Detroit Water and Sewerage Department

Wastewater Master Plan

DWSD Project No. CS-1314

Energy Management

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Energy Management

1. Executive Summary

The purpose of this Technical Memorandum is to first, identify existing reports which address energy use issues; second, quantify existing energy usage at the Detroit Wastewater Treatment Plant (WWTP) and wastewater pumping stations; third, discuss various energy management options; fourth, discuss Detroit Water and Sewerage Department (DWSD's) current energy management plan; and fifth, make recommendations for energy and cost savings at the DWSD wastewater facilities.

Seven data sources were reviewed as follows:

1. Electrical Energy Audit (July 1999)
2. PC-744 Needs Assessment Study.
3. PC-744 Asset Audit.
4. Retail Wheeling Feasibility Study (December 2000)
5. Natural Gas By-Pass Feasibility (September, 1999)
6. PC-713 Department-Wide Instrumentation Control and Computer System Program II.
7. DWSD Summary of Operating Statistics (1982-89)

Significant energy using facilities at the WWTP and in the collection system are inventoried and their energy use and energy cost are presented. Currently the WWTP requires 721 kWh per MG, which is reasonable when compared to other wastewater facilities. Both Detroit Edison (DTE) and Public Lighting Department (PLD) rate schedules are discussed. Various energy management options are discussed under the following categories:

1. Pumping versus Gravity Flow.
2. Pump Station Management.

Recommendations are made for both the WWTP and the wastewater pumping stations. At the WWTP, it is recommended that a Variable Frequency Drive (VFD) drive be considered for Influent Pump Station No. 1. Also, the use of VFD drives should be investigated for at least one of the SFE pumps. Finally, energy savings can be achieved by switching off lights during the daylight hours.

For the wastewater pumping stations, it is recommended that:

- At least one of the pumps at the Clintondale and Woodmere pumping stations should be considered for a VFD.

- In general, when planning new sewers, provide deep sewers so as to have a small number of pumping stations.
- At pumping stations, every three years, evaluate the actual power consumption verses the theoretical power demand for actual flow and head readings.
- When purchasing new equipment, make sure that high efficiency motors are specified.

The costs of implementing these recommendations are listed in Table 1.1.

Table 1.1 Energy Management Project Cost Summary

Project	Cost
Clintondale and Woodmere VFDs	$345,000
WWTP Pump Station No. 1 VFD	$255,000
WWTP Lighting Timers	$10,000
Total	$610,000

2. Introduction

2.1 Purpose

The purpose of this study is to present the information required to determine a strategy for reducing energy consumption at the WWTP and wastewater collection system.

2.2 Scope

Create a list of elements for an Energy Management Plan for the collection system by performing the following tasks.

- Identify energy management issues and applications for the collection system.
- Evaluate pumping vs. gravity flow for transportation of wastewater for new and existing systems.
- Identify preferred improvements with respect to energy management.

This report details technologies that can be used to remedy energy management related deficiencies/improvements and recommend solutions, including cost estimates for implementation. A prioritized implementation plan is to be developed for all recommendations.

This technical memorandum is organized to 1) identify existing reports which address energy use issues, 2) quantify existing energy usage at the WWTP and Wastewater pumping stations, 3) discuss various energy management options, 4) discuss DWSD's current energy management plan, and 5) make recommendations for energy and cost savings at the DWSD wastewater facilities.

2.2 Fuel Management Program

DWSD launched a fuel management program to track and control the use of vehicle fuels. Under this program, each employee filling a vehicle was required to use an access card and enter data pertaining to the vehicle being refueled. Information regarding vehicle ID, mileage and idle time was required to activate the fuel pumps. This program was implemented at all of the refueling stations operated by DWSD.

The fuel management system is not currently being operated. After launching the system, problems prevented many employees with valid access cards from activating the fuel pumps. The system is currently being debugged with plans to reactivate it once it has been determined to be reliable. The system was not active long enough to collect any usable data regarding vehicle fuel use.

A system of this type will provide valuable data for DWSD to manage their fleet.

3. Data Sources

Seven data sources are reviewed as follows:

1. Electrical Energy Audit (July 1999)
2. PC-744 Needs Assessment Study.
3. PC-744 Asset Audit.
4. Retail Wheeling Feasibility Study (December 2000)
5. Natural Gas By-Pass Feasibility (September 1999)
6. PC-713 Department-Wide Instrumentation Control and Computer System Program II.
7. DWSD Summary of Operating Statistics (1982-89)

A brief summary of each of these projects is included below.

3.1 Electrical Energy Audit (July 1999)

The scope of services for this report was authorized pursuant to DWSD Contract No. CS-1272 "Study and Evaluation of DWSD Electric Utility Rates". It covers the five water treatment plants and 20 water booster stations as well as the wastewater treatment plant and 14 wastewater pumping stations.

This report includes a review of electrical energy usage, on-site inspections and interviews, an inventory of electrical requirements and a determination of operational requirements. This report summarizes findings with regard to potential operational changes and capital improvements that might provide opportunities for energy savings or peak demand reduction, as summarized below.

3.1.1 Wastewater Pumping Stations

Older stations with large but under-utilized pumping capacity are candidates for modifications to smaller motors and/or VFDs that allow greater flexibility in ramping up and ramping down the pumps and motors.

3.1.2 Wastewater Treatment Plant

The primary target for saving energy appears to be in the area of secondary treatment. Based on the information provided to date, energy use in this area varies between 11% and 31% of recorded overall plant usage. This area includes oxygen plants 1 and 2, intermediate lift pumps 1 and 2 and aeration decks A-2, A-3 and A-4. There is also a considerable aeration blower load, for which specific data is unavailable to date. Power usage in the primary treatment area appears to be another useful target. Energy use in this area varies between 5 percent and 13 percent of the plant total. The primary treatment area loads include intermediate lift pumps 2, 4 and 7 and other loads specific to the primary treatment process. The processed water plant (1% to 4%) and final clarifier (2% to 5%) have what appears to be complete data. The sludge disposal process has partial data. Data for the main pump station, which includes motors totaling 8100 horsepower at 13,800 volts, has not been obtained. Possible energy management measures include but are not limited to:

- SFE pumps, which include 1-600 Hp and 7-1000 Hp, are run four at a time. The pumps are constant speed pumps but the demand on the SFE system is fluctuating. The use of variable frequency drives or alternative methods of pump management may provide energy reduction opportunities.

- In plant use of SFE may be greater than necessary. There were observed utility water hoses left running during the plant visit. Shutting off hoses when water is not required for useful purposes may result in energy reduction by minimizing the amount of SFE that is subject to re-treatment.

- During the plant visit, it was noted that yard lights were on in broad daylight. Simply switching lights off when not needed for safety or to perform work will reduce overall energy consumption.

Some energy management efforts are being made. Plant operators prefer to start large motors off-peak, if possible. However, because of the weather driven nature of the operation, planning a balance between available capacity and pump station flows is difficult. When possible, motors are ramped up using plant treated effluent to avoid sudden heavy start loads. Operators prefer running two pumps at full load rather than three at partial load. The three pure oxygen aeration basins are the most heavily

used and, therefore, the 7000 Hp blower serving the air basin is on standby and seldom operated.

There are several improvements in the works that will increase efficiency and reduce electrical use. The eddy current drives on the intermediate lift pumps No.1 and No.2 are presently being replaced with VFDs. Pumps 3, 4, 7 are also scheduled to receive VFDs.

A study of the oxygen plants is planned. The 180-ton plant seems to run well during the cold season. The 400-ton plant is expected to see increased use in the future. The oxygen plants are typically large consumers of electricity at wastewater plants. The 180-ton plant is presently operational, but the 400-ton plant is out of service, necessitating purchase of oxygen from outside sources. Visual observation of the plant indicated considerable external deterioration possibly due to a combination of weather, operation and lack of timely preventive maintenance.

Plant lighting levels suffer from considerable dirt and grime on lenses. It is suggested that lens cleaning or replacement be included as part of lighting maintenance activities.

3.2 PC-744 Needs Assessment Study

This study identifies what needs exist for the capital improvement projects at the DWSD WWTP. It serves as a roadmap for upgrading the WWTP over the next five years and beyond. This study addresses four key areas of the WWTP: 1) Liquid stream treatment processes, 2) Solids stream treatment processes, 3) Utilities and 4) Miscellaneous support facilities. An initial program plan schedule of projects is provided. An equipment condition evaluation was performed for 2,200 + pieces of major / critical equipment.

3.3 PC-744 Asset Audit

The DWSD Second Amended Consent Judgment required that an asset audit be conducted for the WWTP and major WWTP treatment and pumping facilities. This audit assesses the current and projected operational status of all significant system components, their state of repair condition, and their projected major maintenance and replacement status. This report contains pump operating run times for wastewater pumping stations.

3.4 Retail Wheeling Feasibility Study (December 2000)

The Scope of services for this report was authorized pursuant to DWSD Contract No. CS-1272 “Study and Evaluation of DWSD Electric Utility Rates”. It covers the five water treatment plants and 20 water booster stations as well as the wastewater treatment plant and 14 wastewater pumping stations. Under Task 2.3 of this project, the projected cost of electricity needed to supply DWSD facilities under Michigan’s retail open access rates was investigated. These costs of electricity include supply, backup, transmission, distribution and transition charges (stranded investment

applicable to the DWSD facilities). This study uses the load information available from "Electrical Energy Audit". (Section 3.1 of this memorandum) to determine the applicable costs of energy usage for DWSD facilities under retail wheeling.

In the analysis of the retail wheeling feasibility study, two separate methods were utilized. The first method looked at the cost of power supplied from DTE's service area. This method utilizes only those transmission costs needed to transmit energy over DTE's system and the applicable distribution and stranded investment charges. The second methodology looked at the cost of power supplied from an alternative service area. This method utilizes those transmission costs needed to transmit energy from the alternative service area into DTE's service area and over DTE's transmission system and the applicable distribution and stranded investment charges.

The report concludes that there would be a projected savings of 17.82% and 11.83%, when retail wheeling is undertaken in the DTE's service area and the alternative service area, respectively. Some individual wastewater pumping and water booster stations rates increase with retail wheeling. If these facilities were not included in the retail wheeling options, then the savings would increase an additional 1.3 to 1.8 percent for DTE and alternation service areas, respectively.

The DWSD so far has not decided to take the risk to implement retail wheeling.

3.5 Natural Gas By-Pass Feasibility (September 1999)

The Scope of Services for this report is authorized pursuant to DWSD Contract No. CS-1272 "Study and Evaluation of DWSD Electric Utility Rates". Task 9.1 "Natural Gas By-Pass Feasibility" was undertaken to determine the technical, regulatory and financial feasibility to construct a natural gas distribution line and by-pass Michcon for distribution of natural gas. Four by-pass routes were investigated. No regulatory issues were found to preclude the construction of a bypass line to the WWTP and Mistersky Power Plant. Preliminary financial analysis suggests that significant savings are possible with the construction of a gas by-pass. Further detailed engineering studies are recommended as follows:

- Continue discussions with Panhandle to develop a firm route for by-pass.
- Develop firm estimated costs associated with each route.
- Confirm Panhandle operations and maintenance costs associated with the proposed by-pass line.
- Solicit bids / confirm gas transportation costs.
- Solicit bids / confirm gas wellhead costs.
- Investigate further regulatory requirements for construction of by-pass line.
- Enter into negotiations with DTE to lower the current distribution rate.

The DWSD is not pursuing the direct purchase of natural gas, because the Minergy project is scheduled to phase out the use of the multiple hearth incinerators.

3.6 PC-713 Department-Wide Instrumentation Control and Computer System Program II

DWSD (January 11, 2002) directed PC-713 to submit a control narrative for water and wastewater station generators. Thus, DATA.NET submitted to DWSD "Emergency Generators Control Narrative for Water and Wastewater Stations" (June 2002). Table 3.1 lists the facilities with generators. Each site has one or more 2000 kW generators with 2 fuel storage sites, except the Central Services facility, which has one fuel storage tank. The existing generators are currently controlled manually. However, the generators may be controlled in the automatic mode (emergency mode).

It is proposed that, in this PC-713 program, the System Control (SCC) operator remotely start and stop the generators. Three operating modes are suggested:

A. Emergency Mode – This mode will be able to start / stop the generator units automatically when the station loses its main utility power.

B. Peak Shaving Mode – When the utility power production capacity is stressed, the utility company will notify DWSD to disconnect the station from the utility grid.

C. Operate During Maintenance Procedures – Operate the generators locally during maintenance.

3.7 DWSD Summary of Operating Statistics (1982-89)

Wastewater pumping station annual power usage is presented along with other System Wide operating data.

Table 3.1. DWSD Wastewater Pumping Stations with Generators

Location	Storm Water Pump Total HP	Generator	Power (KW)	Voltage Class (KV)	Fuel Storage Capacity (gallons)
Bluehill Pump Station	3 @ 2000 = 6000	1	2000	2.4	2 x 6,000
		2	2000	2.4	
		3	2000	2.4	
Conner Pump Station	4 @ 2300 + 4 @ 2250 = 18,200	1	2000	4.8	2 x 8,000
		2	2000	4.8	
		3	2000	4.8	
		4	2000	4.8	
Freud Pump Station	8 @ 3000 = 24, 000	1	2000	4.16	2 x 8,000
		2	2000	4.16	
		3	2000	4.16	
		4	2000	4.16	
Northeast Pump Station		1	2000	4.16	2 x 6,000
		2	2000	4.16	
		3	2000	4.16	
Fairview Pump Station		1	2000	4.8	2 x 4,000
		2	2000	4.8	
Oakwood Pump Station	2 @ 200 + 4 @ 450 = 2200	1	2000	4.8	2 x 4,000
Central Services Facility		1	2000	4.8	1 x 4,000
		2	2000	4.8	

4. Current Energy Use

This section contains an inventory of the large power using equipment at the WWTP and the Wastewater pumping stations. The energy usage and operating costs are discussed. Next, the existing energy rate schedules for both Detroit Edison (DTE) and the Public Lighting Department (PLD) are presented. Finally, projected future rate categories for a retail open access system are identified.

4.1 Facilities Inventory

Both the wastewater Treatment Plant (WWTP) and the Wastewater Pumping Stations have high Horsepower electric motors, which are discussed below. The CSO Basins have small electric motors, which are listed in Appendix A-3 and are not considered here.

4.1.1 Wastewater Treatment Plant

Table 4.1 lists all existing and planned electric motors equal to or greater than 100 Hp. The two influent pumping stations, intermediate lift stations, the aeration deck compressors, and the SFE pumps all have large horsepower motors, many with VFD controls.

4.1.2 Wastewater Pumping Stations

Electric motors for the 10 largest wastewater pumping stations are listed in Table 4.2. The Bluehill, Conner, Freud, Northeast and Woodmere stations all have pumps with electric motors of 1000 – 3000 Hp. Most of these pump station have VFD controlled motors. Table 4.3 lists the horsepower and annual run time for each pump, within each of the pump stations.

