

DOCKET NO. 171 - An application of the } Connecticut  
 Connecticut Light and Power Company for a }  
 Certificate of Environmental Compatibility and } Siting  
 and Public need for a 200 kW landfill gas fuel cell }  
 facility at the Groton Landfill, in the Town of } Council  
 Groton, Connecticut. }  
 } January 23, 1996

## FINDINGS OF FACT

1. The Connecticut Light and Power Company (CL&P), in accordance with provisions of General Statutes §§ 16-50g through 16-50aa applied to the Connecticut Siting Council (Council) on October 2, 1995, for a Certificate of Environmental Compatibility and Public Need for the installation of a 200 kW (nominal capacity) fuel cell at the Groton landfill in the Town of Groton, Connecticut. (CL&P 1, pp. 1, 4)
2. Public Notice of the application, as required by General Statutes § 16-50l (b) was published in the New London Day on September 20, 1995, and on September 21, 1995. (CL&P, Attachment 9)
3. Pursuant to General Statutes § 16-50m, the Council, after giving due notice thereof, held a public hearing on November 14, 1995, beginning at 3:00 p.m. and reconvening at 7:00 p.m. in the Library Media Center of the West Side Middle School, 250 Brandegee Avenue, Groton, Connecticut. (Council hearing notice of October 13, 1995)
4. The Council and its staff made an inspection of the proposed site on November 14, 1995. (Council hearing notice of October 13, 1995)
5. On June 2, 1995, CL&P had its initial meeting on the proposed project with the Town of Groton (Town) and the Department of Environmental Protection (DEP). On July 19, 1995, the Town and CL&P signed a Memorandum of Understanding (M.O.U.) on the proposed project. Additional meetings between the Town and CL&P were held on August 3, 1995, and on August 25, 1995. (CL&P 1, p. 16)

### Proposed Project

6. The proposed project would be undertaken jointly with the Town to research and find a more efficient design for fuel cells and a landfill gas clean-up system to demonstrate the sustained operation of a fuel cell using landfill gas. The goals of the proposed project are to establish operating experience and develop data over a sufficient period of time to evaluate a phosphoric acid fuel cell, to obtain more data on a landfill gas clean-up system and determine if this system can be modified to simplify its design, and to demonstrate that the equipment used in the project is portable and capable of being moved between different climates. (CL&P 1, p. 4; CL&P 1, Attachment 1; Tr., pp. 21-22)

7. Of the 62 fuel cell units in operation in the world today, none uses landfill gas as would this project. This project would be a continuation of an Environmental Protection Agency (EPA) project begun at the Penrose landfill in Los Angeles, California (CL&P 1, p. 2)
8. At the end of 12 months of operation, CL&P and the Town would evaluate the project's status and determine whether or not to extend the project beyond the minimum 18 month project duration. If the project is extended, CL&P could operate the project for 20 years with major overhauls in the seventh and thirteenth years. (CL&P 3, Q. 9; Tr., pp. 16-17)
9. The proposed fuel cell system is currently owned by the Environmental Protection Agency (EPA). It is CL&P's intent to assume ownership of the fuel cell system after a demonstration period. CL&P would be responsible for the majority of the site preparation work, including the installation of a condensate tank, gas compressor, foundation, piping, and associated equipment. The condensate tank and associated foundation and piping would be owned by the Town. The compressor would be owned by CL&P. (CL&P 1, Attachment 2, pp. 1-2)
10. The Town would be responsible at its expense for the electrical interconnection to the existing CL&P distribution system. The electricity generated from the project would be considered test power and transferred to CL&P at no cost. CL&P would be responsible for operation and maintenance of the fuel cell system at its own expense. (CL&P 1, Attachment 2, p. 2)
11. The Town would provide the proposed site at no cost to CL&P. The Town would be responsible for the landfill gas supply, and would maintain a temporary gas flare as a back-up system. (CL&P 1, Attachment 2, p. 3)
12. At the conclusion of the project, CL&P would be responsible for removal of the fuel cell and associated equipment. The electrical interconnection would be removed and the distribution system returned to a safe condition. (CL&P, Attachment 2, p. 2)

#### Fuel Cell Technology

13. Fuel cells operate by converting the chemical energy in methane to produce electrical and thermal energy. Hydrogen from the methane and oxygen from the atmosphere are introduced at electrodes which cause ions to flow through an electrolyte and across the cell, and produce a flow of electrons into a circuit as a direct current of electricity. (CL&P 1, p. 5)
14. The fuel cell would operate unattended, with automatic monitoring of load and operating conditions by International Fuel Cells from its facility in South Windsor, Connecticut. If the fuel cell controller detected a malfunction which could not be resolved by automatically reducing output, the fuel cell would shut down and automatically cool down. International Fuel Cells of South Windsor, Connecticut, is one of two Connecticut-based companies researching the manufacture of fuel cells. The other company is Energy Research Corporation of Danbury, Connecticut. (Connecticut Siting Council Review of Electric Utilities' 1994 Twenty-year Forecasts of Loads and Resources, p. 18; CL&P 1, p. 5, p. 8)

