



NEC Consultants (Pvt.) Ltd.

Punjab Cities Governance Improvement Project

Energy Audit & Energy Efficiency Improvement Program for WASAs in Punjab



REPORT
Disposal Pumps- East Division, Faisalabad

March 2016



THE URBAN UNIT
Urban Sector Planning & Management Services Unit (P) Ltd.
A Public Sector Company.



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March 2016

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LIST OF ACRONYMS AND ABBREVIATIONS

Bhp	Brake Horsepower
Cusec	Cubic Feet per Second
Ehp	Electrical Horsepower
Gpm	Gallon Per Minute
Hp	Horsepower
kVA	Kilo Volt Ampere
kW	Kilo Watt
kWh	Kilo Watt Hour
LESCO	Lahore Electric Supply Company
m/s	Meter Per Second
m³/hr	Cubic Meter Per Hour
MCB	Fuses or Miniature Circuit Breaker
Mm	Millimeter
MS	Mild Steel
Psig	Pound Per Square Inch (Gauge)
RPM	Revolution Per Minute
TDH	Total Dynamic Head
VFD	Variable Frequency Drive
WASA	Water and Sanitation Agency
Whp	Water Horsepower

GLOSSARY

Discharge Pressure	The pressure obtained at center line of pump discharge pipe using a calibrated gauge (psig). Discharge pressure is converted to feet and expressed as "Discharge Head".
Brake Horsepower	The output horsepower of a motor to a pump; may also be used to refer to the required input horsepower to the pump itself.
Deep Well Turbine Pump	A turbine pump installed inside a well casing below the pumping water level in the well.
Discharge Head	Head measured above center line of pump discharge pipe.
Drawdown	The measured distance that a well's water level changes from standing/static level to operating pumping level during observed test conditions.
Dynamic Head	The sum of the pressure and the pumping head developed by a pump
Friction Head	The head required to overcome the fluid friction in a pipe or water system
Friction Losses	Energy losses associated with moving water against rough surfaces. In water pumping applications, it is the water pressure lost as a result of contact between moving water and a pipeline or open channel.
GPM per Foot Drawdown	The ratio of capacity (GPM) to drawdown feet is useful in determining the well's performance.
Head	Alternate term for pressure. One pound per square inch (psi) = 2.31 feet of water head

Overall Plant or Pumping System Efficiency	The ratio of the water horsepower (the overall output of the plant) to input horsepower (the power input). The overall output can also be defined as the amount of horsepower required to deliver the measured capacity (water gallons per minute) and the measured total head.
Pumping Water Level	The well's operating water level below center line of discharge pipe as observed during test condition
Static Water Level	The well's water level obtained when pumping plant is at rest.
Suction Head	Head measured above center line of pump suction intake. Most often obtained with calibrated bourdon tube pressure gauge (suction pressure) and converted to feet by conversion factor 2.31 ft. water/psi
Suction Lift	The distance between pump discharge head and water level.
Total Head	The sum of the water head above and below the center line of the pump discharge pipe. For well applications, the Total Head is the sum of the Discharge Head and the Pumping Water Level. Total head is used in determination of water horsepower and pump performance.
Water Horsepower	The output horsepower of a water pump. It is the combination of flow rate and pressure.

1.0 Introduction

1.1 Background

Government of the Punjab, Pakistan with financial assistance from the World Bank, is implementing “Punjab Cities Governance Improvement Project (PCGIP)” for strengthening systems for improved planning, resource management, and accountability in five large cities of Punjab i.e. Lahore, Faisalabad, Multan, Gujranwala and Rawalpindi.

The project utilizes a result-based approach and, consistent with this focus, the disbursement decisions to the city and its entities are based on achievement of pre-specified results, referred to as Disbursement linked Indicators (DLIs) which reflect priority elements in furthering the Government’s urban agenda, critical at the provincial level, within the existing legislative, regulative and policy framework of the Government. DLIs includes intermediate outcomes, incremental steps and results contributing to improved efficiency, effectiveness, accountability and service delivery during and beyond the project life by building capacities, system and processes.