Table 4.1. Wastewater Treatment Plant - Electrical Inventory (> 100 Hp)

Equipment	No. Motors	(hp)	Rating	VFD	Comments
Main Pump Station No. 1	8	2@	1250		
		4@	1000		
		2@	800		
Main Pump Station No. 2					
Influent Pumps	8	8@	900	6 of 8	Includes one new 900 Hp pump to be installed under PC 740 in 2003
Aeration Blowers	3	3@	200		
Aeration Deck Blowers	2	2@	7000		
Aeration Deck 2					
Compressors	2	2@	400	2 of 2	
Mixers	14	14@	120		
Aeration Deck 3					
Compressors	5	3@	350		
		2@	250		
Aeration Deck 4					
Compressors	5	3@	350		
		2@	250		
Intermediate Lift Station No. 1	2	2@	2000	2 of 2	Pumps No. 3, 4 and 7 to have VFD

Equipment	No. Motors	(hp)	Rating	VFD	Comments
Intermediate Lift Station No. 2	2	2@	2500	2 of 2	
Final Tank RAS Pump	25	1@	250		
		20@	200		
		3 @	150		
SFE Booster Pump (CII Basement)	2	2@	125		
Blended Sludge Transfer Pumps (CA)	3	2@	125		
Sludge Feed Pumps (CA)	6	6@	200	Hyd (6 of 6)	
Secondary Water Pumps (IC1)	3	3@	200		
Inc Burner Air Fan (IC1)	6	6@	100		
Inc Induced Draft Fan (IC1)	6	6@	400		
Ash Vacuum Pumps (IC1)	2	2@	300		
Ash Vacuum Pump (ICII)	3	3@	300		
SFE Booster Pump	1	1@	250		
Wet Ash Pump	1	1@	150		
SFE Pump	8	7@	1000		
		1@	600		
Chlorine Solution Pump (CF)	4	4@	100		
Sulfur Dioxide Solution Pump (CF)	4	4@	100		
Sludge Pumping Units (Pri Sed)	4	4@	125		To be installed under PC-740 in 2003
Dewatering Centrifuges (DWC II)	4	4@	300		
		4@	100		
Dewatering Centrifuges (DWC II)	8	8@	300		To be installed under PC-750 in 2004
		8@	50		
Thickening Centrifuges (SPB)	3	3@	250		
		3@	30		

Table 4.2. Wastewater Pumping Stations - Electrical Inventory

Station	No. Motors	(Hp)	Rating	VFD	Comments
Belle Isle	4	2@	40		
		2@	60		
Bluehill Station	5	3@	2,000	2 of 3	New 1000 Hp pump to be
		2@	75	1 of 2	installed by 2004
Clintondale	3	3@	500		
Conner Station	12	4@	2,300	2 of 4	New motors to be installed
		4@	2,250	2 of 4	under PC-674.
		2@	500	1 of 2	SP#9 (500 Hp),
		1@	350	1 of 1	SP#10 (3500 Hp)
		1@	250		SP#11 (500 Hp)
					SP#12 (200 Hp)
Fairview Station	4	4@	700		
Fischer	2	2@	40		
Freud Station	10	2@	200	1 of 2	SP#9 & 10 to be rehabilitated
		8@	3,000	2 of 8	under DWS-837.
Northeast	3	2@	2,000	1 of 2	New SP#2 (2250 Hp with VFD
		1@	1,500	1 of 1	to be installed under PC-736.
Oakwood Station	8	2@	150	1 of 2	New stormwater pump Nos. 3,4,5,6 & 10 to be installed
		2@	200	1 of 2	under PC-719. Storm-
		4@	450	2 of 4	water pump Nos. 7 & 8 to be
					rehabilitated.
					New combined pump No. 9
					will work as both a sanitary and
					Stormwater pump
Woodmere	5	3@	1,000		
		2@	50		

Table 4.3. Wastewater Pumping Station Hp and Run Time

Pumping Stations	Sanitary Pumps	Storm Pumps	Hp	Annual Run Time (hours)										
				1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Bluehill	Pump 5		75	3397	2188	1342	1697	1477	1177	2030	3678	1514	328	2059
	Pump 6		75	1494	2507	1393	2402	1065	1115	2838	1840	3354	4846	1774
		Pump 1	2000	70	9	1384	448	1234	1263	18	32	103	31	1085
		Pump 2	2000	29	7	1422	683	1184	1523	15	18	112	88	239
		Pump 3	2000	0.5	2	0	0	0	0	0	0	0	0	0
Clintondale	Pump 1		500	1871	2150	2746	2695	1645	0	1330	1179	385	1519	1947
	Pump 2		500	1733	238	2	0	1866	2326	1695	1870	2079	1549	1330
	Pump 3		500	1630	2215	2530	2488	863	1815	1480	1627	1987	1387	1548
Conner Creek	Pump 9		500	5564	3705	3500	599	1789	3267	4404	4097	1809	2615	1631
	Pump 10		350	5766	5609	7324	6872	1690	5445	4827	5081	5157	5755	5321
	Pump 11		500	10	0	0	2345	4983	3087	2742	3398	2412	2254	2188
	Pump 12		250	5822	6063	7681	6259	3765	8	2753	3816	4527	3797	2591
		Pump 1	2300	9	0	0	0	0	0	0	3	0	0	0
		Pump 2	2300	20	0	13	4	11	8	30	5	0	0	15
		Pump 3	2300	19	4	13	2	4	0	13	44	73	26	44
		Pump 4	2300	11	0	3	3	2	1	0	59	29	0	45
		Pump 5	2250	22	3	22	0	0	0	0	0	0	3	95
		Pump 6	2250	0	0	0	0	0	0	0	0	44	0.2	5
		Pump 7	2250	52	0	32	3	5	3	6	33	318	57	32
		Pump 8	2250	62	6	12	17	3	7	4	18	0	21	0

Pumping Stations	Sanitary Pumps	Storm Pumps	Hp	Annual Run Time (hours)										
				1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fariview	Pump 1		700	0	2179	4803	4490	2205	3425	5326	4933	1071	3997	4275
	Pump 2		700	1244	3106	0	0	0	1923	2501	4229	2774	3526	1982
	Pump 3		700	5512	1538	2844	2771	4559	1843	0	0	2017	2149	3371
	Pump 4		700	4135	3968	3812	4115	4111	3611	3006	1608	3528	228	808
	Pump 9		200	262	1600	1344	1165	835	592	820	1976	1628	3244	2414
	Pump 10		200	885	18	237	1288	1818	1365	1277	1968	1766	93	0
Freud		Pump 1	3000	78	40	36	17	49	34	52	67	115	65	68
		Pump 2	3000	53	35	27	21	16	26	20	43	64	33	28
		Pump 3	3000	24	17	13	14	31	17	17	55	94	72	100
		Pump 4	3000	52	10	33	10	4	4	10	73	99	51	130
		Pump 5	3000	18	9	26	13	32	15	24	58	58	50	99
		Pump 6	3000	8	0	36	15	13	8	20	79	87	49	100
		Pump 7	3000	25	12	8	2	38	16	20	49	92	17	47
		Pump 8	3000	25	13	7	6	36	24	22	30	0	4	0
Northeast	Pump 1		2000	3438	3148	2079	956	1634	2877	3611	1488	0.5	4047	2694
	Pump 5		1500	2383	2786	2481	2943	4403	4387	767	2021	4401	2577	1539
	Pump 6		2000	675	325	2142	2731	1013	60	2323	3805	3476	791	3113
Oakwood	Pump 1		150	3346	1439	986	2294	1733	2261	1296	1685	1104	1269	1148
	Pump 2		150	108	1408	2364	951	1824	644	1456	1263	1505	1318	1278
		Pump 3	200	141	48	84	88	86	56	13	96	119	66	96
		Pump 4	200	16	1	0	2	0	7	2	4	0	0.7	0
		Pump 5	450	38	8	22	9	22	30	19	35	38	23	41

Pumping Stations	Sanitary Pumps	Storm Pumps	Hp	Annual Run Time (hours)										
				1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Oakwood cont.		Pump 6	450	10	1	8	1	1	4	4	6	3	0.3	0
		Pump 7	450	8	1	4	1	9	4	5	12	13	9	30
		Pump 8	450	4	2	2	0	6	3	19	10	6	0	9
Woodmere	Pump 5		50	3364	2451	2991	2943	2475	3682	3555	5557	5174	3734	3179
	Pump 6		50	3585	3900	4112	4544	4385	4220	3861	3088	1032	2441	2701
		Pump 1	1000	14	5	6	4	12	9	24	28	19	41	22
		Pump 2	1000	16	8	16	4	11	14	12	15	8	13	17
		Pump 3	1000	14	3	11	0.4	9	17	4	14	13	4	11

4.2 Review of Energy Usage and Cost

4.2.1 Wastewater Treatment Plant

Table 4.4 presents the annual and average monthly energy usage and annual and average monthly billing at the WWTP. The average cost per kWh ranges from $0.0461 in 1997/98 to $0.0534 in 2001/02. Assuming an average WWTP flow of 940 MGD, the plant energy use is 721 kWh per MG. From other sources, a similar 10 MGD plant uses 1334 kWh per MG and a similar 160 MGD plant uses 783 kWh per MG. Thus, the Detroit WWTP power usage is reasonable.

4.2.2 Wastewater Pumping Stations

Annual and average monthly power consumption and annual average billings are shown for the Clintondale, Conner and Oakwood Pumping stations in Tables 4.5 thru 4.7. The average cost per kWh varies from $0.0891 to $0.1154. Note, for some reason, the electrical power usage increased 40 percent between 2001 / 02 and 1994 / 96 at the Oakwood Wastewater Pumping Station. The pumping station pump operating time did not significantly increase during this same time frame.

4.2.3 DWSD Total Operating Expenses

Table 4.8 presents a comparison of the cost of electrical power and natural gas with the total operating expenses of both the WWTP and the wastewater pumping stations. Electrical power is approximately 12 to 13 percent and natural gas is 5 percent of the total operating cost at the WWTP. At the three-wastewater pumping stations, electrical power costs average 16% of the total operating cost.

4.3 Energy Rate Calculations Factors

4.3.1 Existing Rate Schedule

The CS-1272 Task 1 “Electrical Energy Audit Final Report” has a discussion of existing rates schedules, which is included herein.

All facilities studied fall under DTE D-6, D-6.1, E4 and E5 rate schedules or PLD rate schedules. Some facilities share service or are provided emergency backup by Public Lighting Department (PLD) facilities and are subject to charges set by PLD. Each of these rate schedules is discussed below.

Table 4.4. WWTP Electrical Power Consumption and Billing

Fiscal Year	Months	Annual Energy usage (kwh)	Average Monthly Energy Usage (kwh)	On-Peak Energy (kwh)	Monthly Maximum On-Peak Demand (kw)	Average On-Peak Demand (kw)	Annual Billing ($)	Average Month Billing ($)	Cost Per kwh
7/ 94 – 6/ 95	12	249,561,922	20,796,827	57,172,494	34,406				
7/ 95 – 6/ 96	12	248,107,915	20,675,660	56,862,164	36,656				
1/ 97 – 8/ 98	20		19,910,850		34,238	30,319		918,503	0.0461
7/ 00 – 6/ 01	12	264,448,800	22,037,400		35,064	34,012	13,106,171	1,092,181	0.0496
7/ 01 – 6/ 02	12	231,854,000	19,321,167		32,203	31,575	11,686,839	973,903	0.0534

Table 4.5. Clintondale Wastewater Pumping Station - Power Consumption and Billing

Fiscal Year	Months	Annual Energy usage (kwh)	Average Monthly Energy Usage (kwh)	On-Peak Energy (kwh)	Monthly Maximum On-Peak Demand (kw)	Average On-Peak Demand (kw)	Annual Billing ($)	Average Month Billing ($)	Cost Per kwh
7/ 94 – 6/ 95	12	1,493,792	124,483		658				
7/ 95 – 6/ 96	12	1,489,350	124,113		666				
12/ 95 – 9/ 98	34		131,907			407		12,884	0.0977
7/ 00 – 6/ 01	12	1,717,440	143,120		655	433	159,295	13,275	0.093
7/ 01 – 6/ 02	12	1,484,760	124,147		536	371	142,264	11,855	0.0955

Table 4.6. Conner Wastewater Pumping Station - Power Consumption and Billing

Fiscal Year	Months	Annual Energy usage (kwh)	Average Monthly Energy Usage (kwh)	On-Peak Energy (kwh)	Monthly Maximum On-Peak Demand (kw)	Average On-Peak Demand (kw)	Annual Billing ($)	Average Month Billing ($)	Cost Per kwh
7/ 94 – 6/ 95	12	4,169,088	347,424	1,042,272	2534				
7/ 95 – 6/ 96	12	4,699,175	391,598	1,188,282	7290				
1/ 97 – 8/ 98	20		462,000		5338	1933		41,397	0.0896
7/ 00 – 6/ 01	12	4,480,480	373,373		1780	1070	414,580	34,548	0.0925
7/ 01 – 6/ 02	12	4,713,920	392,827		1730	1248	418,817	34,901	0.0891

Table 4.7. Oakwood Wastewater Pumping Station - Power Consumption and Billing

Fiscal Year	Months	Annual Energy usage (kwh)	Average Monthly Energy Usage (kwh)	On-Peak Energy (kwh)	Monthly Maximum On-Peak Demand (kw)	Average On-Peak Demand (kw)	Annual Billing ($)	Average Month Billing ($)	Cost Per kwh
7/ 94 – 6/ 95	12	505,624	42,135	126,406					
7/ 95 – 6/ 96	12	513,742	42,812	130,567					
1/ 97 – 8/ 98	20		50,480		1450	439		5,827	0.1154
7/ 00 – 6/ 01	12	714,720	59,560		1042	330	80,013	6,668	0.1119
7/ 901– 6/ 02	12	719,360	59,947		1093	416	77,924	6,494	0.1089

Table 4.8. - DWSD Total Operating Expenses (Dollars)

WWTP Annual Expenses

Fiscal Year	Total	Electrical Power	Natural Gas	Percent Electrical Power	Percent Natural Gas
7/ 94 – 6/ 95	75,495,504				
7/ 95 – 6/ 96	81,212,430				
7/ 97 – 6/ 98		10,901,995			
7/ 99– 6/ 00	98,660,787				
7/00 – 6/ 01	110,205,698	13,106,171	5,400,000	12	5
7/01 – 6/ 02		11,686,839			
Average	91,936.05	11,898,335		13	

Wastewater Pumping Station Annual Expenses +

Fiscal Year	Total	Electrical Power	Natural Gas	Percent Electrical Power	Percent Natural Gas
7/ 94 – 6/ 95	4,778,195				
7/ 95 – 6/ 96	3,914,101				
7/ 97 – 6/ 98		704,543			
7/ 99 – 6/ 00	4,983,751				
7/ 00 – 6/ 01	2,871,539	653,888		23	
7 /01 – 6/ 02		639,005			
Average	4,136,897	666,145		16	

+ Total for Clintondale, Conner and Oakwood P.S.

Rate Schedule D-6: This is a Primary Supply Rate and applies to customers at primary, sub-transmission or transmission voltage for contract capacity of not less than 50 kW. The rate consists of a service charge, on-peak demand charge, maximum hourly demand charge and energy charge for the on-peak kW hours and off-peak kW hours. The on-peak billing demand is the single highest thirty-minute integrated demand reading during the on-peak billing period. The on-peak billing demand should not be less than sixty-five percent of the highest monthly on-peak meter demand during the months of June, July, August, September and October of the preceding eleven months billing. The maximum demand shall be the highest thirty minute demand created during the previous twelve billing months, including the

current month. In addition to these standard charges, a power factor charge also applies as well as a power supply cost recovery factor and other surcharges and credits as approved by the Michigan Public Service Commission (MPSC).

Rate Schedule D-6.1: This is an Alternative Primary Supply Rate and consists of a service charge, demand charge for a maximum demand and various energy charges for contract capacity of not less than 10,000 kW at a single location. The energy charges are based on an hours-used block structure. The hours used block structure provides for a rate per kW hour determined by multiplying the peak demand in kW by the number of hours specified in the block (i.e., 150 use of on-peak billing demand). The block structure is declining. The maximum demand is the highest thirty-minute demand created during the previous twelve months, including the current month. The power supply cost recovery factor and other surcharges and credits also apply to the Alternative Primary Supply Rate.

Rate Schedule E-4: This is a Primary Pumping Rate and is applicable to government agencies desiring service at primary voltage for pumping and who contract for a specified capacity of not less than 50 kW. The rate consists of a service charge, an on-peak billing demand, a maximum demand charge and an on-peak and off-peak energy charge. The on-peak billing demand is the highest monthly billing demand during the on-peak billing period plus one third of the amount of demand generated during the off-peak period which is greater than the on-peak period. The monthly billing demand shall not be less than fifty percent of the highest monthly billing demand during the months of June through October established during the preceding eleven billing months. The maximum demand is the highest demand created during the previous twelve billing months.

Rate Schedule E-5: This is a secondary pumping rate. It is applicable to government agencies desiring service as secondary voltage for pumping and to government agencies with service at primary voltage having a storm pumping horsepower that is at least sixty percent of the total connected load. The rate is not applicable to installations, other than storm pumping, having a demand of over 1,000 kW and not taking service on this rate prior to August 1972. The rate consists of a service charge and an energy charge. In addition, the power supply cost recovery factor and other surcharges apply.