### Proposed Site

15. The proposed site would be within a 145-acre property off of Flanders Road in Groton, Connecticut. Forty-six acres of this property is a closed landfill. The proposed site is located approximately 800 feet north of I-95, lies approximately 400 feet west of Flanders Road, and is zoned 1P-80B Industrial. (CL&P 1, p. 6; Tr., p. 31)
16. The proposed fuel cell would be approximately 50 feet from the nearest edge of solid waste in the landfill, which has a height of approximately 30 feet. The nearest residence is approximately 1000 feet to the south of the proposed site. (CL&P 5; Tr., p. 12; CL&P 1, p. 4)
17. There would be no clearing of vegetation, no grading, and no habitat disturbance at the proposed site. A wetland approximately 900 feet north of the proposed site would not be affected. (CL&P 1, p. 11)
18. The proposed site is in a paved area adjacent to existing landfill structures including a scrap metal storage area, equipment garage, and the Southeastern Connecticut Regional Resources Recovery Authority solid waste recycling building. The proposed 45-foot by 90-foot site would be enclosed by a six-foot high chain link fence. (CL&P 1, p. 6, p. 9; CL&P 5)
19. The proposed facility would consist of two buildings and five equipment areas within a 4050 square-foot fenced area. The gas pretreatment unit building, 20-foot by 30-foot by 14 feet in height, would house the gas pretreatment unit, refrigeration unit, and landfill gas compressor. A control room, 10-foot by 20-foot by 12 feet in height would house the gas pretreatment unit module and control panel. (CL&P 1, p. 4)
20. Equipment areas would consist of the fuel cell, which would be 12.5 feet by 26 feet by 11.5 feet in height; an emergency generator and switchgear which would measure 5 feet by 7.5 feet by 4 feet in height; cooling module which would measure 10 feet by 12.5 feet by 7 feet in height; a nitrogen bottle storage area which would be 5 feet by 5 feet by 6 feet in height; and a flare area with a 10-foot by 10-foot base, and a 3-foot diameter flare. The tallest of these structures would be the existing 16-foot flare. (CL&P 1, p. 4)
21. Other potential sites considered include landfills in New Milford, Shelton, and Hartford. The New Milford and Shelton landfills were eliminated from consideration for this project because electric generating facilities are already in place at these landfills. An energy recovery facility at the Hartford landfill is under development, and therefore this site was also eliminated as a proposed project site. (CL&P 1, p. 10)

### Landfill Gas

22. Landfill gas consists of approximately 47 percent methane, with the remaining 53 percent consisting of nitrogen, oxygen, volatile organic compounds, hydrogen sulfide, and carbon dioxide. (CL&P 3, Q 3; Tr., p. 11)

23. Without landfill gas recovery and use, landfill gas is emitted into the atmosphere. Methane is a contributor to ground-level ozone and smog, with 35 times the global warming potential of carbon dioxide emissions. Some of the non-methane constituents of landfill gas are odoriferous and potentially harmful to the environment. (CL&P 1, p. 7)
24. The components of landfill gas can be eliminated by combustion equipment which directly burns the gases but would not eliminate nitrogen oxides, sulfur oxides, or carbon dioxide. Landfill gas at the proposed site is presently burned with a temporary flare. Sulfur oxides are a precursor to acid rain, nitrogen oxides contribute to ground-level ozone formation and acid rain, and carbon dioxide is a greenhouse gas. (CL&P 1, p. 1, p. 4)
25. Under a DEP Consent Order, the Town is required to install a permanent flare. The Town would seek DEP modification of the Consent Order to allow operation of the fuel cell and a postponement of the installation of the permanent flare. (CL&P 1, p. 5)
26. Based on the estimated volume of solid waste in the Groton landfill, a calculated 204 million cubic feet of landfill gas would be produced annually. Most landfills produce landfill gases for a period of 15 to 20 years after closing. (CL&P 3, Q. 2; Tr., pp. 45-46)
27. The landfill would produce an estimated 200 to 400 cubic feet per minute (cfm) of landfill gas. The fuel cell would require an estimated 80 cfm of landfill gas to produce full power. Methane collected at the landfill in excess of that processed by the fuel cell would be flared off. (Tr., p. 48; CL&P 1, p. 5; CL&P 3, Q. 5)
28. A landfill gas pretreatment system would remove contaminants from the landfill gas that might be harmful to the fuel cell, including certain hydrocarbons, organic sulfur, and halogen compounds. In this project, CL&P would attempt to simplify the gas clean-up system by installing a system to bypass various desiccant beds within the system, and determine to what extent such beds are needed. (CL&P 1, p. 5; CL&P 6; Tr., pp. 19-20)
29. The gas pretreatment system would be enclosed within a 20-foot by 30-foot building which would be insulated and heated. It is uncertain whether cooling of the building would be required. (Tr., p. 54)
30. Water discharge from the clean-up system would consist of a first stage cooler to remove water, certain hydrocarbons, and sulfides from the landfill gas. The water would then be collected in a 1000 gallon underground condensate tank. The water would be stored and then emptied into the Town's waste treatment plant. A DEP permit to discharge the water into the Town sewage treatment plant would be obtained. (CL&P 1, p. 14; Tr., p. 12, p. 14)
31. Water produced by the fuel cell exhaust would be condensed in the fuel reforming process. A maximum discharge of two gallons per minute is expected. This clean potable water would be discharged onto the surface of the landfill cap. (CL&P 1, p. 12)