Disbursement Linked Indicator 4 (DLI -4) aims for improvements in own source revenue collection system that encourages the City Local Government (CDGs), Development Authorities (DAs) and Service providers (WASAs) to bring improved systems for revenue enhancement. This DLI is linked with the initiative of WASAs to carry out the Energy Audit for resources conservation and efficiency to improved service delivery, accountability and own source revenue.

One of the proposed actions & initiatives to enhance revenue was to conduct energy audit of WASAs to reduce the power cost by various systematic analysis of the energy use and finding out the energy management opportunities. WASAs each year incur significant cost. It was **Rs. 4,697 million** in 2014 year for energy/Electricity bills, with an installed capacity of approximately 131 MW for 5,663 Million Gallons per Day (water management), which can be reduced through detailed energy audit and implementing its findings.

In the context of existing scenario energy audit of WASAs is a technical and efficient way to obtain energy analysis and savings through improvements that optimize pumping systems of tube well stations and disposal stations to operate efficiently with significant cost saving.

The Urban Planning and Management Services Unit, Pvt. Ltd. has assigned NEC Consultants Pvt. Ltd to conduct energy audits of WASAs in Punjab in five major cities of Lahore, Rawalpindi, Faisalabad, Multan and Gujranwala.

This is the energy audit report of **Disposal Pumps of East Division of Faisalabad city**.

1.2 Methodology

The primary and secondary sources were used to collect data for different WASAs and pumps installed there. The Urban Unit provided information and contact detail of all the WASAs. An energy audit report template was developed to collect field data from each WASA subdivision. Prior to start the on field measurements of each subdivision, meetings were conducted with the respective WASA management and briefed them about the activity. The technical team then collected data by on field measurements of each pump and recorded in their energy audit report template. On the basis of this energy audit report template, The Urban Unit also developed Android based software to record data of each pump online. This data was also recorded on line in this Android based application.

On the basis of field measurements, efficiency of the pumping system was calculated and energy efficiency opportunities were identified.

1.3 Scope

The scope of the this assignment is to conduct energy audits of about 1,600 fresh water supply and wastewater disposal pumps installed at different WASA stations in five major cities of Lahore, Rawalpindi, Multan, Faisalabad and Gujranwala. The detail of these pumps is given in Table-1.

Table-1: Detail of WASAs Pumps

WASA	Population Served (Million)	Total Water Connections	Total Sewerage Connections	Total Supply Stations	Total Disposal Stations	Total No. of Pump Sets
WASA Lahore	5.48	587,595	583,532	491	99	776
WASA Gujranwala	0.54	29,375	97,236	66	23	112
WASA Faisalabad	1.55	110,452	217,002	87	43	222
WASA Multan	1.2	43,996	175,615	102	21	161
WASA Rawalpindi	1.17	92,468	38,437	362	-	362
Total	9.94	863,886	1,111,822	1,108	186	1,633

The efficiency of each pumping system was evaluated and energy efficiency improvement opportunities were identified for those pumping systems whose efficiencies were not at required level. The detail of reports prepared is as under:

- The energy audit report of each pump was prepared.
- On the basis of each pump report, summary report of findings of each WASA subdivision/zonewas prepared.
- On the basis of each subdivision/zone summary report, one consolidated report of each city for energy efficiency improvement opportunities of the WASAs was prepared.

2.0 Energy Audit Findings

There are 38 WASA wastewater disposal pumps in East Division of Faisalabad city. The detail of these stations along with pumps installed capacity and actual discharge is given in Table-2:

Table-2: Detail of Disposal Pumps of East Division

#	WASA Station	No. of Wastewater Disposal Pumps Installed	Installed Capacity (Cusec)	Actual Discharge (Cusec)
1	Abdullah Pur Pump-01	01	4.0	3.18
2	Abdullah Pur Pump-03	01	6.0	5.04
3	Ahmed Nagar Small Disposal	01	0.66	1.63
4	Ahmed Nagar PS-36 Pump-01	01	25.0	17.45
5	Ahmed Nagar PS-36 Pump-02	01	25.0	17.56
6	Ahmed Nagar PS-36 Pump-03	01	25.0	13.01
7	Ahmed Nagar PS-36 Pump-04	01	15.0	12.11
8	Al Masoom Town Pump-41	01	1.0	0.76
9	Al Masoom Town Pump-42	01	1.0	0.78
10	Central Jail Disposal Pump-34	01	1.0	1.26
11	D- Type Disposal Pump-18	01	6.0	3.58
12	DawoodChowk Pump-01	01	4.0	2.79
13	DawoodChowk Pump-02	01	6.0	5.05
14	Elahi Abad Old Pump-02	01	6.0	4.31
15	Elahi Abad Old Pump-126	01	6.0	5.0
16	Elahi Abad Old Pump-128	01	4.0	2.79
17	Elahi Abad Old Pump-129	01	6.0	3.68
18	Gulshan-e-Iqbal	01	2.0	1.56
19	IllahiAbabNew Pump-01	01	6.0	2.50
20	IllahiAbab New Pump-127	01	4.0	4.01
21	IllahiAbab New Pump-130	01	6.0	4.75
22	Jhumra Road Pump-01	01	1.0	0.83
23	Jumna Road Pump-02	01	1.0	1.71
24	Mansoor Abad Pump-01	01	6.0	8.33
25	Mansoor Abad Pump-02	01	6.0	5.39
26	Mansoor Abad Pump-03	01	4.0	2.79
27	Samanabad PS34 Pump-02	01	6.0	2.45
28	Samanabad PS34 Pump-05	01	4.0	3.48
29	Satiana Road PS42 Pump-01	01	15.0	16.42
30	Satiana Road PS31 Pump-01	01	25.0	18.49
31	Satiana Road PS42 Pump-02	01	15.0	15.51
32	Satiana Road PS31 Pump-02	01	25.0	19.99
33	Satiana Road PS31 Pump-03	01	25.0	17.99
34	Satiana Road PS31 Pump-04	01	25.0	17.49
35	Satiana Road PS42 Pump-06	01	15.0	16.22
36	Sir Syed Town Novalty Pull	01	0.50	0.63
37	Sharif Pura Pump-01	01	4.0	3.72
38	Sharif Pura Pump-02	01	4.0	3.67
Total		38	341.16	267.91

The installed capacity of WASA disposal pumps of East Zone of Faisalabad city is 152.41 million m³ per annum whereas actual discharge is 119.69 million m³ per annum, for average 12 hours

per day operation and 365 days per year. This actual discharge is about 21% lesser than the installed capacity.

2.1 Pumping System Efficiency

Pumping plant performance can be classified as “Low”, “Fair”, “Good”, or “Excellent” by referring to the following table, which is based upon the results of thousands of pump tests conducted by Pacific Gas & Electric Company, USA. This classification is used to categorize WASA pumps.

Table-3: Typical Overall Pumping System Efficiency Classification

Motor HP	Low	Fair	Good	Excellent
3-7.5	<44.0	44-49.9	50-54.9	>54.9
10	<46.0	46-52.9	53-57.9	>57.9
15	<47.1	48-53.9	54-59.9	>59.9
20-25	<48.0	50-56.9	57-60.9	>60.9
30-50	<52.1	52.1-58.9	59-61.9	>61.9
60-75	<56.0	56-60.9	61-65.9	>65.9
100	<57.3	57.3-62.9	63-66.9	>66.9
150	<58.1	58.1-63.4	63.5-68.9	>68.9
200	<59.1	59.1-63.8	63.9-69.4	>69.4
250	<59.1	59.1-63.8	63.9-69.4	>69.4
300	<60	60-64.0	64.1-69.9	>69.9

Source: Pacific Gas & Electric Company, USA

The detail of pumping system efficiency and motor loading of each WASA station is given in Table-4. The calculations for the efficiency determination are given in the energy audit report of each pump in **Annexure-1**.