Note that there is a Power Factor penalty as follows:

.850 and higher	none
.800 to .849	1%
.750 to .799	2%
.700 to .749	3%

The Public Lighting Department (PLD): This is the rate under which DWSD takes service is the primary demand rate. This rate consists of a service charge, a demand

charge and an energy charge. The demand charge provides for a minimum equal to 65% of the highest billing demand occurring in the previous eleven months or 60 kW minimums. The rate schedule also provides for adjustments to the power factor, which is a percentage increase in the overall bill based on the level of the power factor as follows:

.800 and higher	none
.750 to .799	2%
.700 to .749	5%

Copies of the applicable rate schedules and power factor adjustments and other surcharges are provided in Technical Appendix B.

Presented in Table 4.9 is a summary of the applicable rate schedules for each one of the facilities studied.

Table 4.9. Facilities Rate Schedules

Facility	Source of Power	DTE Rate Schedule
Wastewater Treatment Plant	DTE	D6.1
Belle Isle	PLD	
Bluehill	PLD	
Clintondale	DTE	D6
Conner	DTE	E4
Fairview	PLD	
Fischer	PLD	
Freud	PLD	
Northeast	DTE with PLD Backup	D6
Oakwood	DTE	E-4
Woodmere	PLD	
Central Services	DTE with PLD Backup	D6
Water Board Building	PLD	

A comparison of DTE and PLD rates is shown in Table 4.10.

A summary of billing information for the various facilities is presented in Table 4.11. The summary shows the average maximum demand, billing demand, energy usage, bill and cost per kWh over the period as identified. Different periods were utilized due to the fact that this was the only information provided. Those facilities where no information is provided had no information with regard to billings.

Table 4.10. DTE Energy and PLD Rate Schedule Comparison

DTE Energy						PLD
		Primary D-6	**Alternative Primary D6.1**	**Primary Pumping E-4**	**Secondary Pumping E-5**	
Minimum Capacity		50 kw	10,000 kw	50 kw	1000 kw	
Service Charge		$275 / month	$275 / month	$275 / month	$10.85 / month	$275 / month
Demand Charges	On-Peak	$14.25/ kw		$14.25/ kw		$18 / kw ($1^{st}$ 1000 kw) $17.50 kw (≥ 1000 kw)
Primary Service	Max Demand	$3.75 / kw	$3.75 / kw	$3.75 / kw		
Sub-transmission Voltage (24 to 41.6 kw)	Max Demand	$2.65 / kw	$2.65 / kw	$2.65 / kw		
Transmission Voltage (≥ 120 Kw)	Max Demand	$1.80 / kw	$1.80 / kw	$1.80 / kw		
Energy Charge	On-Peak	2.96 ¢/ kwh	14.52 ¢/ kwh (First 150 hr used)	3.55 ¢/ kwh	8.54 ¢/ kwh	3.85 ¢/ kwh
	On-Peak	2.96 ¢/ kwh	2.31 ¢/ kwh (next 300 hr used)	3.55 ¢/ kwh		
	On-Peak	2.96 ¢/ kwh	1.92 ¢/ kwh (>450 kwh used)	3.55 / kwh		
	Off-Peak	2.66 ¢/ kwh	-0.3 ¢/ kwh off above rates	3.25 ¢/ kwh		
Voltage Level Discount						
Transmission		15 ¢/ kwh	15 ¢/ kwh	15 ¢/ kwh		
Sub-transmission		10 ¢/ kwh	10 ¢/ kwh	10 ¢/ kwh		

Table 4.11. Facility Monthly Average Costs per Period

Facility	Maximum Demand	Billing Demand	Energy Usage	Bill w/o Tax	Cost per kWh	Period
Wastewater Treatment Plant	30,988	30,319	19,910,855	918,503	0.0461	1/97 - 8/98
Clintondale	486	461	131,907	12,884	0.0977	12/95 – 9/98
Conner	3,205	1,933	462,000	41,397	0.0896	1/97 – 8/98
OakWood	817	439	50,480	5,827	0.1154	1/97 – 8/98
Central Services	1,424	1,422	771,854	47,573	0.0616	12/95 – 8/98

4.3.2 Projected Future Rate Categories

The projected cost of electricity needed to supply DWSD facilities under Michigan's retail open access rules were discussed under Task 2.3 of CS-1272 "Study and Evaluation of DWSD Electric Utility Rates".

The following cost factors categories were developed based on other Midwest contracts.

Power Use for Month

- Maximum Hour (kW)
- On- Peak (kWh)
- Off-Peak (kWh)

Generation

- On-Peak ($ / kWh)
- Off-Peak ($ / kWh)

Transmission ($ / kWh)

Distribution

- Service Charge ($ / month)
- System Use ($ / kW / Month)
- Surcharges ($ / kWh)

A detailed discussion of these factors is provided in Appendix F - Retail Wheeling Energy Rates.

5. Energy Management Options

Energy management option evaluation includes the following:

- Pumping verses gravity flow for new and existing areas.
- Pump station modifications such as using high efficiency motors, variable frequency drives (VFDs), multiple sized pumps, on-site generators, and on-site engine drives
- Force main size optimization

Other subjected touched upon are daytime storage, flow reduction (source control), and natural gas usage reduction.

5.1 Pumping vs. Gravity Flow

The goal of this section is to investigate the possible cost savings of providing deeper sewers with fewer pumping stations.

5.1.1 New Areas:

5.1.1.1 Practical maximum depth of trunk sewers and interceptors.

The DWSD sewer collection system consists of laterals, trunks and interceptors. Laterals vary in size and depth from 8 to 24 inches in diameter and from 10 to 20 feet deep. Trunk sewers vary in size and depth from 3 to 12 feet in diameter and from 15 to 50 feet deep. Interceptors vary in size and depth from 6 to 17 feet in diameter and from 10 to 100 feet deep.

Laterals have a minimum depth of approximately 10 feet because they must serve house basements. Normally, they are not over 1000 feet long and discharge into a trunk sewer at no lower than a 15-20 foot depth. Most trunk sewers are at a depth of 15 to 40 feet deep.

5.1.1.2 One pump station vs. multiple pump stations.

Using typical lateral and trunk sewer sizes and flows three major collection system size categories (1.55 cfs – 8 inches diameter, 10 cfs – 24 inches diameter and 50 cfs – 54 inches diameter) were evaluated (Table 5.1). Each size category was divided into alternatives involving from one to three pumping stations and gravity sewer segments.

Sewer and pumping station O & M and construction costs were estimated and converted into present worth using a 6% interest rate for 35 years for pumping stations and 60 years for sewers. For each collection system size category, the single deep gravity sewer with one pumping station resulted in the lowest present worth compared to multiple gravity segments and multiple pumping stations. Therefore, minimizing the number of pumping stations results in cost savings.

Table 5.1 Gravity Sewer vs Pump Station Alternatives

Alternative Gravity Sewer / Pump Station					O & M Cost ($)			Construction Cost ($)			Total Present Worth
	1.55 cfs Collection System Capacity				Sewer	P.S.	Present Worth +	Sewer	P.S.	Total	
1.	1A	One	2700 ft 8"- dia	1 P.S							
			Slope = 0.0074	TDH 25 ft	3,070		49,614	519,000	333,000	852,000	959,606
			20 ft drop			4,000	57,992				
	1B	Two	1350 ft 8" dia	2 P.S.							
			Slope = 0.0074	TDH 15 ft	3,070		49,614	651,000	666,000	1,317,000	1,476,799
			20 ft drop			7,600	110,185				
2.	10 cfs Collection System Capacity										
	2A	One	15,000 ft 24" dia	1 P.S							
			Slope = 0.002	TDH 35 ft	17,050		275,545	5,430,000	2,380,000	7,810,000	8,587,176
			30 ft drop			34,600	501,631				
	2B	Two	7,500 ft 24" dia	2 P.S							
			Slope = 0.002	TDH 25 ft	17,050		275,545	6,457,000	4,760,000	11,217,000	12,265,288
			30 ft drop			53,300	772,743				
	2C	Three	5,000 ft 24" dia	3 P.S							
			Slope = 0.002	TDH 15 ft	17,050		275,545	7,475,000	3,140,000	14,615,000	15,714,031
			30 ft drop			56,800	823,486				
3.	50 cfs Collection System Capacity										
	3A	One	50,000 ft 54" dia	1 P.S							
			Slope = 0.006	TDH 35 ft	56,800		917,945	36,600,000	15,950,000	52,550,000	55,963,051
			30 ft drop			172,100	2,495,106				
	3B	Two	25,500 ft 54" dia	2 P.S							
			Slope = 0.006	TDH 25 ft	56,800		917,945	40,200,000	31,900,000	72,100,000	76,865,714
			30 ft drop			265,400	3,847,769				
	3C	Three	16,667 ft 54" dia	3 P.S							
			Slope = 0.006	TDH 15 ft	56,800		917,945	44,118,000	47,850,000	91,968,000	97,000,477
			30 ft drop			283,800	4,114,532				

+ Sewer = 60 years at 6% (Pwf = 16.161) ; Pump Station = 35 years at 6% (Pwf = 14.498)

5.1.2 Existing Areas:

5.1.2.1 Potential abandonment of pump stations using cross-city interceptors.
During the 1970s, the North Interceptor - East Arm and, in 1999, the Garfield / Romeo interceptor extension both eliminated flow through existing pumping stations. Other opportunities to eliminate other in service pumping stations are not readily apparent.

5.1.2.2 Gravity flow of storm water to Detroit River south of Jefferson.
MDEQ Act 98 Permit requires separate sewers for large new developments south of the Detroit River Interceptor (DRI) which is runs under Jefferson Avenue. Stormwater from these areas would be routed directly to the Detroit River.

This requirement was applied to 610 acres (made up of parcels >10 acres in size) in the Long Term CSO Plan (10.04 A1 Solution Evaluations and References – Solution Element C13a & C13b). If this requirement was enforced, it would result in reduced stormwater flows to the DRI pumping station and the WWTP resulting in less power consumption.

5.1.2.3 Provide relief interceptor along Northwest interceptor (NWI) to allow gravity instead of pumped flow.
During wet weather periods, the NWI surcharges causing some suburban area wastewater flow to be pumped to the NWI. Murwood, Dearborn and Melvindale are pumping stations that discharge to the NWI. Lower high water levels in the NWI would allow suburban gravity inflow or require less pumping head.

5.2 Pump Station Management

5.2.1 Pump Station Modification

5.2.1.1 High Efficiency motors
Energy-efficient motors differ from normal-efficiency motors because they use electrical energy more efficiently to generate shaft output power. Table 5.2 presents a comparison of energy efficient motors and industrial average electric motors along with watts saved and potential cost savings. The difference in efficiencies between high and standard efficiency motors decrease with increasing motor size.

It is not practical or possible to develop a rule-of-thumb to estimate the capital cost difference between an energy-efficient motor and a normal-efficient motor. The price of a motor is a function, not only of its power output, but also of its efficiency, the service factor, number of revolutions per minute, enclosure, and motor design (that is normal starting torque, high starting torque, high slip, etc). Generally, it can be said that the cost of energy-efficient motors range from 15 to 60% more than the cost of standard motors.

Each electric motor application requires a payback period calculation. The more hours each day that the motor runs, the rapid the payback is from a high-efficiency motor. The more recently a motor has been installed, the more likely it is a energy-efficient motor. However, even a difference of 1 or 2% can repay the extra cost of an

energy-efficient motor in a few months or years. DWSD should require any motor replacement to be evaluated for power efficiency.

Table 5.2. High Efficiency Electric Motor Annual Savings (*+)

Hp	Energy Efficient	Industrial Average Efficiency	Watts Saved	Annual Money Saved ($)
10	90.2	85.0	506	292
15	93.0	86.5	904	521
20	93.0	87.5	1008	581
25	93.6	88.0	1270	732
30	93.6	88.1	1493	860
40	94.1	89.4	1667	960
50	94.5	90.4	1790	1031
60	95.0	90.3	2452	1412
75	95.0	90.8	2724	1568
100	95.4	91.6	3245	1870
125	95.8	91.8	4243	2444
150	96.2	92.3	1912	2830
200	96.2	93.3	1819	2776
250	96.2	93.6	5390	3104
300	96.5	93.8	6676	3846

*The above table illustrates the annual savings of 1800 RPM designs of high efficiency verses standard industrial designs based on $.08 per kilowatt-hour, 7200 hours of operation per year.

+ Source Reliance Electric

Table 5.3. Monthly Maximum and Average Power Demand (kW)

	Clintondale Station			Fairview Station			Woodmere Station		
Month	**Peak Peak**	**Avg. Peak**	**24 Hr Avg**	**Peak Peak**	**Avg. Peak**	**24 Hr Avg**	**Peak Peak**	**Avg. Peak**	**24 Hr Avg**
July 1994	600	350	190	950	720	700	70	38	30
August	650	330	170	710	710	700		70	30
September	500	340	180	710	480	480	70	38	38
October	680	330	160	1180	480	450	800	38	30
November	650	330	170	710	480	400		38	27
December 1994		350	180	710	480	375		38	27
January 1995	630	320	200	710	480	480		70	70
February		340	175		480	350		38	30
March	630	320	190	710	480	480		38	25
April	630	320	190	960	710	600	70	38	32
May		320	175	950	480	500	800	38	35
June	670	320	170	950	480	950	70	38	40
July		340	150	950	700	950	70	38	40
August	650	320	160	710	480	380		38	34
September		340	150		480	375	70	38	32
October		340	155	710	480	350	70	38	32
November	600	310	160	960	480	500	800	38	32
December 1995		370	165	960	480	525		38	30
January 1996	670	370	180				70	38	32
February		370	190					38	32
March		370	195				70	38	32
April	670	370	205				250	38	52
May	650	320	200					38	34
June 1996	680	325	200				1500	38	100

Peak Peak: Peak storm flow of 15 minutes to 3 hours
Average Peak: Sustain Storm Flow of 3 to 18 hours
24 Hours Average: Peak day 24 hours flows

Table 5.4. VFD Cost Analysis

Location	Current Peak Demand kW (Duration	New Peak Demand kW (Duration)	Average Demand Cost ($)	Peak Demand Cost ($)	24 hr Average Cost ($)	Service Charge Per Month ($)	Total Monthly Cost ($)	Total Annual Cost ($)	Capital Cost of VFD Installed ($)	VFD Payback Period (yrs)
Clintondale										
Existing	680 (3 hrs)		200			275	11,600	139,200		
Modified		380 (20 hrs)	200			275	6,614	79,368	165,000	2.8
Savings								59,832		
Fairview										
Existing	1180 (3 hrs)		500	21,150	12,810	275		34,235		
Modified		950 (24 hrs)	500	17,100	12,810	275		30,185	180,000	44
Savings								4,050		
Woodmere										
Existing	1500 (1/2 hrs)		35	26,750	897	275	27,922	335,064		
Modified		800 (3 hrs)	35	14,400	897	275	15,572	186,864	255,000	1.7
Savings								148,200		

5.2.1.2 Variable Frequency Drives

Variable frequency drives (VFD) are used frequently where there is a variable air or wastewater flow being boosted by a blower or pumped, respectively. Most wastewater pumping stations have varying flow and thus should have at least one pump driven by a motor controlled by a VFD.

A significant number of motors in the wastewater pumping stations and WWTP have VFDs (Tables 4.1 and 4.2). The following facilities should be considered for providing at least one VFD.

Wastewater Pumping Stations

Clintondale Station

Fairview Station

Woodmere Station

WWTP

Main Pump Station No. 1

A further analysis of the above wastewater pumping stations is summarized in Table 5.3. Monthly diurnal curves (Appendix E) were surveyed to extract the monthly data (July 1994-June 1996) presented in this table. Peak peak, average peak and 24 hour average kilowatt demands are given. From this data and the diurnal curves, Table 5.4 was generated. Existing and modified (VFD) demand data was used to generate monthly and annual power costs. Only the Clintondale and Woodmere pump stations would realize net savings, if VFDs were installed in place of one of the existing constant speed motors. A simple payback calculation resulted in a payback period of 2.8 and 1.7 years for the Clintondale and Woodmere pumping stations, respectively.

