WSTA 11th Gulf Water Conference
Oman, 20-22 October, 2014

Improvement of Environmental Performance by activities related to Water Supply

Eng. D.M.P. Dissanayake
Eng. Kassim Al Jabri

Introduction

- Water is becoming scarcer, often making it more energy intensive to procure. More energy is required pump water greater distances and deeper in the ground. The burning of fossil fuel to generate the energy used to supply water affects local and global air quality. Millions of tons of CO2 are emitted every year contributing to global climate change.

Objectives of the study

- Energy is necessary for moving water through water systems, making water potable and removing waste from water. Wastage of water regularly leads to a waste of energy. Objective of the study is recognize the environmental risks from energy use in a water system and how it contribute to the global climate change due to emission of carbon dioxide

Factors that can contribute for energy wasting

- System design errors
- Equipment efficiency
- Poor machinery maintenance
- Water losses in transmission and distribution
- Consumer behavioral pattern

- Maximize in utilizing the generated power and minimizing the power wastages could result not only saving the natural gas reserves but also reduction in emitting harmful green house gases as well.(CO_2 ,CH_4, Nitrous oxide and fluorinated gases) .
- Global warming is a result of accumulating these green house gases in more quantities in the atmosphere which contribute to disrupt the eco system in the environment.

Pollutant can lead to

- Smog
- Acid rain
- Air bone particulate matter can cause respiratory problem (US EPA 2011)

Benefits of Improving Efficiency in Water facilities

- Can produce a range of environmental economic and other benefits including
  - Reduce air pollution and GHG emissions
  - Improving energy efficiency in water facilities can help reduce GHG emission by reducing consumption of fossil fuel based energy
  - Reduce the electricity demand
  - Avoid the risk of blackouts high demand
  - Helping to avoid the need to build new power plants.

Case study: Existing Status of Gubbrah Pumping Station

Pump Station	Pump Operation and Type	Year of Installation	Pump Duty Point(m3/hr@m)	Total Capacity(m3/hr)
NPS1	6 duty KSB Split case	1982	1000m3/hr@105mhead	4000 m3/hr
NPS2	6 duty KSB Split case	1991	1000m3/hr@105mhead	4000 m3/hr