32. Fuel cell air emissions would be as follows: nitrogen oxide, 0.00001 lb./kWh; sulfur dioxide, 0.0 lb./kWh; carbon dioxide, 0.96 lb./kWh. Carbon monoxide would be emitted at the level of one part per million. (CL&P 1, Table 1; Tr., pp. 24-25)
33. For comparison purposes, an internal combustion engine generating one megawatt of electricity would emit 2000 parts per million of carbon monoxide. A combustion turbine would emit 0.00153 lb./kWh of nitrogen oxide; 0.00017 lb./kWh of sulfur dioxide; and 1.96 lb./kWh of carbon dioxide. An internal combustion engine would emit 0.00092 lb./kWh of nitrogen oxide; 0.00012 lb./kWh of sulfur dioxide; and 1.37 lb./kWh of carbon dioxide. (CL&P 1, Table 1; Tr., pp. 24-25)
34. CL&P would sample raw landfill gas with complete analysis at the start and end of the proposed project, landfill gas at the entrance of the pretreatment unit for hydrogen sulfide, weekly; raw landfill gas for hydrogen sulfide, weekly; clean landfill gas, for composition, heat content, and contaminants, monthly; clean landfill gas flow, weekly; the fuel cell electrical output, weekly; and a complete analysis of landfill gas, including composition, contaminants, and heat content. The results of all of these tests would be provided to the EPA on a monthly basis. (CL&P 3, Q. 7; Tr., p. 11)
35. Solid waste from the clean-up system would be generated as spent carbon pellets. Carbon in the clean-up system would be changed when the carbon could no longer be regenerated. This would probably occur about once a month depending on the amount of impurities in the landfill gas. Carbon pellets from the Penrose project were found to be non-hazardous. A request to dispose of the carbon pellets as a special waste at a solid waste disposal site would be submitted to the DEP (CL&P 1, p. 14)

#### Electrical Generation

36. The expected electrical generation from the proposed project is 140 kW, an estimate based on the Penrose project. Operating at a 90 percent capacity factor (126 kW), electrical generation over the 18 month term of the proposed project would be 1,657,152 kWh. (CL&P 3, Q. 10)

#### Costs

37. CL&P estimates the direct expenses of the project at \$195,000. The installed cost of electricity from the project would be 11.8 cents per kWh. (CL&P 3, Q. 10; CL&P 1, p. 5)
38. The fuel cell, landfill gas clean-up module, and associated equipment, currently owned by the EPA, has an estimated value of \$1,500,000. (CL&P 3, Q. 10)

#### Environmental Effects

39. The proposed project would have no effect on historic, architectural, or archaeological sites listed on or eligible for the National Register of Historic Places. There are no listings of rare, endangered, or threatened species on the Natural Diversity Data Base for the proposed site. (CL&P 1, Attachment 6; DEP letter of November 8, 1995)

40. Operation of the proposed fuel cell would result in sound levels well below federal, State, or local sound level standards. The noise level would be approximately 40 dba at the nearest property line, a distance of approximately 400 feet. The maximum sound level from the power module is estimated at 60 dba at 30 feet. The inverter, processor, blower, and fans for ventilating and cooling would be the primary sound sources. (CL&P 1, p. 11; CL&P 3, Q. 6)

#### Schedule

41. CL&P would start construction of the proposed project on approximately February 1, 1996, with construction expected to be completed by April 15, 1996. Testing would begin on approximately April 16, 1996, and be completed by April 25, 1996. The in-service date is approximately May 1, 1996. (CL&P 2)