5.2.1.3 Multiple Varying Sized Pumps

In addition to providing VFDs, a mixed sized group of pumps is another way of approaching varying wastewater flows. Often low nighttime sanitary flows can be handled with a small pump. Many of the wastewater pump stations have small pumps for sanitary flows as shown earlier in Table 4.2. Possible candidates for small pumps are the Clintondale and Fairview Pumping Stations.

5.2.1.4 Pump Efficiency Evaluation

All centrifugal pumps have varying efficiencies depending on the flow and head rating. Most designers attempt to pick a pump with the highest efficiency at the average flow and head condition of the system curve. As actual wastewater flows increase over time, some pumps may be operating off their high efficiency point. Thus, a periodic (every 3 years) pump efficiency evaluation should be performed. Actual pump flow and head reading should be compared to actual motor kilowatt readings.

5.2.1.5 On-Site Generators for Storm Water Pumps

As seen in Table 4.3, most of the storm water pumps are only operated from 0 to 100 hours per year. Most of these pumps are in the 1000 to 3000 Hp range and have high peak electrical power demands for short periods of time. Since 12% of the total of all wastewater pumping kWh usage is due to peak demand, on-site generators could save DWSD some electrical power peak demand cost. (See Appendix B).

Due to Y2K concerns, many wastewater pumping stations were supplied with emergency generators as shown in Table 5.3. The Fairview pumping station is scheduled to be supplied with a backup generator in 2003 under Contract DWS 837. Each facility has a 24-hour full load fuel storage tank. The generators are designed to switch on automatically for storm water pump operation, but they are currently only used as an emergency backup. See PC-713 in Section 3.6 above for a further discussion of wastewater pumping station generator operation.

Table 5.5. Wastewater Pumping Station Emergency Generators

Facility	Stormwater Hp	Capacity (MW)	Installation
Bluehill	6,000	3 @ 2 = 6	1999
Conner	18,200	4 @ 2 = 8	1999
Fairview		1 @ 2 = 2	DWS 837 in 2003
Freud	24,000	4 @ 2 = 8	1999
Northeast		3 @ 2 = 6	1999
Oakwood	2,200	1 @ 2 = 2	1999

5.2.1.6 On-Site Engine Drives for Storm Water Pumps

Storm water pumps can be driven by diesel engines rather than electric-motor-supplied-power from an on-site generator, to shave peak utility power demand. Special factors prevent right-angle engine drives from being installed in existing wastewater pumping stations. However, any proposed future storm water pumping station should consider this option.

5.2.2 Force Main

5.2.2.1 Provide large diameter or multiple force mains for use with different capacity pumps

Most of the wastewater pumping stations in the DWSD collection system do not have force mains. The wastewater is simply lifted and then flows by gravity. Wastewater pumping stations on the periphery of the main DWSD collection system require pumping stations with force mains. If the tributary population is to increase significantly, it may be advantageous to design two or more force to maintain a minimum velocity of 2 fps both now and in the future, without incurring future high head losses, which require high horsepower pump motors.

5.3 Daytime Storage (to allow nighttime off-peak pumping)

Some communities store wastewater in equalization basins during the day allowing a nighttime release of stored wastewater during low-flow nighttime periods. Flow equalization devices that could be considered include pump station wet wells, in-system storage and CSO detention basins.

These facilities are applicable to CSO flow storage, and, therefore, cannot be used to store dry weather flows because that would interfere with their designated purpose of CSO flow storage.

5.4 Flow Reduction (Source Control)

A reduction in both dry weather and CSO wastewater flows would result in reduced pumping and treatment electrical energy consumption. Dry weather flow reduction (including infiltration / inflow control and water conservation) and CSO flow reduction (including downspout disconnection, maximization of tree coverage and storm water sewer separation between Jefferson Avenue and the Detroit River) are discussed in other technical memorandums.

5.5 Natural Gas Usage Reduction (WWTP)

In 2001, the incinerators at the Wastewater Treatment Plant (WWTP) utilized 15,900,000 units (100 cu ft) of natural gas which resulted in a cost of approximately 5.4 million dollars (based on 33.96¢ / 100 cu ft).

Currently, the existing incinerators receive a sludge cake with a 23 percent solids content. If this cake concentration could be raised to 29%, the incineration natural gas consumption would drop to nearly zero. If the Minergy proposal is implemented, the incinerators will be taken out of service and, therefore, WWTP natural gas usage will drop drastically to be only used for building heating and cooling.

6. Current DWSD Energy Management Plan

6.1 Recommendations from 1999 Energy Audit (CS-1272)

6.1.1 Wastewater Treatment Plant

Consideration should be given to providing a VFD for at least one of the pumps for Main Pump Station No. 1. SFE pumps, which include a 600 Hp and 7-1000 Hp, are run four at a time. The pumps are constant speed with fluctuating demand. Investigation of variable frequency drives or alternative methods of pump management may provide energy reduction opportunities.

During a plant visit, it was noted that yard lights were on in broad daylight. Simply switching lights off when not needed for safety or to perform work would reduce overall energy consumption.

6.1.2 Wastewater Pumping Station

At least one pump at the Clintondale and Woodmere Pumping Stations should be considered for providing VFDs.

6.2 Current Energy Management Program

Some energy management efforts are being made. Plant operators prefer to start large motors off-peak, if possible. Because of the weather driven nature of the operation, devising a plan to balance between available capacity and pump station flows is difficult. When possible, motors are ramped up using plant treated effluent to avoid sudden heavy start loads. Operators prefer running two pumps at full load rather than three at partial load.

There are several improvements in the works that will increase efficiency and reduce electrical use. The eddy current drives on the intermediate lift pumps No.1 and No.2 are presently being replaced with VFDs. Pumps 3, 4, 7 are also scheduled to receive VFDs.

7. Recommendations

A. An analysis of pumping versus gravity flow indicates that building long deep sewers is more economical, on a present worth basis, than providing shallow sewers with intermittent pumping stations. Thus, new construction should utilize as few pumping stations as practical.

B. Three wastewater pumping stations should be considered for providing at least one VFD. They are the Clintondale and Woodmere wastewater pumping stations and the Main Pump Station No. 1 at the WWTP. The Clintondale wastewater pumping station is also a candidate for a smaller pump.

C. At the WWTP, it would save power if the yard lights were turned off during daylight hours. If it is not convenient to turn the lights on and off manually, timers could be installed.

D. When obtaining new or replacement equipment, make sure that high efficiency motors are specified.

E. Every 3 years, evaluate the theoretical water (head and flow) power demand to the actual electric motor power demand to evaluate the pump efficiency. If the pump efficiency has decreased due to changes flow, head or impeller wear consider replacing the pump and motor. Check the Oakwood Pumping Station first for the inefficiency identified in Section 4.2.2 of this report.

F. Many suggestions for reducing collection system flows also result in reduced energy consumption. A list of recommended actions are as follows:

    1. Require gravity flow of separated storm water for new development (> 10 acres) south of Jefferson Avenue.

2. Provide CSO source control, such as downspout disconnection and maximization of tree cover.

3. Provide dry weather flow reduction including infiltration/inflow control and water conservation.

Appendix A - Reference

1. DWSD Contract No. CS-1272 – Study and Evaluation of DWSD Electric Utility Rates, Task 1- Electrical Energy Audit Final Report, July 1999

2. DWSD Contract No. PC-744 - Needs Assessment Study for the Detroit Wastewater Treatment Plant, Revision O (November 15, 2000)

3. DWSD Contract No. PC-744 – Assets Audit Report for the Detroit Wastewater Treatment Plant and Collection System (December 19, 2001)

4. Iowa Association of Municipal Utilities, How to Save Energy and Money in You Water and Wastewater Systems (August 1998).

5. DWSD Contract No. CS-1158 Long Term CSO Control Plan Section 10.06B – Pump Stations Rehabilitation, (July 1, 1996).

6. DWSD Contract No. CS-1272 – Study and Evaluation of DWSD Electric Utility Rates, Task 2.3 Retail Wheeling Feasibility Study, Final Report (December 2000).

7. DWSD Contract No. PC-713 Department – Wide Instrumentation Control and Computer System Program II “Emergency Generators Control Narrative For Water and Wastewater Stations, DATA.NET (June 2002)

8. DWSD Contract No. CS-1272 – Study and Evaluation of DWSD Electric Utility Rates, Task 9.1 Natural Gas By-Pass Feasibility (September 1999).

9. WEF, Energy Conservation in Wastewater Treatment Facilities, Manual of Practice No. MFD-2.

10. New York State Energy Research and Development Authority, Energy Efficiency in Municipal Wastewater Treatment Plants.

Wastewater Pumping Stations

Wastewater Treatment Plant

Appendix B - Energy Usage

Appendix B-1 Wastewater Treatment Plant

Appendix B-2 Wastewater Pumping Station

Appendix B-3 CSO Basins

Appendix B – 1 Wastewater Treatment Plant

Energy Usage and Demand for wastewater Treatment Plant (July 94 thru May 96)

Wastewater Treatment Plant 1994-1995 Monthly Usage

Wastewater Treatment Plant 1994-1995 Monthly Peak

Wastewater Treatment Plant 1995-1996 Monthly Usage

Wastewater Treatment Plant 1995-1996 Monthly Peak

Wastewater Treatment Plant Summary of Monthly Usage (1994-1996)

Appendix B – 2 Wastewater Pumping Station

Annual Electrical Power Consumption (kWh) at Wastewater Pumping Station (1982-89).

Summary for all Wastewater Pumping Stations average monthly kWh usage (July 94 thru May 96)

Summary of Energy Usage and Demand for Wastewater Pumping Stations total for two years (July 94 thru May 96)

Summary of Energy Usage and Demand for Wastewater Pumping Stations total for two years (July 94 thru may 96)

1994-1995 Wastewater Pumping Station kWh Usage

1994-1995 Wastewater Pumping Stations Peak Demand

1995-1996 Wastewater Pumping Station kWh Usage

1995-1996 Wastewater Pumping Stations Peak Demand

Clintondale Wastewater Pumping Station

Summary of Monthly usage (1994-1996)

Conner Wastewater Pump Station

Summary of Monthly Usage (1994-1996)

Oakwood Wastewater Pumping Station

Summary of Monthly Usage (1994-1996)

Appendix B-3 - CSO Basins

Appendix B - Rate Schedules

Appendix C - Rate Schedules

Appendix C-1 Detroit Edison Rate Schedule

- Primary Supply Rate Schedule D-6
- Primary Pumping Rate Schedule E-4
- Secondary Pumping Rate Schedule E-5
- Application Rules and Regulation

Appendix C-2 PLD Rate Schedule

Appendix D - Billing Information

Appendix D-1 Wastewater Treatment Plant

Appendix D-2 Clintondale Wastewater Pumping Station

Appendix D-3 Conner Wastewater Pumping Station

Appendix D-4 Oakwood Wastewater Pumping Station

Appendix D-5 Central Services Building

Appendix D-1 - Wastewater Treatment Plant

Appendix D-2 - Clintondale Wastewater Pumping Station

Appendix D-3 - Conner Wastewater Pumping Station

Appendix D-4 - Oakwood Wastewater Pumping Station

Appendix D-5 - Central Services Building

Appendix C-1 - Detroit Edison Rate Schedules

Appendix C-2 - PLD Rate Schedules

Appendix E - Diurnal Curves

Wastewater Treatment Plant (Jan thru June, 1995)

Bluehill station (Jan thru June, 1995)

Clintondale Station (July 1994 thru June, 1996)

Conner Station (Jan thru June, 1995)

Fairview Station (July 1994 thru June, 1996)

Freud Station (Jan thru June, 1995)

Oakwood Station (Jan thru June, 1995)

Woodmere Station (July 1994 thru June, 1996)

Central Services Facility (Jan thru June, 1995)

Appendix F - Retail Wheel Energy Rates

Table
Energy Usage and Demand
Detroit Water and Sewerage Department
Wastewater Treatment Plant

	Annual Energy Usage (kWh)	On-Peak Energy (kWh)	Off-Peak Energy (kWh)	Maximum Demand (kW)	Maximum On-Peak Demand (kW)	Minimum Demand (kW)	Annual Load Factor
1994-95	249,561,922	57,172,494	192,389,428	34,406	34,406	18,043	0.8280
1995-96	248,107,915	56,862,164	191,245,751	36,656	36,656	0	0.7727
Summary For Study Period	497,669,837	56,862,164	440,807,673	36,656	36,656	0	0.7749

Appendix B - 2
Wastewater Pumping Station

Annual Electrical Power Consumption (Kwh) at Wastewater Pumping Station (1982-89).

Summary for all Wastewater Pumping Stations average monthly kwh usage (July 94 thru May 96)

Summary of Energy Usage and Demand for Wastewater Pumping Stations total for two years (July 94 thru May 96)

Summary of Energy Usage and Demand for Wastewater Pumping Stations total for two years (July 94 thru may 96)

1994-1995 Wastewater Pumping Station kwh Usage

1994-1995 Wastewater Pumping Stations Peak Demand

1995-1996 Wastewater Pumping Station kwh Usage

1995-1996 Wastewater Pumping Stations Peak Demand

Clintondale Wastewater Pumping Station

Summary of Monthly usage (1994-1996)

Conner Wastewater Pump Station

Summary of Monthly Usage (1994-1996)

Oakwood Wastewater Pumping Station

Summary of Monthly Usage (1994-1996)

ANNUAL ELECTRIC POWER CONSUMPTION (Kwh) AT WASTEWATER PUMPING STATION (1982-89)

FISCAL YEAR

STATION	1982	1983	1984	1985	1986	1984	1988	1989
PLD								
Belle Isle	224,482	200,178	209,870	-	165,402	148,874	173,610	154,946
Bluehill	585,562	535,530	586,382	-	620,542	589,959	522,543	474,118
Fairview	4,700,179	4,627,813	4,692,860	-	5,085,019	5,059,811	5,666,128	5,765,294
Fisher	80,750	71,720	58,960	-	63,800	62,400	54,500	45,680
Freud	1,529,053	1,345,030	1,741,953	-	1,536,759	1,429,763	1,235,426	1,506,343
Puritan	101,440	107,200	89,520	-	94,680	89,800	69,670	98,600
Woodmere	328,348	357,152	299,950	-	423,447	353,558	318,946	337,746
Detroit Edison								
Chesterfield	-	-	371,360	-	486,120	823,200	660,760	1,010,040
Clintondale	1,150,560	1,218,040	1,276,240	-	1,586,240	1,462,800	1,461,120	1,466,240
Conner	4,356,200	3,945,000	3,949,800		5,188,800	4,631,100	4,320,800	4,389,800
15-Mile-Hayes	2,424,900	3,852,200	1,868,839	-	-	-	-	-
Garfield	-	-	148,000	-	315,200	186,240	177,280	156,160
Northeast	6,704,000	6,760,480	7,073,680	-	8,032,640	8,040,960	8,405,120	7,187,059
Oakwood	545,340	498,480	544,080	-	521,760	529,140	588,600	548,940
Total	22,730,814	23,518,823	22,911,494	0	24,120,409	23,407,605	23,654,503	23,140,966

Table
Detroit Water and Sewerage Department
Summary for all Wastewater Pumping Stations
Average Monthly kWh Usage

Period	Sanitary Pumps	Stormwater Pumps	Background
July-Aug 94	10,878	3,943	504
Sep-Nov 94	9,121	3,253	500
Dec 94-Feb 95	6,865	3,205	595
Mar-May 95	11,614	4,899	555
Jun-Aug 95	8,868	2,171	495
Sep-Nov 95	9,037	7,404	446
Dec 95-Feb 96	9,477	2,927	591
Mar-May 96	4,634	0	580
Monthly Average for Period	8,812	3,475	531
% Total	69%	27%	4%

Table
Detroit Water and Sewerage Department
Summary of Energy Usage and Demand for Wastewater Pumping Stations Total for Two Year Period

	Energy Usage (kWh)	On-Peak Energy (kWh)	Off-Peak Energy (kWh)	Maximum Demand (kW)	Maximum On-Peak Demand (kW)	Minimum Demand (kW)	Load Factor
Clintondale	2,983,142	680,015	2,303,127	685	666	0	0.2486
Conner	8,868,263	2,230,554	6,637,709	7,290	7,290	0	0.0793
Oakwood	1,019,366	256,973	762,393	1,179	833	0	0.0493
Total of all Stations	12,870,771	3,167,542	9,703,229	7,290	7,290	0	0.1008

CSO Detention Basin Major Equipment (≥10HP)
Electrical Inventory

Units	Hubbell-Southfield	Puritan / Fenkell	Seven Mile	Comments
Chemical Feed Units	3@ 10 Hp	2@ 10 Hp	1@ 10 Hp	
Dewatering Pumps	4@ 45 Hp	4@ 20 Hp		
Wet Well Sump Pumps	2@ 10 Hp			
Submersible Mixers	6@ 20 Hp 2@ 15 Hp	8@ 20 Hp		
Overhead Crane Hoist	1@ 10 Hp			
Flushing System Pumps	2@ 325 HP	1@ 25 Hp		
Ventilation System				
Supply Fans	13@ 15 Hp	2@ 15 Hp 1@ 100 Hp	2@ 100 Hp	
Exhaust Fan	1@ 12 Hp	1@ 30 Hp 1@ 20 Hp	1@ 10 Hp	
HVU		1@ 10 Hp		

CSO Detention Basin Major Equipment (≥10HP)
Electrical Inventory

Units	Hubbell-Southfield	Puritan / Fenkell	Seven Mile	Comments
PACU		1@ 15 Hp		
Odor Control System				
Fan	2@ 60 Hp	1@ 10 Hp 1@ 40 Hp	1@ 50 Hp	
Recycle Pump	2@ 10 Hp			

Appendix C
Rate Schedules

Appendix C-1 Detroit Edison Rate Schedule

Primary Supply Rate Schedule D-6

Primary Pumping Rate Schedule E-4

Secondary Pumping Rate Schedule E-5

Application Rules and Regulation

Appendix C-2 PLD Rate Schedule

PRIMARY SUPPLY RATE

AVAILABILITY OF SERVICE: Available to customers desiring service at primary, sub-transmission, or transmission voltage who contract for a specified capacity of not less than 50 kilowatts at a single location.