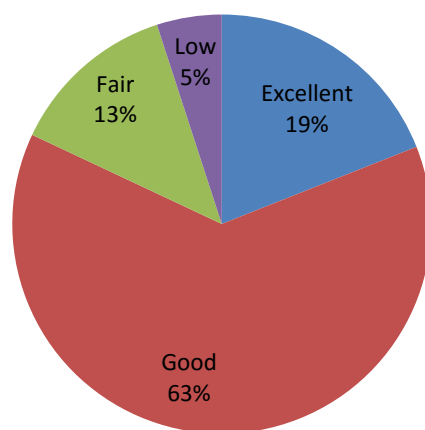
Table-4: Detail of Motor Loading and Pumping System Efficiency

WASA Station	Motor Load (%)	Pumping System Efficiency (%)	Pumping System Efficiency Rating
Ahmed Nagar PS-36 Pump-01	74	84	EXCELLENT
Ahmed Nagar PS-36 Pump-02	76	83	EXCELLENT
Elahi Abad Old Pump-02	66	71	EXCELLENT
Elahi Abad Old Pump-126	73	87	EXCELLENT
Elahi Abad Old Pump-129	71	85	EXCELLENT
IllahiAbabNew Pump-01	32	77	EXCELLENT
IllahiAbab New Pump-127	76	79	EXCELLENT
D- Type Disposal Pump-18	37	61	GOOD
Abdullah Pur Pump-01	74	60	GOOD
Abdullah Pur Pump-03	86	61	GOOD
Ahmed Nagar Small Disposal	88	60	GOOD
Al Masoom Town Pump-41	42	54	GOOD
Al Masoom Town Pump-42	45	55	GOOD
Dawood Chowk Pump-01	58	59	GOOD
Dawood Chowk Pump-02	76	61	GOOD
Jhumra Road Pump-01	55	58	GOOD
Mansoor Abad Pump-02	76	61	GOOD
Mansoor Abad Pump-03	71	61	GOOD
Samanabad PS34 Pump-05	85	59	GOOD

Satiana Road PS31 Pump-01	74	63	GOOD
Satiana Road PS31 Pump-02	80	63	GOOD
Satiana Road PS31 Pump-03	72	64	GOOD
Satiana Road PS31 Pump-04	70	64	GOOD
Jhumra Road Pump-02	79	59	GOOD
Mansoor Abad Pump-01	69	63	GOOD
Satiana Road PS42 Pump-02	83	64	GOOD
Satiana Road PS42 Pump-06	81	64	GOOD
Sir Syed Town Novalty Pull	71	51	GOOD
Satiana Road PS42 Pump-01	86	63	GOOD
Sharif Pura Pump-01	88	59	GOOD
Sharif Pura Pump-02	76	59	GOOD
Ahmed Nagar PS-36 Pump-03	76	57	FAIR
Ahmed Nagar PS-36 Pump-04	74	53	FAIR
Central Jail Disposal Pump-34	80	52	FAIR
Elahi Abad Old Pump-128	69	54	FAIR
IllahiAbab New Pump-130	69	50	FAIR
Gulshan-e-Iqbal	59	17	LOW
Samanabad PS34 Pump-02	55	24	LOW

About 82% of the disposal pumps are under excellent and good category of pumping system efficiency whereas 18% are under fair and low category as illustrated in Fig-1.

Figure-1: Pumping System Efficiency Category



2.2 Electricity Consumption Trend

The detail of annual water discharge and correspondingly electricity consumption and unit electricity consumption of each WASA disposal pumps is given in Table-5.

