors suggest that a wood fired co-burning system similar to the one I have described should be built at Weston and replicated in other parts of the state and nation. Wisconsin's energy policy clearly establishes a preference for wood-fired generating systems over coal and natural gas. The economics of this system appear to be in range of the coal unit, and the wood system will be able to use the high thermodynamic efficiencies of the supercritical steam cycle to its advantage. Existing and likely federal incentives and taxes, likely increases to state renewable requirements on utilities, and existing and likely future value for emission reductions make this option a high probability to be least cost compared with the coal unit itself. Considering the very positive economic impact to the local and state economy, inclusion of a wood co-burn option would appear to be a 40-year opportunity that should not be missed. For all these reasons and others

that I have neither the time nor resources to develop here, the Commission should order WPSC to include co-burning with wood in any CPCN given for a coal plant at Weston 4.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes it does.