HOURS OF SERVICE: 24 hours, subject to interruption by agreement, or by advance notice.

CURRENT, PHASE AND VOLTAGE: Alternating current, three-phase, nominally at 4,800, 13,200, 24,000, 41,570 or 120,000 volts at the option of the Company.

CONTRACT CAPACITY: Customers shall contract for a specified capacity in kilowatts sufficient to meet normal maximum requirements but not less than 50 kilowatts. The Company undertakes to provide the necessary facilities for a supply of electric power from its primary distribution system at the contract capacity. Any single reading of the demand meter in any month that exceeds the contract capacity then in effect shall become the new contract capacity. The contract capacity for customers served at more than one voltage level shall be the sum of the contract capacities established for each voltage level.

RATE PER MONTH:

Service Charge:
$275.00 per customer per month

Demand Charges:
$14.25 per kW for on-peak billing demand, plus:
For primary service (less than 24 kV) $3.75 per kW of maximum demand.
For service at subtransmission voltage level (24 to 41.6 kV) $2.65 per kW of maximum demand.
For service at transmission voltage level (120 kV and above) $1.80 per kW of maximum demand.
The maximum demand shall be the highest 30-minute demand created during the previous 12 billing months, including the current month but not less than 50% of contract capacity. This clause is applicable to each voltage level served.

Energy Charge:
2.96¢ per kWh for all on-peak kWh
2.66¢ per kWh for all off-peak kWh

Voltage Level Discount:
.15¢ per kWh at transmission level
.10¢ per kWh at sub-transmission level

SUBSTATION CREDIT: Available to customers where service at sub-transmission voltage level (24 to 41.6 kV) or higher is required, who provide the on-site substation including all necessary transforming, controlling and protective equipment. A credit of $.30 per kW of maximum demand shall be applied to the maximum demand charge. A credit of .040¢ per kWh shall be applied to the energy charge where the service is metered on the primary side of the transformer.

POWER SUPPLY COST RECOVERY FACTOR: The Energy Charge in the above rate is subject to the provision of Schedule Designation B-4.6.

SURCHARGES AND CREDITS: As approved by the Commission. See Schedule Designation B-4.9.

LATE PAYMENT CHARGE: See Schedule Designation B-2.10.

(Continued on next sheet)
M/113

Issued: January 27, 1994
By: L. G. Garberding
Executive Vice President
and Chief Financial Officer
2000 Second Avenue
Detroit, Michigan 48226

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PRIMARY SUPPLY RATE-Continued

DEFINITION OF CUSTOMER VOLTAGE LEVEL: See Schedule Designation B-4.7.

MONTHLY ON-PEAK BILLING DEMAND: The monthly on-peak billing demand shall be the single highest 30-minute integrated reading of the demand meter during the on-peak hours of the billing period. The monthly on-peak billing demand will not be less than 65% of the highest monthly on-peak metered billing demand during the billing months of June, July, August, September, and October of the preceding eleven billing months, nor less than 50 kilowatts.

MINIMUM CHARGE: All demand charges plus the service charge.

SCHEDULE OF ON-PEAK HOURS: See Schedule Designation B-4.4.

POWER FACTOR CLAUSE: The rates and charges under this tariff are based on the customer maintaining a power factor of not less than 85% lagging. Any power factor less than 70% will not be permitted and the customer will be required to install at his own expense such corrective equipment as may be necessary to improve power factor. A penalty will be applied to the total amount of the monthly billing for electric energy for power factor below 85% lagging in accordance with the table in Power Factor Determination, Schedule Designation B-4.5. The Power Factor Clause shall not be applied to the on-peak billing demand ratchet nor to the minimum contract demand, but will be applied to metered quantities.

SPECIAL TERMS AND CONDITIONS: The contract capacity however established shall not be decreased during the term of the contract and subsequent renewal periods as long as service is required unless there is a specific reduction in connected load.

Customer-owned equipment must be operated so that voltage fluctuations on the primary distribution system of the Company shall not exceed permissible limits.

Customers will be permitted to transfer from this rate to a secondary commercial rate, provided they can meet the availability requirements, if the load characteristic changes sufficiently so that the customer would benefit by the change for the foreseeable future even thought metering was continued at primary voltage. Frequent changes, however, from on rate to another for a period less than one full year will not be permitted in accordance with Rule B-2.4 - Choice of Rates.

(continued on next sheet)
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By: L. G. Garberding
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2000 Second Avenue

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PRIMARY SUPPLY RATE--Continued

For example, during the period that a building is under construction, primary service may be supplied and metered at primary voltage and billed on a secondary rate while the building is under the jurisdiction of the contractor.

Also, for the convenience of the utility, service to a large school complex or a high rise building where, as a matter of design, primary voltage is furnished with Company owned transformers at remote locations fed by customer owned primary cables, the account can be billed on a secondary rate though metered at one central primary voltage location at or near the termination of the utility-owned cables.

At the option of the Company, service may be supplied at the primary voltage and metered at a secondary voltage when the customer transfers from a secondary rate. For loads metered at a secondary voltage (less than 600V), all measured quantities shall be increased by 2%.

CONTRACT TERM: For new primary installations over 1000 kW the term is for not less than five years, extending thereafter from month-to-month until terminated by mutual consent or on twelve months' written notice by either party, which may be given at any time after the end of the fourth year. For new primary installations of 1000 kW or less and for new customers at existing installations, the term is for one year which under special circumstances may be increased or reduced at the discretion of the Company, extending thereafter from month-to-month until terminated by mutual consent or on one month written notice by either party. Where special services are required, the term will be as specified in the applicable contract rider.

Issued: August 15, 1985
By: E. L. Grove, Jr.
Vice Chairman of the Board
2000 Second Avenue
Detroit, Michigan 48226

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Alternative Primary Supply Service Schedule D6.1

ALTERNATIVE PRIMARY SUPPLY SERVICE

AVAILABILITY OF SERVICE: Available to customers desiring service at primary, subtransmission, or transmission voltage who contract for a specified capacity of not less than 10,000 kilowatts at a single location.

HOURS OF SERVICE: 24 hours, subject to interruption by agreement, or by advance notice.

CURRENT, PHASE AND VOLTAGE: Alternating current, three-phase, nominally at 4,800, 13,200, 24,000, 41,570 or 120,000 volts at the option of the Company.

CONTRACT CAPACITY: Customers shall contract for a specified capacity in kilowatts sufficient to meet normal maximum requirements but not less than 10,000 kilowatts. The Company undertakes to provide the necessary facilities for a supply of electric power from its primary distribution system at the contract capacity. Any single reading of the demand meter in any month that exceeds the contract capacity then in effect shall become the new contract capacity. The contract capacity for customers served at more than one voltage level shall be the sum of the contract capacities established for each voltage level.

RATE PER MONTH:

Service Charge:
$275.00 per customer per month

Demand Charge:
For primary service (less than 24 kV) $3.75 per kW of maximum demand.
For service at subtransmission voltage level (24 to 41.6 kV) $2.65 per kW of maximum demand.
For service at transmission voltage level (120 kV and above) $1.80 per kW of maximum demand.
The maximum demand shall be the highest 30-minute demand created during the previous 12 billing months, including the current month but not less than 50% of contract capacity.
This clause is applicable to each voltage level served.

Energy Charge:
14.52¢ /kWh for the first 150 hours use of on-peak billing demand created during the month, but not less than 10,000 kW.
2.31¢ /kWh for the next 300 hours use of on-peak billing demand created during the month, but not less than 10,000 kW.
1.92¢ /kWh for the excess kilowatthours.
The energy charge will be reduced by 3.00 mills per kWh for all off-peak use.

Voltage Level Discount:
.15¢ per kWh at transmission level .
.10¢ per kWh at subtransmission level

POWER SUPPLY COST RECOVERY FACTOR: The Energy Charge in the above rate is subject to the provisions of Schedule Designation B-4.6.

SURCHARGES AND CREDITS: As approved by the Commission. See Schedule Designation B-4.9.

LATE PAYMENT CHARGE: See Schedule Designation B-2.10.

(Continued on next sheet)
M/114b

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January 21, 1994 in Case U-10102

ALTERNATIVE PRIMARY SUPPLY SERVICE--Continued

DEFINITION OF CUSTOMER VOLTAGE LEVEL: See Schedule Designation B-4.7.

MONTHLY ON-PEAK BILLING DEMAND: The monthly on-peak billing demand shall be the single highest 30-minute integrated reading of the demand meter during the on-peak hours of the billing period. The monthly on-peak billing demand will not be less than 65% of the highest monthly on-peak metered billing demand during the billing months of June, July, August, September, and October of the preceding eleven billing months, nor less than 10,000 kilowatts.

MINIMUM CHARGE: Energy charge for first 150 hours of use.

SCHEDULE OF ON-PEAK HOURS: See Schedule Designation B-4.4.

POWER FACTOR CLAUSE: The rates and charges under this tariff are based on the customer maintaining a power factor of not less than 85% lagging. Any power factor less than 70% will not be permitted and the customer will be required to install at his own expense such corrective equipment as may be necessary to improve power factor. A penalty will be applied to the total amount of the monthly billing for electric energy for power factor below 85% lagging in accordance with the table in Power Factor Determination, Schedule Designation B-4.5. The Power Factor Clause will be applied to metered quantities.

SPECIAL TERMS AND CONDITIONS: The contract capacity however established shall not be decreased during the term of the contract and subsequent renewal periods as long as service is required unless there is a specific reduction in connected load.

Customer-owned equipment must be operated so that voltage fluctuations on the primary distribution system of the Company shall not exceed permissible limits.

Customers will be permitted to transfer from this rate to a secondary commercial rate, provided they can meet the availability requirements, if the load characteristic changes sufficiently so that the customer would benefit by the change for the foreseeable future even though metering was continued at primary voltage. Frequent changes, however, from one rate to another for a period less than one full year will not be permitted in accordance with Rule B-2.4 - Choice of Rates.

For example, during the period that a building is under construction, primary service may be supplied and metered at primary voltage and billed on a secondary rate while the building is under the jurisdiction of the contractor.

(Continued on next sheet)
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ALTERNATIVE PRIMARY SUPPLY RATE–Continued

At the option of the Company, service may be supplied at the primary voltage and metered at a secondary voltage when the customer transfers from a secondary rate. For loads metered at a secondary voltage (less than 600V), all measured quantities shall be increased by 2%.

SUBSTATION CREDIT: Available to customers where service at subtransmission voltage level (24 to 41.6 kV) or higher is required, who provide the on-site substation including all necessary transforming, controlling and protective equipment. A credit of $.30 per kW of maximum demand shall be applied to the maximum demand charge. A credit of .040¢ per kWh shall be applied to the energy charge where the service is metered on the primary side of the transformer.

CONTRACT TERM: The term is five years, extending thereafter from month-to-month until terminated by mutual consent or on twelve months' written notice by either party, which may be given at any time after the end of the fourth year. Where special services are required, the term will be as specified in the applicable contract rider.

M/114d

Primary Pumping Rate Schedule E-4

PRIMARY PUMPING RATE

AVAILABILITY OF SERVICE: Available to government agencies desiring service at primary voltage for pumping and who contract for a specified capacity of not less than 50 kilowatts at a single location.

HOURS OF SERVICE: 24 hours, subject to interruption by agreement, or by advance notice.

CURRENT, PHASE AND VOLTAGE: Alternating current, three-phase, nominally at 4,800, 13,200, 24,000, 41,570 or 120,000 volts, at the option of the Company.

CONTRACT CAPACITY: Customers shall contract for a specified capacity in kilowatts sufficient to meet normal maximum requirements but not less than 50 kilowatts. The Company undertakes to provide the necessary facilities for a supply of electric power from its primary distribution system at the contract capacity. Any billing demand in any month that exceeds the contract capacity then in effect shall become the new contract capacity.

RATE PER MONTH:

Service Charge:
$275.00 per customer per month, plus

Demand Charges:
$14.21 per kW for on-peak billing demand, plus:
For primary service (less than 24 kV) $3.75 per kW of maximum demand.
For service at subtransmission voltage level (24 to 41.6 kV) $2.65 per kW of maximum demand.
For service at transmission voltage level (120 kV and above) $1.80 per kW of maximum demand.

The maximum demand shall be the highest 30-minute demand created during the previous 12 billing months, including the current month but not less than 50% of contract capacity. This clause is applicable to each voltage level served.

Energy Charge:
3.55¢ per kWh for all on-peak kWh
3.25¢ per kWh for all off-peak kWh

Voltage Level Discount:
.15¢ per kWh at transmission level
.10¢ per kWh at subtransmission level

POWER SUPPLY COST RECOVERY FACTOR: The Energy Charge in the above rate is subject to the provisions of Schedule Designation B-4.6.

SURCHARGES AND CREDITS: As approved by the Commission. See Schedule Designation B-4.9.

LATE PAYMENT CHARGE: See Schedule Designation B-2.10.

(Continued on next sheet)

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January 21, 1994 in Case U-10102

PRIMARY PUMPING RATE--Continued

MONTHLY BILLING DEMAND: The daily on-peak demand is the highest 30-minute integrated reading of the demand meter in each day, subject to Schedule of On-Peak Hours B-4.4. To this shall be added one-third of the amount by which it is exceeded by the highest single demand occurring during the off-peak hours on the same calendar day. The monthly billing demand is the highest of the daily demands. In no event will the monthly billing demand be less than 50% of the highest monthly metered billing demand computed above during the billing months of June through October established during the preceding eleven billing months, nor less than 50 kilowatts.

ON-PEAK HOURS: See Schedule Designation B-4.4.

MINIMUM CHARGE: All demand charges, plus the service charge.

POWER FACTOR CLAUSE: The rates and charges under this tariff are based on the customer maintaining a power factor of not less than 85% lagging. Any power factor less than 70% will not be permitted and the customer will be required to install at his own expense such corrective equipment as may be necessary to improve power factor. A penalty will be applied to the total amount of the monthly billing for electric service for power factor below 85% lagging in accordance with the table in Power Factor Determination, Schedule Designation B-4.5. The Power Factor Clause shall not be applied to the on-peak billing demand ratchet nor to the minimum contract demand, but will be applied to metered quantities.