Table-5: Detail of Water Discharge and Electricity Consumption

#	WASA Station	Annual Water	Annual Electricity	Unit Electricity
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		Discharge (m ³)	Consumption (kWh)	Consumption (kWh/m ³)
1	Abdullah Pur Pump-01	2,372,500	202,805	0.09
2	Abdullah Pur Pump-03	1,503,800	141,107	0.09
3	Ahmed Nagar Small Disposal	365,730	43,301	0.12
4	Ahmed Nagar PS-36 Pump-01	10,395,200	389,464	0.04
5	Ahmed Nagar PS-36 Pump-02	10,465,280	397,292	0.04
6	Ahmed Nagar PS-36 Pump-03	7,755,520	397,292	0.05
7	Ahmed Nagar PS-36 Pump-04	7,218,240	389,464	0.05
8	Al Masoom Town Pump-41	170,820	10,275	0.06
9	Al Masoom Town Pump-42	175,200	11,009	0.06
10	Central Jail Disposal Pump-34	376,680	35,228	0.09
11	D- Type Disposal Pump-18	799,350	45,356	0.06
12	DawoodChowk Pump-01	1,872,450	142,673	0.08
13	DawoodChowk Pump-02	3,383,550	282,484	0.08
14	Elahi Abad Old Pump-02	2,569,600	115,469	0.04
15	Elahi Abad Old Pump-126	2,979,568	238,767	0.08
16	Elahi Abad Old Pump-128	1,664,400	150,697	0.09
17	Elahi Abad Old Pump-129	2,192,920	156,568	0.07
18	Gulshan-e-Iqbal	1,051,200	115,812	0.11
19	IllahiAbabNew Pump-01	1,401,600	66,052	0.05
20	IllahiAbab New Pump-127	2,244,750	155,957	0.07
21	IllahiAbab New Pump-130	2,655,375	212,835	0.08
22	Jhumra Road Pump-01	310,250	29,846	0.10
23	Jhumra Road Pump-02	638,750	64,633	0.10
24	Mansoor Abad Pump-01	6,205,000	281,334	0.05
25	Mansoor Abad Pump-02	4,015,000	311,424	0.08
26	Mansoor Abad Pump-03	2,080,500	232,895	0.11
27	Samanabad PS34 Pump-02	456,250	30,029	0.07
28	Samanabad PS34 Pump-05	7,336,500	321,895	0.04
29	Satiana Road PS31 Pump-01	8,260,680	291,804	0.04
30	Satiana Road PS31 Pump-02	8,930,820	317,932	0.04
31	Satiana Road PS31 Pump-03	8,037,300	286,227	0.04
32	Satiana Road PS31 Pump-04	7,813,920	276,979	0.04
33	Satiana Road PS42 Pump-06	7,248,900	303,547	0.04
34	Satiana Road PS42 Pump-02	6,933,540	312,207	0.05
35	Sir Syed Town Novalty Pull	237,250	9,663	0.04
36	Satiana Road PS42 Pump-01	7,336,500	321,895	0.04
37	Sharif Pura Pump-01	1,109,600	96,877	0.09
38	Sharif Pura Pump-02	1,095,000	83,177	0.08
	Total	141,659,493	7,272,271	0.07

Total annual energy cost of East Zone disposal pumps is about Rs. 95 million. The unit electricity consumption trend for each WASA disposal pump is illustrated in Fig-2 & 3.

