International Workshop on Solar and Bio-Energy Systems

POTENTIAL AND PROSPECTS OF SOLAR ENERGY USE AND ENERGY EFFICIENCY IMPROVEMENT FOR WATER PUMPING SYSTEMS IN PAKISTAN

by

Mr. Shaukat Khan
Chief Executive
Waterman Consulting Engineers

Presentation

- Water Pumping Systems
- Statistics of Agricultural Tubewells
- Population and Energy Use
- Status and Trend
- Energy Efficiency Improvement Potential
- Solar Pump – HMA Pumps

Water Pumping Systems

- Agriculture – Private Farmers
- Irrigation Departments - SCARPs;
- Public Health Engineering Departments – Rural Water Supply
- WASAs (Municipalities) – Urban Water Supply

Statistics of Agricultural Tubewells (2009-10)

Category	Electric TWs (No)	Diesel TWs (No)	Total
Punjab	98,444	828,652	927,096
Sindh	31,742	63,809	95,251
KPK	11,132	3,647	14,779
Balochistan	22,330	10,709	33,039
Total	163,648	906,727	1070,375

Population and Energy Use
(Electric Power Supplies Companies – August 2011)

Category	Population (No)	Load (MW)	Avg. Load (kW/TW)
Agriculture	247,450	3,214	13.0
WASA	1,031	78	75.7
TMAs	8,960	182	20.3
PHED	3,979	79	20.0
Total	261,420	3,553	13.6

Status and Trend

Electric Tubewells

Extended load shedding, voltage fluctuations and power failures – Declining / Conversion to Diesel Tubewells

Diesel Tubewells

Higher rise in diesel prices – Compel to look for Alternate Energy Sources (Solar/Wind/Bio-mass)

Solar Energy Tubewells

Higher initial capital investment

Energy Efficiency Improvement Potential

- **Maximum Attainable Efficiencies of Electric Tubewells**
- **Energy Audit Results for CDA Pumping System**

Maximum Attainable Efficiencies

S. No.	Efficiency Component	Max. Attainable (Average)	Range
1	Motor	90	87-92
2	Pump	80	78-82
3	Transmission	99	
4	Pump-set	70	68-72
5	Piping	99	
6	Overall	70	

Energy Audit Results for CDA Pumping System (1992)

S. No.	Particulars	Unit	Average	Maximum	Minimum
1	Rated Power	kW	29.43	44.80	11.20
2	Power In	kW	20.39	52.40	5.63
3	Loading	%	69.78	140.48	26.41
4	Power Factor	Decimal	0.78	0.99	0.48
5	Discharge	L/s	20.70	55.93	3.27
6	Total Head	m	44.18	95.66	12.10
7	Power Out	kW	8.17	22.01	1.76
8	Disch. Pressure	m	28.36	75.48	0.70
9	System Pressure	m	24.31	66.34	0.70
10	Difference	m	4.05	46.65	-
11	Drawdown	m	8.00	27.50	0.30
12	Specific Drawdown	m/L/s	0.63	8.41	0.02
13	Motor Efficiency	%	83	93	71
14	Transm Efficiency	%	98	99	92
15	Pump Efficiency	%	52	82	16
16	Piping Efficiency	%	93	99	45
17	Overall Efficiency	%	40	74	12

Energy Saving Potential for CDA Pumping System (1992)

- Pumpsets : 64
- Annual Energy Use : 12 million kWh
- Annual Energy Cost : 18 million Rs (@ Rs. 1.5/kWh)
- Annual Energy Saving : 4.8 million kWh
- Annual Cost Saving : 7 million Rs
- Energy & Cost Saving : 40%
- Efficiency Improvement : 40 to 65 percent

Solar Pump – HMA Pumps
F-10 Park, Islamabad

- Pump Rated Q : 4 L/s (Submersible)
- Rated Power : 4 kW
- Total Head : 100 ft
- Panel Size : 200 W
- No. of Panels : 20
- Cost : 2.0 - 2.2 MRs (Complete Unit)

Solar Pump Videos

solar water pump at chakri m5 3 inch delivery.flv

4 inch solar water pump in soon valley.flv

Thank You