SPECIAL TERMS AND CONDITIONS: The contract capacity, however established, shall not be decreased during the term of the contract and subsequent renewal periods as long as service is required unless there is a specific reduction in connected load.

Customer-owned equipment must be operated so that voltage fluctuations on the primary distribution system of the Company shall not exceed permissible limits.

Customers with large storm pumping facilities will be permitted to transfer to the Secondary Pumping Rate (E5) if their storm pumping horsepower is at least 60% of their total connected load.

CONTRACT TERM: The term is five years, extending thereafter from month-to-month until terminated by mutual consent or on twelve months' written notice by either party, which may be given at any time after the end of the fourth year. Where special services are required, the term will be as specified in the applicable contract rider.

Issued: January 27, 1994
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Effective for service rendered on
and after January 22, 1994 under
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Public Service Commission dated
January 21, 1994 in Case U-10102

Secondary Pumping Rate Schedule E-5

SECONDARY PUMPING RATE

AVAILABILITY OF SERVICE: Available to governmental agencies desiring service at secondary voltage for pumping and to governmental agencies with service at primary voltage having the storm pumping horsepower that is at least 60% of the total connected load. This rate is not available to installations, other than storm pumping, having a demand of over 1,000 kilowatts and not taking service on this rate prior to August 19, 1972.

HOURS OF SERVICE: 24 hours.

CURRENT, PHASE AND VOLTAGE: Alternating current, single-phase and three-phase four-wire Y connected at 208Y/120 volts, or under certain conditions three-phase four-wire, Y connected at 480Y/277 volts.

In certain city districts, alternating current is supplied from a Y connected secondary network from which 120/208 volt three-wire service may be taken.

RATE PER MONTH:

Service Charge:
$10.85 per customer per month, plus
An energy charge per kilowatthour of:
8.54¢ per kWh for all kWh

POWER SUPPLY COST RECOVERY FACTOR: The Energy Charge in the above rate is subject to the provisions of Schedule Designation B-4.6.

SURCHARGES AND CREDITS: As approved by the Commission. See Schedule Designation B-4.9.

LATE PAYMENT CHARGE: See Schedule Designation B-2.10.

CONTRACT TERM: Open order, terminable on three days' written notice by either party.

MINIMUM CHARGE: The Service Charge.

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Public Service Commission dated
January 21, 1994 in Case U-10102

Applicable Rules and Regulations

RULES AND REGULATIONS--Continued

B-4.3 (cont'd.)

(3) CHECKS RETURNED BY BANKS OR OTHER FINANCIAL INSTITUTIONS:

Checks remitted by customers as bill payments and returned because they are not valid are rebilled to the customer's accounts. A $5.00 charge will be assessed to customers for handling checks received and returned by banks for reasons of insufficient funds, bank account closed, no account and similar situations excluding bank errors. Appropriate collection action follows if the customer does not redeem the check.

*(4) The date of rendition of a utility bill for service will be the date of physical mailing of the bill by the Company. If the last calendar day for remittance falls upon a Sunday, legal holiday or any other day when the offices of the Company regularly used for the payment of customer bills are not open to the general public, the final payment date shall be extended to the next business day.

(5) The customer is responsible for payments of all bills for service used until service is ordered discontinued and the Company has been given reasonable time and opportunity to secure a final meter reading. Payment after due date will result in the assessment of a late payment charge as specified in B-2.10. The failure on the part of the customer to receive the bill shall not entitle him to a waiver of the late payment charge.

B-4.4 SCHEDULE OF ON-PEAK HOURS:

For Large General Service Rate-D4;
Primary Supply Rate-D6;
Alternative Primary Supply Rate-D6.1;
Primary Space Conditioning Rate-D6.2;
Interruptible Supply Rate-D8;
Primary Pumping Rate-E4;
Standard Contract Rider-R3

On-peak hours are those hours between 1100 hours and 1900 hours each day, Monday through Friday, legal holidays excluded.

The following will be considered legal holidays for the purpose of applying this schedule: New Year's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas Day. "Monday" holidays, where legally recognized, will be recognized in place of the "traditional" holidays.

Schedule of on-peak hours also applies to on-peak and off-peak kWh charges.

B-4.5 POWER FACTOR DETERMINATION:

Where the filed rate requires a determination of power factor, the Company will install a lagging reactive component meter in addition to the kilowatthour meter used for the measurement of energy. From the readings of these two meters, the power factor for the regular billing period will be determined according to the following table:

* Residential Customers Only

(Continued on next sheet)
M/60

Issued: January 27, 1994
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Public Service Commission dated
January 21, 1994 in Case U-10102

RULES AND REGULATIONS--Continued

B-4.5 (cont'd.)

RATIO OF REGISTRATION OF REACTIVE COMPONENT METER TO REGISTRATION OF KILOWATTHOUR METER POWER FACTOR

1.021 and higher	.699 and lower
1.020 to .883	.700 to .749
.882 to .752	.750 to .799
.751 to .622	.800 to .849
.621 to .000	.850 to 1.000

Power Factor: A penalty will be applied to all metered quantities in accordance with the following table:

POWER FACTOR	PENALTY
.850 and higher	None
.800 to .849	1%
.750 to .799	2%
.700 to .749	3%

Power factors less than .700 are not permitted and necessary corrective equipment must be installed by the customer. A 25% penalty will be applied to any billing after two consecutive months below .700 power factor and will continue as long as the power factor remains below .700. The first two consecutive months below .700, the penalty will be 3%. Once the customer's power factor exceeds .700, it is necessary to go through two consecutive months below .700 again before the 25% penalty applies.

B-4.6 POWER SUPPLY COST RECOVERY CLAUSE:

(1) This Power Supply Cost Recovery Clause permits the monthly adjustment of rates for power supply to allow recovery of the booked costs of fuel and purchased and net interchanged power transactions incurred under reasonable and prudent policies and practices in accordance with 1982 PA 304. All rates for electric service, unless otherwise provided in the applicable rate schedule, shall include a Power Supply Cost Recovery factor.

(2) The Power Supply Cost Recovery factor is that element of the rates to be charged for electric service to reflect power supply costs incurred by the company and made pursuant to the Power Supply Cost Recovery Clause.

(Continued on next sheet)
M/61

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Effective for service rendered on and after January 22, 1994 under authority of order of the Michigan Public Service Commission dated January 21, 1994 in Case U-10102

RULES AND REGULATIONS--Continued

B-4.6 (cont'd.)

(3) Effective January 22, 1994, the Power Supply Cost Recovery Factor shall consist of an increase or decrease of .01078 mills per kWh for each full .01 mill increase or decrease in the projected average booked cost of fuel burned for electric generation and purchased and net interchange power incurred above or below a base of 15.49 mills per kWh. Average booked cost of fuel burned and purchased and net interchange power shall be equal to the booked costs in that period divided by that period's net system kWh requirements. Net system kWh requirements shall be the sum of the net kWh generation and net kWh purchased and interchange power.

(4) The following factors were applied during the billing month as indicated below for the calendar year 1996.

	Mills/kWh		Mills/kWh		Mills/kWh
January	(0.71)	May		September	
February		June		October	
March		July		November	
April		August		December	

B-4.7 DEFINITION OF CUSTOMER VOLTAGE LEVEL:

(1) **Transmission Voltage Level - 120 kV and above:**

A customer is defined as taking service at the transmission voltage level when he is served directly from the transmission system at 120 kV or above, or from the transmission system through a Company-owned substation dedicated or primarily providing service to the customer and located on or immediately adjacent to the customer's premises.

(2) **Subtransmission Voltage Level - 24 kV to 41.6 kV:**

A customer is defined as taking service at the subtransmission voltage level when he is served directly from the subtransmission system at voltages from 24 kV to 41.6 kV or from the subtransmission system through a Company-owned substation dedicated or primarily providing service to the customer and located on or immediately adjacent to the customer's premises.

(3) **Primary Service - Less Than 24 kV:**

A customer is defined as taking primary service when he is served directly from the primary distribution system at a nominal voltage between 4.8 kV and 13.2 kV who does not qualify as either a transmission voltage customer or a subtransmission voltage customer.

M/62

RULES AND REGULATIONS--Continued

B-4.8 CONVERSION FROM MASTER METERING TO DIRECT SERVICE METERING:

(1) Apartment Buildings and Other Multiple Dwellings:

Where the owners of an apartment building or multiple dwelling choose to convert from a master metering installation to an individual tenant direct service utility metering installation, the Company, at its cost, shall provide the equipment and installation ordinarily provided for a newly constructed direct metered multi-dwelling.

(2) Expiration of Master Meters:

All newly constructed duplexes, apartment buildings, mobile homes and multiple occupancy dwellings receiving electrical service on and after August 1, 1979 shall have individual tenant metering.

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Public Service Commission dated
January 21, 1994 in Case U-10102

RULES AND REGULATIONS--Continued

B-4.9 SURCHARGES AND CREDITS:

(1) ENERGY CONSERVATION SURCHARGE: Pursuant to the Commission's Order in Case No. U-10297 dated April 11, 1994, the Company implemented an energy conservation program for residential low-income customers for the period 1994-1996. The purpose of this program is to address the needs of low-income customers by implementing measures that result in overall energy efficiency. This program consists of energy education, in-home audits, analysis of energy usage, and installation of energy conservation measures.

(2) NUCLEAR DECOMMISSIONING SURCHARGE: A January 1987 MPSC Order authorized the establishment of an external trust fund to finance the decommissioning of Fermi 2 Power Plant when its operating license expires. The Order approves a decommissioning surcharge on customer bills under which the funds are collected. Pursuant to Commission Order U-10102 dated January 21, 1994, a revised surcharge became effective with service rendered on and after January 22, 1994.

(3) DEMAND SIDE MANAGEMENT SURCHARGE: Pursuant to the Commission's Order in Case U-10102 the Company implemented a demand-side management program in all customer classes. The purpose of this program is to reduce or shift the use of electricity in a manner that will reduce the need for new power plants. The program implemented by the Company consists of the following services:

- Incentive toward the purchase of energy efficiency measures.
- Incentives or rates to encourage electricity usage during hours when it is less expensive to produce as opposed to hours when it is more expensive to produce.
- Energy audits and/or information.
- Evaluation of programs for cost-effectiveness.

(4) OTHER(S): Power Supply Cost Recovery clause (PSCR): See Rule B-4.6

(Continued on next sheet)

Issued: April 18, 1994
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Effective for service rendered on
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authority of order of the Michigan
Public Service Commission dated
April 11, 1994 in Case U-10297

RULES AND REGULATIONS--Continued

B-4.9 SURCHARGES AND CREDITS:

(1) 1998 RATE REDUCTION: MPSC Order U-11588 issued in November 1997 approves a credit which is to be applied to bills rendered in 1998. The credit is the result of the netting of expenses associated with the extraordinary storms in 1997 against cost of service reductions resulting from the expiration of the accounting treatments related to the completion of Fermi 2 which were previously approved in a 1988 rate settlement.

(2) NUCLEAR DECOMMISSIONING SURCHARGE: A January 1987 MPSC Order authorized the establishment of an external trust fund to finance the decommissioning of Fermi 2 Power Plant when its operating license expires. The Order approves a decommissioning surcharge on customer bills under which the funds are collected. Pursuant to Commission Order U-10102 dated January 21, 1994, a revised surcharge became effective with service rendered on and after January 22, 1994.

(3) POWER SUPPLY COST RECOVERY (PSCR) CLAUSE: See Rule B-4.6

(Continued on next sheet)

Issued: December 22, 1997
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Effective for service rendered on
and after January 1, 1998 under
authority of order of the Michigan
Public Service Commission dated
November 25, 1997 in Case U-11588

RULES AND REGULATION - CONTINUED

B-4.9 (4) Summary of surcharges and credits, including PSCR, pursuant to sub-rules (1) (2) and (3) of this rule. (Dollars per kilowatthours or percent of total bill)

	1998 Rate Reduction	NDS	Subtotal	PSCR (3)	Total w/PSCR
Residential					
Res. D1 - D1.7	($.0008507)	$.0008499	($.0000008)	($.00230)	($.0023008)
D2 Space Heating	($.0008507)	$.0009147	$.0000640	($.00230)	($.0022360)
D5 Water Heating	($.0008507)	$.0002038	($.0006469)	($.00230)	($.0029469)
D9 Otdr Lighting (1)	(0.517%)	0.331%	(0.186%)	NA	(0.186%)
R11 Photovoltaic	($.0008507)	$.0002038	($.0006469)	NA	($.0006469)
Commercial					
D3 General Service	($.0008507)	$.0008934	$.0000427	($.00230)	($.0022573)
D3.1 Unmetered (1)	(0.673%)	0.848%	0.175%	NA	(0.175%)
D3.3 Interruptible	($.0008507)	$.0008934	$.0000427	($.00230)	($.0022573)
D3.4 Time-of-Day	($.0008507)	$.0008934	$.0000427	($.00230)	($.0022573)
D4 Lg. Gen Service	($.0008507)	$.0008178	($.0000329)	($.00230)	($.0023329)
D5 Water Heating	($.0008507)	$.0002038	($.0006469)	($.00230)	($.0029469)
D9 Otdr Lighting (1)	(0.517%)	0.331%	(0.186%)	NA	(0.186%)
D10 Schools	($.0008507)	$.0007721	($.0000786)	($.00230)	($.0023786)
R3 Standby (Sec.)	($.0008507)	see note (2)		($.00230)	
R7 Greenhouse Ltg	($.0008507)	$.0005035	($.0003472)	($.00230)	($.0026472)
R8 Spc Conditioning	($.0008507)	$.0007060	($.0001447)	($.00230)	($.0024447)
R11 Photovoltaic	($.0008507)	$.0002038	($.0006469)	NA	($.0006469)
Industrial					
D6 Primary Supply	($.0008507)	$.0006985	($.0001522)	($.00230)	($.0024522)
D6.1 Alt Primary	($.0008507)	$.0006985	($.0001522)	($.00230)	($.0024522)
D6.2 Spc Cond.	($.0008507)	$.0006985	($.0001522)	($.00230)	($.0024522)
D8 Interr. Primary	($.0008507)	$.0006301	($.0002206)	($.00230)	($.0025206)
R1.1 Metal Melting	($.0008507)	$.0004554	($.0003953)	($.00230)	($.0026953)
R1.2 Elec Proc. Htg.	($.0008507)	$.0004554	($.0003953)	($.00230)	($.0029653)
R3 Standby (Pri.)	($.0008507)	see note (2)		($.00230)	
R10 Interr. Supply	($.0008507)	$.0003420	($.0005087)	NA	($.0005087)
R11 Photovoltaic	($.0008507)	see note (2)		NA	
Governmental					
E1 Streetlighting (1)	(0.415%)	0.265%	(0.150%)	NA	(0.150%)
E1.1 Energy Only	($.0008507)	$.0005035	($.0003472)	($.00230)	($.0026472)
E2 Traffic Lights (1)	(1.901%)	1.427%	(0.474%)	NA	(0.474%)
E4 Primary Pumping	($.0008507)	$.0008803	$.0000296	($.00230)	($.0022704)
E5 Sec. Pumping	($.0008507)	$.0007086	($.0001421)	($.00230)	($.0024421)

Notes:
(1) % applied to $ amount of base bill.
(2) NDS for standby energy based upon customer's supplemental rate.
(3) Detroit Edison's proposed PSCR factor in Case No. U-11528 (MPSC order pending).