Figure-2: Unit Electricity Consumption Trend

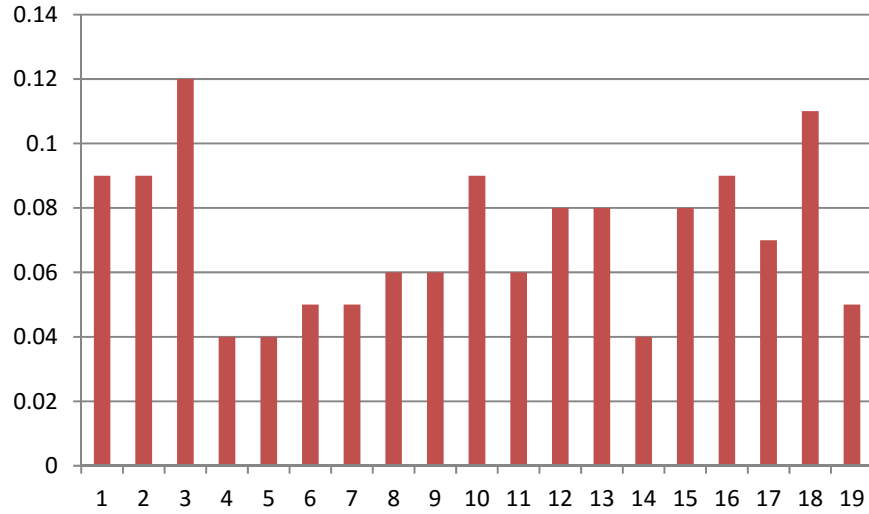
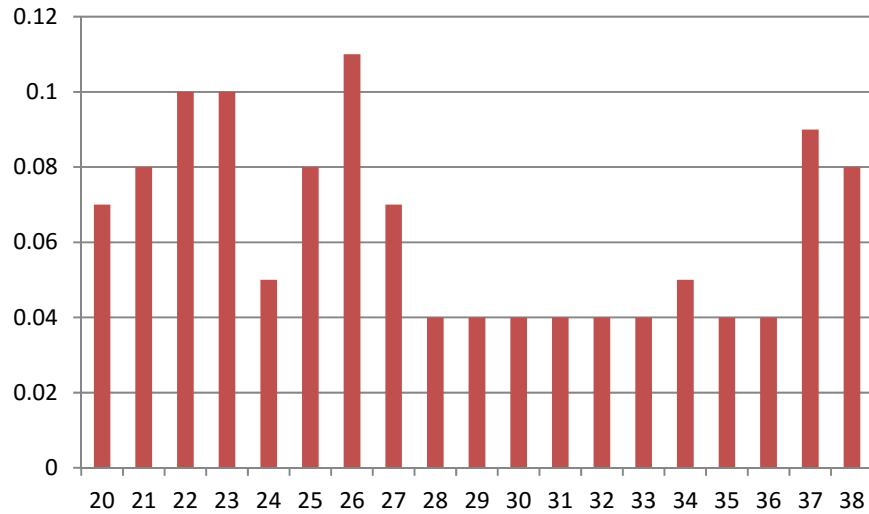


Figure-3: Unit Electricity Consumption Trend



2.3 Pumping System Efficiency Improvement Potential

The 07 disposal pumps having system efficiency in the category of FAIR to LOW, as given in Table-4, have the potential of efficiency improvement into the GOOD category. Table-6 gives detail of this efficiency improvement potential.

Table-6: System Energy Efficiency Potential of Pumps

WASA Station	Existing Pumping Efficiency (%)	Improved Pumping Efficiency (%)	Annual Saving (kWh)	Saving (Rs)	Imp .Adj	Rep & Main	Intervention	
							Motor Repl.	Pump Repl.
Ahmed Nagar PS-36 Pump-03	57	61	28,879	375,421	x			
Ahmed Nagar PS-36 Pump-04	53	61	51,507	669,595	x			
Central Jail Disposal Pump-34	52	61	5,180	67,340	x			
Elahi Abad Old Pump-128	54	59	11,530	149,889	x			
Gulshan-e-Iqbal	17	59	83,240	1,082,116				x
IllahiAbab New Pump-130	50	59	31,134	404,737	x			
Samanabad PS34 Pump-02	24	59	18,042	234,547	x	x		
Total			229,512	2,983,645				

2.4 Interventions for the Improvement of WASA Disposal Pumps

Energy audit activity of East Zone revealed that there are certain areas of electrical, mechanical and housekeeping which needs improvement. Table-7A & B presents detail of interventions and investment requirement in each WASA disposal pump for better, efficient and safe operation of WASA station.

About Rs. 25.57 million are required to improve WASA disposal pumps of East Zone of Faisalabad city.

Table-7A: Interventions & Investment Required in WASA Stations-East Division Disposal Pumps

WASA Interventions														
Interventions	Abdullah Pur Pump-01	Abdullah Pur Pump-03	Ahmed Nagar Small Disposal	Ahmed Nagar PS-36 Pump-01	Ahmed Nagar PS-36 Pump-02	Ahmed Nagar PS-36 Pump-03	Ahmed Nagar PS-36 Pump-04	Al Masoom Town Pump-41	Al Masoom Town Pump-42	Central Jail Disposal Pump-34	D- Type Disposal Pump-18	Dawood Chowk Pump-01	Dawood Chowk Pump-02	Elahi Abad Old Pump-02
Electrical														
Install VFD	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Install hour meter	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Replace ampere meter	x	x	x					x	x	x	x	x	x	x
Replace volt meter	x	x	x		x	x	x	x	x	x	x	x	x	x
Replace over current relays	x							x	x	x		x	x	x
Replace over voltage relay	x							x	x	x		x	x	x
Install/maintain PFI plant			x					x	x	x				
Install/connect capacitors at PFI plant														
Install PFI control/relay														
Install/replace motor terminal box /Improve open and loose motor connection														
Improve panel condition	x	x						x	x	x				x
Improve wiring condition	x	x						x	x	x				x
Relocate panel away from bore hole														
Replace electrical motor														
Install fan in the panel	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Replace PFI HRC fuses														
Replace PFI display meter	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Correct date & time of electrical meter														
Replace/correct electrical meter														
Replace change over														

WASA Interventions														
Interventions	Abdullah Pur Pump-01	Abdullah Pur Pump-03	Ahmed Nagar Small Disposal	Ahmed Nagar PS-36 Pump-01	Ahmed Nagar PS-36 Pump-02	Ahmed Nagar PS-36 Pump-03	Ahmed Nagar PS-36 Pump-04	Al Masoom Town Pump-41	Al Masoom Town Pump-42	Central Jail Disposal Pump-34	D-Type Disposal Pump-18	Dawood Chowk Pump-01	Dawood Chowk Pump-02	Elahi Abad Old Pump-02
Replace main circuit breaker														
Mechanical														
Replace damaged/install new flow meter	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Replace damaged/install new digital pressure gauge	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Control gland leakage														
Make operational/install new chlorinator														
Maintain ratchet plate										x				
Adjust impeller														
Repair & maintenance of pump														
Replace existing pumping system														
Maintain/install new non return valve														
Housekeeping														
Improve general housekeeping	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Install shades on motor & pump														
Rain protection of motor & pump														
Fix panel properly														
Proper support of discharge pipeline														
Maintain monthly record of fuel consumption	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Station Wise Investment (M. Rs)	0.53	0.59	0.55	0.56	0.56	0.64	0.64	0.45	0.45	0.54	0.86	0.55	0.86	0.98
Annual Saving (M. Rs)	0.00	0.00	0.00	0.00	0.00	0.38	0.67	0.00	0.00	0.07	0.00	0.00	0.00	0.00
Payback (Year)	0.00	0.00	0.00	0.00	0.00	1.71	0.96	0.00	0.00	7.99	0.00	0.00	0.00	0.00

Table-7B: Interventions & Investment Required in WASA Stations-East Division Disposal Pumps

WASA Interventions														
Interventions	Elahi Abad Old Pump-126	Elahi Abad Old Pump-128	Elahi Abad Old Pump-129	Gulshan-e-Iqbal	IllahiAb abNew Pump-01	IllahiAb ab New Pump-127	IllahiAb ab New Pump-130	Jhumra Road Pump-01	Jumna Road Pump-02	Mansoor Abad Pump-01	Mansoor Abad Pump-02	Mansoor Abad Pump-03	Samana bad PS34 Pump-02	Samana bad PS34 Pump-05
Electrical														
Install VFD	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Install hour meter	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Replace ampere meter		x						x	x			x	x	x
Replace volt meter		x	x	x				x	x				x	x
Replace over current relays				x				x	x	x	x	x	x	
Replace over voltage relay				x				x	x	x	x	x	x	
Install/maintain PFI plant														
Install/connect capacitors at PFI plant														
Install PFI control/relay														
Install/replace motor terminal box /Improve open and loose motor connection														
Improve panel condition	x	x	x	x				x	x	x	x	x	x	x
Improve wiring condition	x	x	x	x				x	x	x	x	x	x	x
Relocate panel away from bore hole														
Replace electrical motor														
Install fan in the panel	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Replace PFI HRC fuses														
Replace PFI display meter	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Correct date & time of electrical meter														
Replace/correct electrical meter														
Replace change over														
Replace main circuit breaker														