1998 Rate Reduction and PSCR applied to bills rendered on and after January 1, 1998.

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RULES AND REGULATION - CONTINUED

B-4.9 (5) Summary of surcharges and credits, including PSCR, pursuant to sub-rules (1) (2) (3) and (4) of this rule. (Dollars per kilowatthours or percent of total bill)

	ECS (5)	NDS	DSM (3)	Subtotal	PSCR (4)	Total w/PSCR
Residential						
Res. D1 - D1.7	$.000000	$.0008499	$.000000	$.0008499	($.00071)	$.0001389
D2 Space Heating	$.000000	$.0009147	$.000000	$.0009147	($.00071)	$.0002047
D5 Water Heating	$.000000	$.0002038	$.000000	$.0002038	($.00071)	($.0005062)
D9 Otdr Lighting (1)	0.000%	0.331%	0.000%	0.331%	NA	0.331%
Commercial						
D3 General Service	$.000000	$.0008934	$.000000	$.0008934	($.00071)	$.0001834
D3.1 Unmetered (1)	0.000%	0.848%	0.000%	0.848%	NA	0.848%
D3.3 Interruptible	$.000000	$.0008934	$.000000	$.0008934	($.00071)	$.0001834
D3.4 Time-of-Day	$.000000	$.0008934	$.000000	$.0008934	($.00071)	$.0001834
D4 Lg. Gen Service	$.000000	$.0008178	$.000000	$.0008178	($.00071)	$.0001078
D5 Water Heating	$.000000	$.0002038	$.000000	$.0002038	($.00071)	($.0005062)
D9 Otdr Lighting (1)	0.000%	0.331%	0.000%	0.331%	NA	0.331%
D10 Schools	$.000000	$.0007721	$.000000	$.0007721	($.00071)	$.0000621
R3 Standby (Sec.)	$.000000	see note (2)	$.000000		($.00071)	
R7 Greenhouse Ltg	$.000000	$.0005035	$.000000	$.0005035	($.00071)	($.0002065)
R8 Spc Conditioning	$.000000	$.0007060	$.000000	$.0007060	($.00071)	($.0000040)
Industrial						
D6 Primary Supply	$.000000	$.0006985	$.000000	$.0006985	($.00071)	($.0000115)
D6.1 Alt Primary	$.000000	$.0006985	$.000000	$.0006985	($.00071)	($.0000115)
D6.2 Spc Cond.	$.000000	$.0006985	$.000000	$.0006985	($.00071)	($.0000115)
D8 Interr. Primary	$.000000	$.0006301	$.000000	$.0006301	($.00071)	($.0000799)
R1.1 Metal Melting	$.000000	$.0004554	$.000000	$.0004554	($.00071)	($.0002546)
R1.2 Elec Proc. Htg.	$.000000	$.0004554	$.000000	$.0004554	($.00071)	($.0002546)
R3 Standby (Pri.)	$.000000	see note (2)	$.000000		($.00071)	
R9 Econ Dev.	$.000000	$.0004240	$.000000	$.0004240	($.00071)	($.0002860)
R10 Interr. Supply	$.000000	$.0003420	$.000000	$.0003420	NA	$.0003420
Governmental						
E1 Streetlighting (1)	0.000%	0.265%	0.000%	0.265%	NA	0.265%
E1.1 Energy Only	$.000000	$.0005035	$.000000	$.0005035	($.00071)	($.0002065)
E2 Traffic Lights (1)	0.000%	1.427%	0.000%	1.427%	NA	1.427%
E4 Primary Pumping	$.000000	$.0008803	$.000000	$.0008803	($.00071)	$.0001703
E5 Sec. Pumping	$.000000	$.0007086	$.000000	$.0007086	($.00071)	($.0000014)

Notes:
(1) % applied to $ amount of base bill.
(2) NDS for standby energy based upon customers supplemental rate.
(3) Detroit Edison proposed DSM surcharge in Case No. U-10932 (MPSC order still pending).
(4) Detroit Edison proposed PSCR surcharge in Case No. U-10965 (MPSC order still pending).
(5) Detroit Edison ECS surcharge in Case No. U-10297 (MPSC order issued August 22, 1996)

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Public Service Commission dated
January 21, 1994 in Case U-10102

RULES AND REGULATIONS--Continued

B-4.10 TAX ADJUSTMENT AND FRANCHISE FEES:

Bills to customers receiving service within the limits of political subdivisions which levy special license fees, franchise fees or any other such fee against the Company or its operation or the production or sale of electric energy shall be increased to offset such special fee or any new or increased special fee, thereby preventing other customers from being compelled to share such local fees.

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Appendix C-2
PLD Rate Schedules

(1)

LD RATE BOOK-EFFECTIVE APRIL 1, 1994

RULES AND REGULATIONS: SECTION 02-00-00

CHOICE OF RATES: SECTION 02:01:01

If a customer is eligible to receive service under two or more rates, the responsibility for the selection of the rate lies with the customer. The Department, when requested, will advise the customer on the economic impact of the available rates. Once a rate has been selected, the customer must take service at that rate for at least the period specified under "Term of Agreement" for the rate selected.

TERM OF AGREEMENT: SECTION 02:01:02

The customer agrees to take service at the agreed upon rate for at least the period specified. Thereafter, the customer may request that a different rate be used. A new agreement will be entered into specifying the new rate.

RESPONSIBILITY FOR PAYMENT: SECTION 02:01:03

The customer is responsible for payment of all bills for service until such service is ordered discontinued in writing and the Department has been given a reasonable time and opportunity to secure a final meter reading. Payment after the due date will result in the assesment of the late payment charges.

CONTINUITY OF SERVICES: SECTION 02:01:04

The Department will exercise reasonable care to furnish continuous and adequate service. However, the Department will not be liable for damage caused by interruption of service, voltage or frequency variations, single-phase supply to three-phase lines or reversal of phase rotation.

* * * * * * * * * *

(2)

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RATE BOOK-EFFECTIVE APRIL 1, 1994

MEMORANDUM - POWER SUPPLY COST RECOVERY FACTOR SECTION 04:01:01

THE POWER SUPPLY RECOVERY FACTOR IS SUSPENDED EFFECTIVE JANUARY 1, 1992.

APPLICABLE TO:

General Service Rate,

Primary Demand Rate, ← THIS IS MOSTLY APPLICABLE TO DWSD

Bulk Primary Rate,

All Electric Schools Rider,

Stand-by Service Rider.

The Power Supply Cost Recovery factor permits the monthly adjustment of power supply rates to allow recovery of all of the costs of supplying power. These costs include the booked cost of fuel for power generation plus the additional costs of purchased power.

For purposes of this factor, the following conditions apply:

"Power Supply Cost Recovery Factor" (PSCRF) means that element of the rates to be charged for electric service that accounts for changes in booked cost that were originally incorporated in the rates or rate schedule. This factor is used to allocate the changed booked cost to the customer.

The Power Supply Cost Recovery Factor (PSCRF) shall consist of an increase of 0.010 or decrease of 0.009 mills per KWh for each .01 mill increase or decrease in the projected average booked cost of supplying power as compared to a cost base of 30.50 mills per KWh. This power supply cost would include the projected average booked cost of fuel burned for electric generation plus purchased power.

a. Average Booked costs of fuel burned, and purchased power, shall be equal to the booked costs in that period divided by that period's net system KWh requirements.

b. Net system KWh requirements shall be the sum of the net KWh generation and net KWh purchased power.

All revenues collected from use of base rates and the power supply cost recovery factors are subject to annual reconciliation review.

* * * * * * * * * *

PRIMARY DEMAND RATE:

AVAILABILITY:

Service under this rate is available to any customer:

1. who desires service at primary voltage at one location;
2. who owns and maintains all equipment beyond the point of service;
3. whose facility is permanent in nature; and
4. whose Load Factor exceeds 40%.

CHARACTER OF SERVICE:

Alternating current, 60 Hertz, three-phase, at a nominal voltage of 2,400V, 4,800V, 7,200V, 13,200V or 24,000V at the option of the Department.

RATE PER MONTH:

Monthly service charge of $275.00; plus

Demand Charge of

$18.00 per kilowatt for the first 1,000 kilowatts,

plus

$17.50 per kilowatt for the excess; plus

Energy Charge of

3.85 cents per kilowatt-hour.

* * * * * * * * * *

PRIMARY DEMAND RATE - continued

POWER SUPPLY COST RECOVERY FACTOR:

See Memorandum - PSCRF.

BILLING DEMAND:

The Billing Demand shall be the highest of either:

1) the single highest one-hour integrated demand reading occurring during the billing period;
2) the Minimum Demand (The Minimum Demand is 65% of the highest Billing Demand occurring in the previous eleven (11) months, but not less than 60 kilowatts.);
or
3) 60 kilowatts.

MINIMUM BILLING:

The minimum billing is the Minimum Demand charge plus the Monthly Service Charge.

BILLING PERIOD:

Billings will be rendered monthly.

POWER FACTOR:

This rate is based on the customer maintaining a power factor not less than 80% lagging. A penalty for a power factor less than 80% shall be assessed against the customer's bill according to the following table:

* * * * * * * * * *

PRIMARY DEMAND RATE - continued

Power Factor	Penalty
0.750 to 0.799	2%
0.749 to 0.700	5%

Power factors less than 0.700 are not permitted. The customer will install necessary corrective equipment to improve the power factor to at least 0.700. A 25% penalty will be applied to any billing after two consecutive months below 0.700 power factor and will continue as long as the power factor remains below 0.700.

TAXES:

Any taxes applicable at the time the billing is rendered will be charged and collected by the Public Lighting Department.

SPECIAL CONDITIONS AND ARRANGEMENTS:

Special conditions and/or arrangements by the Department and the customer may be required for an unusual size or type of load.

When service is supplied at the primary voltage and metered at a secondary voltage or vise-versa, all measured kilowatts and kilowatt-hours shall be adjusted to account for transformer losses.

TERM OF AGREEMENT:

Any agreement between the Public Lighting Department and the customer purchasing electric power under this rate shall be in effect for at least two (2) years after making such agreement.

* * * * * * * * * *

(6)

PRIMARY DEMAND RATE - continued

Said agreement shall continue thereafter until modified by mutual consent. The Department will need at least thirty (30) days written notice to implement any change

Application for service shall be made by letter. An agreement for service should be signed prior to delivery of service. The receipt of electrical service shall constitute an agreement between the customer and the Public Lighting Department until such time as a written agreement is signed.

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Appendix D
Billing Information

Appendix D-1	Wastewater Treatment Plant
Appendix D-2	Clintondale Wastewater Pumping Station
Appendix D-3	Conner Wastewater Pumping Station
Appendix D-4	Oakwood Wastewater Pumping Station
Appendix D-5	Central Services Building

Appendix D-1
Wastewater Treatment Plant

DETROIT EDISON
C2000 Information Warehouse
Billing History Report

Customer 2000

09-17-1998

03:26:38 PM

User: E43142

Module: IWHRW010

Service Information

Customer Name: City Of Detroit

Service Name: Wtr Dept Wastewater Plt

OIL Provider Address: 9300 W Jefferson

Detroit

OIL ID: 164

Rate Code: 254

Current Rep Number: 31869

Current Rep Name: Clapper,J Lloyd

Billing Year	Billing Month	Nbr Days	Highest Demand	On Peak Demand	Billing Demand	Power Factor	Total KWH	Percent On Peak	Bill W/O Tax	Hours Used	Cost Per KWH
1998	8	30	33,197	30,946	30,946	0.8881	20,869,080	24.216	943,479.62	674	0.0452
	7	33	32,458	31,013	31,013	0.8880	22,678,560	21.995	966,789.89	731	0.0426
	6	30	34,238	33,802	33,802	0.8974	20,387,640	23.292	993,988.09	603	0.0488
	5	28	29,232	26,678	26,678	0.8625	16,901,880	23.570	804,257.66	634	0.0476
	4	33	28,728	28,291	28,291	0.8684	20,889,480	22.209	736,823.21	738	0.0353
	3	29	27,686	27,451	27,451	0.8680	18,111,480	23.856	835,597.28	660	0.0461
	2	28	32,424	32,390	32,390	0.8935	19,360,080	23.608	950,765.57	598	0.0491
	1	35	31,147	31,114	31,114	0.8942	24,058,800	21.753	984,693.65	773	0.0409
1997	12	29	30,776	29,770	29,770	0.8859	19,137,600	22.536	910,179.91	643	0.0476
	11	29	30,876	30,475	30,475	0.8842	18,738,000	23.777	920,154.91	615	0.0491
	10	32	33,062	30,442	30,442	0.8970	20,992,800	22.422	949,624.35	690	0.0452
	9	30	30,876	30,442	30,442	0.8983	18,685,200	23.093	918,383.61	614	0.0492
	8	30	30,845	30,509	30,509	0.9019	20,292,000	23.998	942,326.44	665	0.0464
	7	32	30,811	30,811	30,811	0.8897	20,893,200	21.679	955,199.93	678	0.0457
	6	30	31,853	31,718	31,718	0.8779	18,441,600	23.292	940,760.42	581	0.0510
	5	32	25,771	25,670	25,670	0.8652	18,243,600	22.422	816,182.93	711	0.0447
	4	29	27,518	27,384	27,384	0.8713	17,466,800	22.686	840,379.57	639	0.0481
	3	28	32,424	32,424	32,424	0.8772	17,692,800	23.880	944,963.07	546	0.0534
	2	33	32,390	31,651	31,651	0.8940	22,909,200	22.792	1,000,399.71	724	0.0437
	1	31	33,432	33,398	33,398	0.9043	21,445,200	22.371	1,015,116.88	642	0.0473
	OIL Totals:		619,750	606,379	606,379		398,217,000		18,370,066.70	13,158	
	OIL Monthly Averages:		30,988	30,319	30,319		19,910,850		918,503.34	657	0.0461
	Monthly Maximum:		34,238	33,802							

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Catalog Description: C2000 Information Warehouse

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Appendix D-2
Clintondale Wastewater Pumping Station

DETROIT EDISON
C2000 Information Warehouse
Billing History Report

09-10-1998

08:47:21 AM

User: E43142

Module: IWHRW020

Service Information

Customer Name: City Of Detroit

Service Name: Wtr Dept Clintondale

OIL Provider Address: 35029 Union Lake Rd

Mt Clemens

OIL ID: 147

Rate Code: 220

Current Rep Number: 31869

Current Rep Name: ClapperJ Lloyd

Billing Year	Billing Month	Nbr Days	Highest Demand	On Peak Demand	Billing Demand	Power Factor	Total KWH	Percent On Peak	Bill W/O Tax	Hours Used	Cost Per KWH
1998	9	29	641	353	353	0.8471	132,640	26.199	11,286.48	376	0.0851
	8	33	340	337	337	0.8301	128,640	18.996	10,930.54	382	0.0850
		33	340	337	337	0.8301	128,640	18.996	10,927.41	382	0.0849
	7	30	340	337	337	0.8388	115,840	25.864	10,634.52	344	0.0918
		30	340	337	337	0.8388	115,840	25.864	10,631.94	344	0.0918
	6	31	360	351	351	0.8362	129,280	16.757	11,136.11	368	0.0861
	5	30	546	339	443	0.8403	128,960	24.045	12,488.62	291	0.0968
	4	30	641	641	641	0.8553	155,840	25.432	14,755.23	243	0.0947
	3	28	684	684	684	0.8622	141,600	25.461	16,136.99	207	0.1140
	2	31	346	344	443	0.8460	132,000	25.180	12,570.24	298	0.0952
	1	32	333	275	443	0.8474	135,360	26.284	12,649.45	306	0.0935
1997	12	28	353	343	443	0.8480	102,400	21.336	11,894.40	231	0.1162
	11	33	346	343	443	0.8390	118,400	23.928	12,327.16	267	0.1041
	10	29	340	337	443	0.8357	112,000	24.519	12,159.84	253	0.1086
	9	32	360	344	443	0.8368	129,600	21.042	12,603.40	293	0.0972
	8	31	354	339	443	0.8368	129,600	26.438	12,623.87	293	0.0974
	7	29	351	342	443	0.8401	126,400	23.690	12,530.63	285	0.0991
	6	32	690	682	682	0.8462	172,800	22.415	17,179.71	253	0.0994
	5	30	346	337	433	0.8256	126,400	25.631	12,394.85	292	0.0981
	4	29	648	648	648	0.8510	150,400	24.664	15,964.52	232	0.1061
	3	28	669	669	669	0.8490	156,800	24.418	16,588.41	234	0.1058
	2	33	375	372	433	0.8526	148,800	24.102	12,857.20	344	0.0864
	1	31	379	352	433	0.8464	142,400	26.363	12,815.42	329	0.0900
1996	12	30	692	369	433	0.8509	129,600	22.507	12,184.83	299	0.0940
	11	31	369	354	433	0.8250	116,800	26.804	11,914.65	270	0.1020