WASA Interventions														
Interventions	Elahi Abad Old Pump-126	Elahi Abad Old Pump-128	Elahi Abad Old Pump-129	Gulshan-e-Iqbal	IllahiAb abNew Pump-01	IllahiAb ab New Pump-127	IllahiAb ab New Pump-130	Jhumra Road Pump-01	Jumna Road Pump-02	Mansoor Abad Pump-01	Mansoor Abad Pump-02	Mansoor Abad Pump-03	Samana bad PS34 Pump-02	Samana bad PS34 Pump-05
Mechanical														
Replace damaged/install new flow meter	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Replace damaged/install new digital pressure gauge	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Control gland leakage														
Make operational/install new chlorinator														
Maintain ratchet plate														
Adjust impeller		x											x	
Repair & maintenance of pump													x	
Replace existing pumping system														
Maintain/install new non return valve														
Housekeeping														
Improve general housekeeping	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Install shades on motor & pump														
Rain protection of motor & pump														
Fix panel properly														
Proper support of discharge pipeline														
Maintain monthly record of fuel consumption	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Station Wise Investment (M. Rs)	1.08	1.06	0.98	1.13	0.58	0.58	0.58	0.56	0.56	0.58	0.58	0.58	0.83	0.55
Annual Saving (M. Rs)	0.00	0.15	0.00	1.08	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.23	0.00
Payback (Year)	0.00	7.07	0.00	1.04	0.00	0.00	1.44	0.00	0.00	0.00	0.00	0.00	3.53	0.00

Table-7C: Interventions & Investment Required in WASA Stations-East Division Disposal Pumps

WASA Interventions														
Interventions	Satian a Road PS42 Pump- 01	Satiana Road PS31 Pump- 01	Satiana Road PS42 Pump- 02	Satiana Road PS31 Pump- 02	Satiana Road PS31 Pump- 03	Satiana Road PS31 Pump- 04	Satiana Road PS42 Pump- 06	Sir Syed Town Novalty Pull	Sharif Pura Pump- 01	Sharif Pura Pump- 02				
Electrical														
Install VFD	x	x	x	x	x	x	x	x	x	x				
Install hour meter	x	x	x	x	x	x	x	x	x	x				
Replace ampere meter			x					x	x	x				
Replace volt meter			x					x		x				
Replace over current relays			x											
Replace over voltage relay			x											
Install/maintain PFI plant			x				x	x						
Install/connect capacitors at PFI plant														
Install PFI control/relay														
Install/replace motor terminal box /Improve open and loose motor connection														
Improve panel condition								x	x	x				
Improve wiring condition								x	x	x				
Replace de-rated capacitors														
Relocate panel away from bore hole														
Replace electrical motor														
Install fan in the panel	x	x	x	x	x	x	x	x	x	x				
Replace PFI HRC fuses														
Replace PFI display meter	x	x	x	x	x	x	x	x	x	x				
Correct date & time of electrical meter														
Replace/correct electrical meter														
Replace change over														

WASA Interventions														
Interventions	Satian a Road PS42 Pump- 01	Satiana Road PS31 Pump- 01	Satiana Road PS42 Pump- 02	Satiana Road PS31 Pump- 02	Satiana Road PS31 Pump- 03	Satiana Road PS31 Pump- 04	Satiana Road PS42 Pump- 06	Sir Syed Town Novalty Pull	Sharif Pura Pump- 01	Sharif Pura Pump- 02				
Replace main circuit breaker														
Mechanical														
Replace damaged/install new flow meter	x	x	x	x	x	x	x	x	x	x				
Replace damaged/install new digital pressure gauge	x	x	x	x	x	x	x	x	x	x				
Control gland leakage														
Make operational/install new chlorinator														
Maintain ratchet plate														
Adjust impeller														
Repair & maintenance of pump														
Replace existing pumping system														
Maintain/install new non return valve														
Housekeeping														
Improve general housekeeping	x	x	x	x	x	x	x	x	x	x				
Install shades on motor & pump														
Rain protection of motor & pump														
Fix panel properly														
Proper support of discharge pipeline														
Maintain monthly record of fuel consumption	x	x	x	x	x	x	x	x	x	x				
Station Wise Investment (M. Rs)	0.68	0.62	0.98	0.62	0.70	0.62	0.98	0.58	0.58	0.24				
Annual Saving (M. Rs)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Payback (Year)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Total Investment (M.Rs)=25.57														

ANNEXURE-1

Energy Audit Reports