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DETRO[illegible]EDISON
C2000 Information Warehouse
Billing History Report

09-10-1998

08:47:22 AM

User: E43142

Module: IWHRW020

Service Information

Customer Name: City Of Detroit

Service Name: Wtr Dept Clintondale

OIL Provider Address: 35029 Union Lake Rd

Mt Clemens

OIL ID: 147

Rate Code: 220

Current Rep Number: 31869

Current Rep Name: Clapper,J Lloyd

Billing Year	Billing Month	Nbr Days	Highest Demand	On Peak Demand	Billing Demand	Power Factor	Total KWH	Percent On Peak	Bill W/O Tax	Hours Used	Cost Per KWH
	10	28	653	346	433	0.8267	115,200	28.851	12,230.30	266	0.1062
	9	33	454	348	433	0.8115	120,000	24.618	12,373.14	277	0.1031
	8	33	506	344	433	0.8183	134,400	28.639	12,789.37	310	0.0952
	7	28	668	666	666	0.8382	132,800	30.397	16,117.88	199	0.1214
	6	31	642	339	420	0.8389	150,400	26.125	13,038.82	358	0.0867
	5	30	646	508	508	0.8455	152,000	22.661	14,345.50	299	0.0944
	4	31	384	380	420	0.8507	142,400	28.673	12,714.14	339	0.0893
	3	29	660	381	420	0.8546	126,400	26.449	12,263.24	301	0.0970
	2	30	671	490	490	0.8498	126,400	22.038	13,373.71	258	0.1058
	1	32	372	351	420	0.7071	120,000	0.000	12,219.50	286	0.1018
1995	12	30	654	349	420	0.8455	121,600	21.813	12,174.51	290	0.1001
	OIL Totals:		17,493	14,668	16,591		4,748,640		463,826.53	10,598	
	OIL Monthly Averages:		486	407	461		131,907		12,884.07	286	0.0977
	Monthly Maximum:		692	684							

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Appendix D-3
Conner Wastewater Pumping Station

DETROIT EDISON
C2000 Information Warehouse
Billing History Report

09-10-1998

10:52:57 AM

User: E43142

Module: IWHRW020

Service Information

Customer Name: City Of Detroit

Service Name: Water Dept-Conner Stm Swg

OIL Provider Address: 12244 E Jefferson

Detroit

OIL ID: 767

Rate Code: 442

Current Rep Number: 31869

Current Rep Name: Clapper,J Lloyd

Billing Year	Billing Month	Nbr Days	Highest Demand	On Peak Demand	Billing Demand	Power Factor	Total KWH	Percent On Peak	Bill W/O Tax	Hours Used	Cost Per KWH
1998	8	32	2,246	2,246	2,246	0.9955	418,400	22.738	37,760.44	186	0.0903
	7	31	4,640	1,395	1,395	0.9986	445,600	23.358	40,036.89	319	0.0898
	6	31	2,214	1,837	1,837	0.9993	415,200	23.210	37,514.97	226	0.0904
	5	29	3,411	1,139	1,139	0.9986	301,600	21.808	28,090.95	265	0.0931
	4	31	3,718	3,622	3,622	0.9991	576,000	26.304	46,701.64	159	0.0811
	3	31	5,229	3,405	3,405	0.9966	682,400	23.615	59,681.32	200	0.0875
	2	28	5,338	5,338	5,338	0.9985	584,800	25.132	51,584.63	110	0.0882
	1	31	4,058	2,586	2,586	0.9954	496,000	25.470	44,217.97	192	0.0891
1997	12	34	1,754	1,363	1,363	0.9965	480,000	21.714	43,265.38	352	0.0901
	11	28	1,248	1,248	1,248	0.9984	280,000	24.595	26,517.66	224	0.0947
	10	30	1,850	1,325	1,325	0.9977	352,000	24.461	32,546.84	266	0.0925
	9	32	1,946	1,946	1,946	0.9984	424,000	23.341	38,576.02	218	0.0910
	8	30	3,731	1,421	1,421	0.9975	448,000	24.504	40,585.74	315	0.0906
	7	32	7,072	1,376	1,376	0.9965	480,000	21.373	43,265.38	349	0.0901
	6	29	4,678	1,728	1,728	0.9979	488,000	25.889	43,935.29	282	0.0900
	5	31	2,541	1,363	1,363	0.9983	552,000	21.851	49,294.56	405	0.0893
	4	28	1,408	1,408	1,408	0.9998	400,000	16.607	36,566.29	284	0.0914
	3	31	4,314	1,338	1,338	0.9999	568,000	15.392	50,634.37	425	0.0891
	2	29	1,338	1,210	1,210	0.9998	440,000	22.286	39,915.83	364	0.0907
	1	33	1,370	1,363	1,363	1.0000	408,000	19.934	37,236.20	299	0.0913
OIL Totals:			64,104	38,657	38,657		9,240,000		827,948.37	5,440	
OIL Monthly Averages:			3,205	1,933	1,933		462,000		41,397.42	239	0.0896
Monthly Maximum:			7,072	5,338							

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Catalog Description: C2000 Information Warehouse

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Appendix D-4
Oakwood Wastewater Pumping Station



DETROIT EDISON
C2000 Information Warehouse
Billing History Report



09-10-1998

10:52:55 AM

User: E43142

Module: IWHRW020

Service Information

Customer Name: City Of Detroit

Service Name: Water Dept

OIL Provider Address: 12330 Sanders

Detroit

OIL ID: 757 Ontwood

Rate Code: 442

Current Rep Number: 31869

Current Rep Name: Clapper,J Lloyd

Billing Year	Billing Month	Nbr Days	Highest Demand	On Peak Demand	Billing Demand	Power Factor	Total KWH	Percent On Peak	Bill W/O Tax	Hours Used	Cost Per KWH
1998	8	32	852	357	357	0.8662	49,920	23.548	5,777.89	140	0.1157
	7	31	1,492	141	141	0.8569	42,560	22.484	5,167.32	302	0.1214
	6	31	664	141	141	0.8489	41,120	23.920	5,047.87	292	0.1228
	5	29	810	189	189	0.8463	45,760	23.427	5,432.79	242	0.1187
	4	31	815	815	815	0.8632	57,440	25.104	5,987.61	70	0.1042
	3	31	1,100	200	200	0.8863	64,320	21.720	6,972.49	322	0.1084
	2	28	972	972	972	0.8839	60,480	27.733	6,653.94	62	0.1100
	1	31	540	393	393	0.8779	52,800	25.144	6,016.61	134	0.1140
1997	12	34	672	239	239	0.8729	54,400	21.801	6,192.02	228	0.1138
	11	28	196	156	156	0.8944	44,800	24.141	5,388.13	287	0.1203
	10	30	210	138	138	0.8423	40,000	25.545	4,986.18	290	0.1247
	9	32	1,225	1,225	1,225	0.8403	49,600	22.998	5,790.06	40	0.1167
	8	30	1,032	205	205	0.8222	41,600	24.858	5,120.17	203	0.1231
	7	32	1,450	1,450	1,450	0.8321	48,000	25.704	5,656.09	33	0.1178
	6	29	1,079	280	280	0.8599	51,200	24.543	5,924.06	183	0.1157
	5	31	667	513	513	0.8838	54,400	21.958	6,192.02	106	0.1138
	4	28	394	154	154	0.8890	52,800	23.023	6,058.03	343	0.1147
	3	31	1,197	320	320	0.9045	75,200	100.000	7,933.79	235	0.1055
	2	29	745	745	745	0.9033	64,000	27.103	6,995.91	86	0.1093
	1	33	228	154	154	0.8944	19,200	15.818	3,244.43	125	0.1690
	OIL Totals:		16,340	8,787	8,787		1,009,600		116,537.63	3,723	
	OIL Monthly Averages:		817	439	439		50,480		5,626.88	115	0.1154
	Monthly Maximum:		1,492	1,450							

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Appendix D-5
Central Services Building

DETROIT EDISON
C2000 Information Warehouse
Billing History Report

Customer 2000

09-10-1998

08:46:58 AM

User: E43142

Module: IWHRW020

Service Information

Customer Name: City Of Detroit

Service Name: Central Services Dwsd

OIL Provider Address: 6425 Huber

Detroit

OIL ID: 132

Rate Code: 220

Current Rep Number: 31869

Current Rep Name: Clapper,J Lloyd

Billing Year	Billing Month	Nbr Days	Highest Demand	On Peak Demand	Billing Demand	Power Factor	Total KWH	Percent On Peak	Bill W/O Tax	Hours Used	Cost Per KWH
1998	8	30	1,498	1,498	1,498	0.7666	789,920	28.460	47,930.19	527	0.0607
	7	33	1,466	1,466	1,466	0.7974	879,520	26.182	49,727.64	600	0.0565
		33	1,466	1,466	1,466	0.7974	879,520	26.182	49,688.69	600	0.0565
	6	30	1,467	1,467	1,467	0.8040	763,680	27.263	46,356.81	521	0.0607
	5	28	1,339	1,339	1,339	0.8113	717,120	27.022	43,335.29	536	0.0604
	4	33	1,452	1,449	1,449	0.8130	886,880	25.152	42,689.20	612	0.0481
	3	29	1,500	1,468	1,468	0.8187	830,400	26.616	48,042.31	566	0.0579
	2	28	1,416	1,386	1,386	0.8176	768,000	26.503	45,282.27	554	0.0590
	1	35	1,389	1,367	1,367	0.8103	924,800	24.108	46,891.84	677	0.0529
1997	12	29	1,460	1,440	1,440	0.8141	809,600	25.350	47,717.56	562	0.0589
	11	31	1,484	1,476	1,476	0.8083	865,600	24.800	49,674.20	586	0.0574
	10	30	1,346	1,346	1,346	0.8055	780,800	27.264	45,662.67	580	0.0585
	9	30	1,453	1,453	1,453	0.8052	801,600	26.461	47,724.07	552	0.0595
	8	32	1,472	1,472	1,472	0.8104	889,600	26.051	50,295.40	604	0.0565
	7	30	1,508	1,508	1,508	0.8104	721,600	29.144	46,859.55	479	0.0649
	6	32	1,399	1,394	1,394	0.8040	848,000	24.846	48,402.47	608	0.0571
	5	30	1,404	1,358	1,358	0.8087	816,000	27.137	47,111.18	601	0.0577
	4	29	1,459	1,417	1,417	0.8129	801,600	25.583	47,548.20	566	0.0593
	3	28	1,420	1,391	1,391	0.8093	740,800	26.267	45,611.86	533	0.0616
	2	33	1,261	1,238	1,238	0.8051	777,600	25.893	44,356.39	628	0.0570
	1	33	1,316	1,295	1,295	0.8070	811,200	23.380	45,987.32	626	0.0567
1996	12	29	1,359	1,331	1,331	0.8115	777,600	25.174	44,803.55	584	0.0576
	11	29	1,506	1,496	1,496	0.8113	801,600	26.373	47,903.57	536	0.0598
	10	29	1,469	1,487	1,487	0.8101	804,800	26.820	50,302.29	541	0.0625
	9	33	1,514	1,514	1,514	0.8036	491,200	27.678	53,145.15	324	0.1082

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Catalog: C:\COGNOS\CATALOGS\IWC2KPROD,

Catalog Description: C2000 Information Warehouse

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DETROIT EDISON
C2000 Information Warehouse
Billing History Report

Customer 2000

09-10-1998

08:47:00 AM

User: E43142

Module: IWHRW020

Service Information

Customer Name: City Of Detroit

Service Name: Central Services Dwsd

OIL Provider Address: 6425 Huber

Detroit

OIL ID: 132

Rate Code: 220

Current Rep Number: 31869

Current Rep Name: Clapper,J Lloyd

Billing Year	Billing Month	Nbr Days	Highest Demand	On Peak Demand	Billing Demand	Power Factor	Total KWH	Percent On Peak	Bill W/O Tax	Hours Used	Cost Per KWH
	8	29	1,604	1,604	1,604	0.8074	814,400	27.525	52,437.84	508	0.0644
	7	30	1,531	1,531	1,531	0.8094	862,400	26.210	52,691.80	563	0.0611
	6	33	1,590	1,590	1,590	0.8110	947,200	24.944	55,866.78	596	0.0590
	5	29	1,526	1,503	1,503	0.8092	817,600	26.490	51,047.80	544	0.0624
	4	32	1,581	1,548	1,548	0.8015	800,000	25.064	51,170.50	517	0.0640
	3	29	577	567	881	0.7168	294,400	27.332	27,930.07	334	0.0949
	2	28	818	802	881	0.7504	336,000	27.243	28,942.77	381	0.0861
	1	34	1,651	1,627	1,627	0.8144	472,000	26.657	56,230.62	290	0.1191
1995	12	30	1,679	1,674	1,674	0.8122	920,000	26.104	56,134.03	550	0.0610
OIL Totals:			48,400	47,968	48,361		26,243,040		1,617,501.88	18,385	
OIL Monthly Averages:			1,424	1,411	1,422		771,854		47,573.58	543	0.0616
Monthly Maximum:			1,679	1,674							

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Catalog: C:\COGNOS\CATALOGS\IWC2KPROD.

Catalog Description: C2000 Information Warehouse

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Contract CS-1272
Study and Evaluation of DWSD Electrical Utility Rates
Task 2.3 Retail Wheeling Feasibility Study Final Report
December 2000

Information from Table 4-1

Maximum Day

	Average On-Peak ($/MWh)	Average Off-Peak ($/MWh)
Jul-96	31.32	15.22
Aug-96	26.8	17.97
Jun-97	26.31	15.13
Jul-97	48.21	18.5
Aug-97	22.01	12.5
Jun-98	161.49	14.33
Average*	**30.93**	**15.86**

*Excludes June 98 on-peak volitity in average

Average Day

	Average On-Peak ($/MWh)	Average Off-Peak ($/MWh)
Sep-96	19.13	16.19
Oct-96	18.24	15.65
Nov-96	27.21	17.75
Dec-96	22.47	17.74
Jan-97	19.22	16.68
Feb-97	18.58	14.41
Mar-97	18.01	14.97
Apr-97	20.82	13.92
May-97	18.47	13.09
Sep-97	20.77	17
Oct-97	30.39	14
Nov-97	27.02	15.42
Dec-97	21.57	14.46
Jan-98	19.22	13.49
Feb-98	18.24	12.98
Mar-98	23.68	14.51
Apr-98	21.52	14.23
May-98	42.21	14.55
Average	**22.60**	**15.06**

Maximum Day Demand

Water Treatment Plants	Power Use for Month				Generation			Transmission	Distribution				Total Month Cost
	Maximum Hour kW	On-Peak (kWh)	Off-Peak (kWh)	Total (kWh)	On-Peak $0.03219 /kWh	Off-Peak $0.01651 /kWh	Total	Cost $1.355 /kW/Month	Service Charge $450 /Month	Systems Use $0.57 /kW/Month	Surcharges $0.001234 /kWh	Total	
Lake Huron	18,796	6,093,477	2,833,496	8,926,973	$196,149	$46,781	$242,930	$25,469	$450	$10,714	$11,016	$22,180	$290,578
Northeast	13600	4,520,025	1,925,930	6,445,955	$145,500	$31,797	$177,297	$18,428	$450	$7,752	$7,954	$16,156	$211,881
Southwest					0	0	0	0	450	0	0	450	450
Springwells					0	0	0	0	450	0	0	450	450
Water Works Park					0	0	0	0	450	0	0	450	450

Booster Stations	Power Use for Month				Generation			Transmission	Distribution				Total Month Cost
	Maximum Hour kW	On-Peak (kWh)	Off-Peak (kWh)	Total (kWh)	On-Peak $0.03386 /kWh	Off-Peak $0.01736 /kWh	Total	Cost $1.355 /kW/Month	Service Charge $48 /Month	Systems Use $3.42 /kW/Month	Surcharges $0.001234 /kWh	Total	
Ford	1,210	314,517	125,631	440,148	$10,650	$2,181	$12,830	$1,640	$48	$4,138	$543	$4,729	$19,199
				0	$0	$0	$0	$0	$48	$0	$0	$48	$48