A. Pumps in NPS-1

B. Pumps in NPS-2

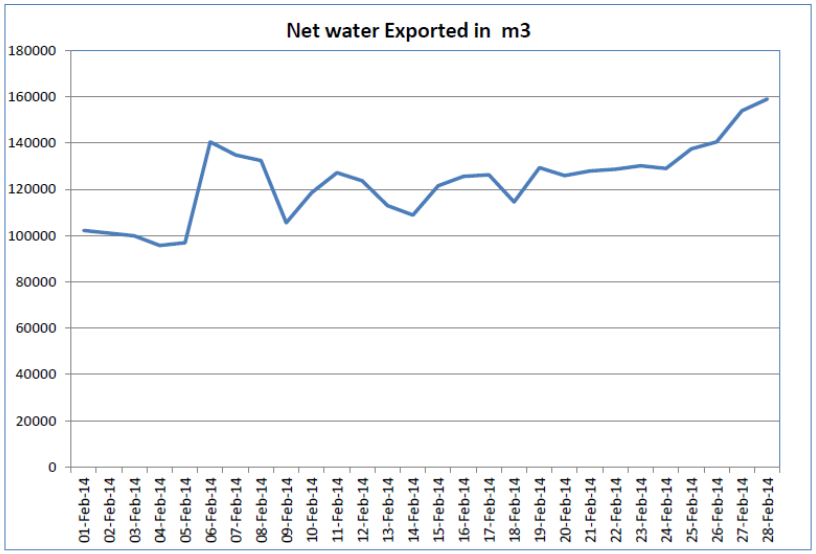


Figure No.4:- NET WATER EXPORTED TO RESERVOIR IN M^3 - FEBRUARY - 2013

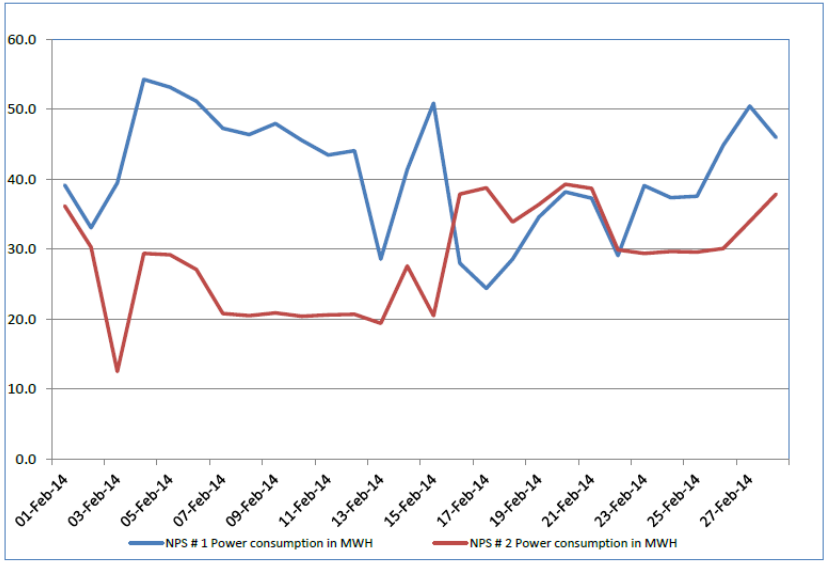
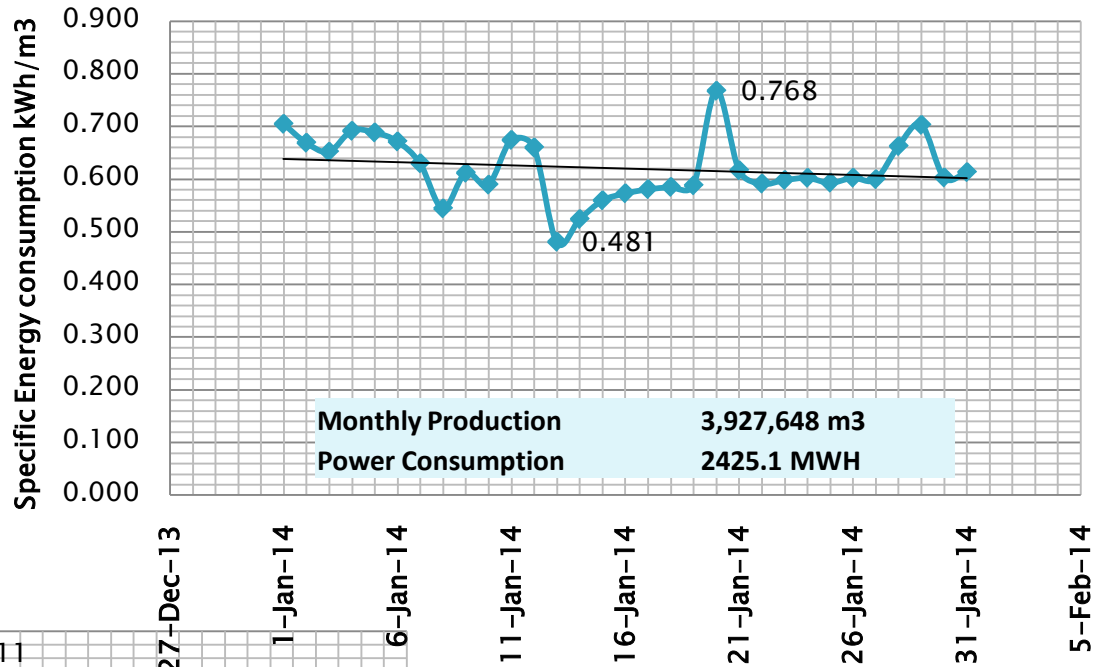
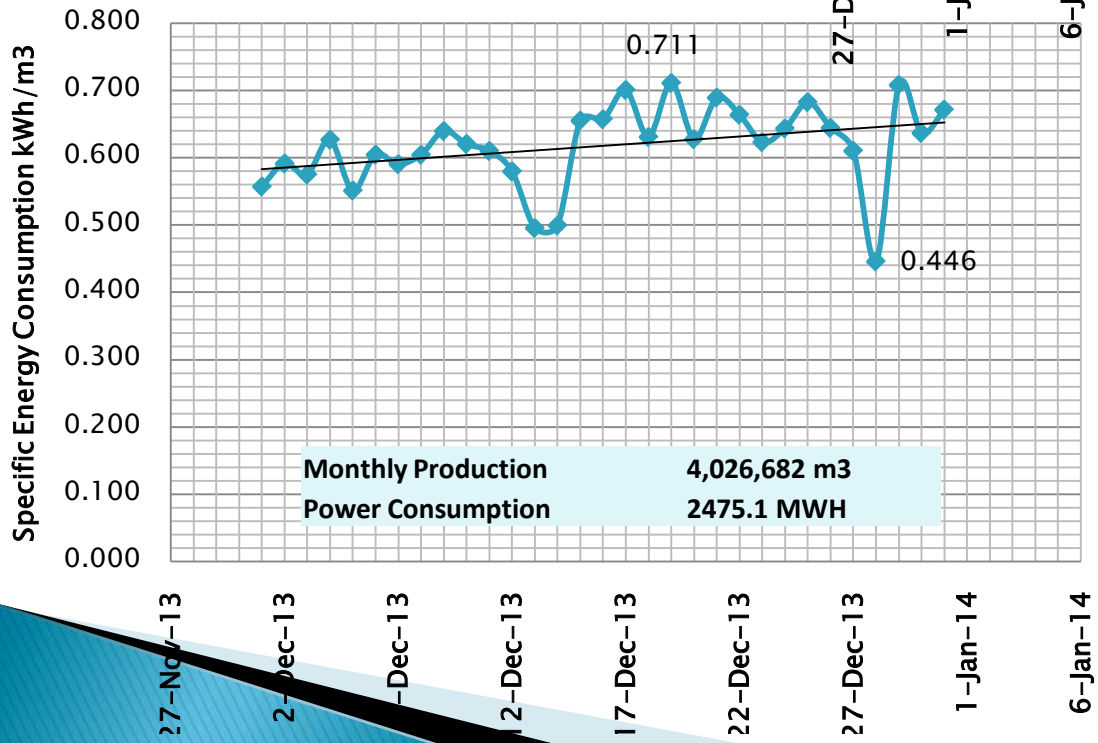


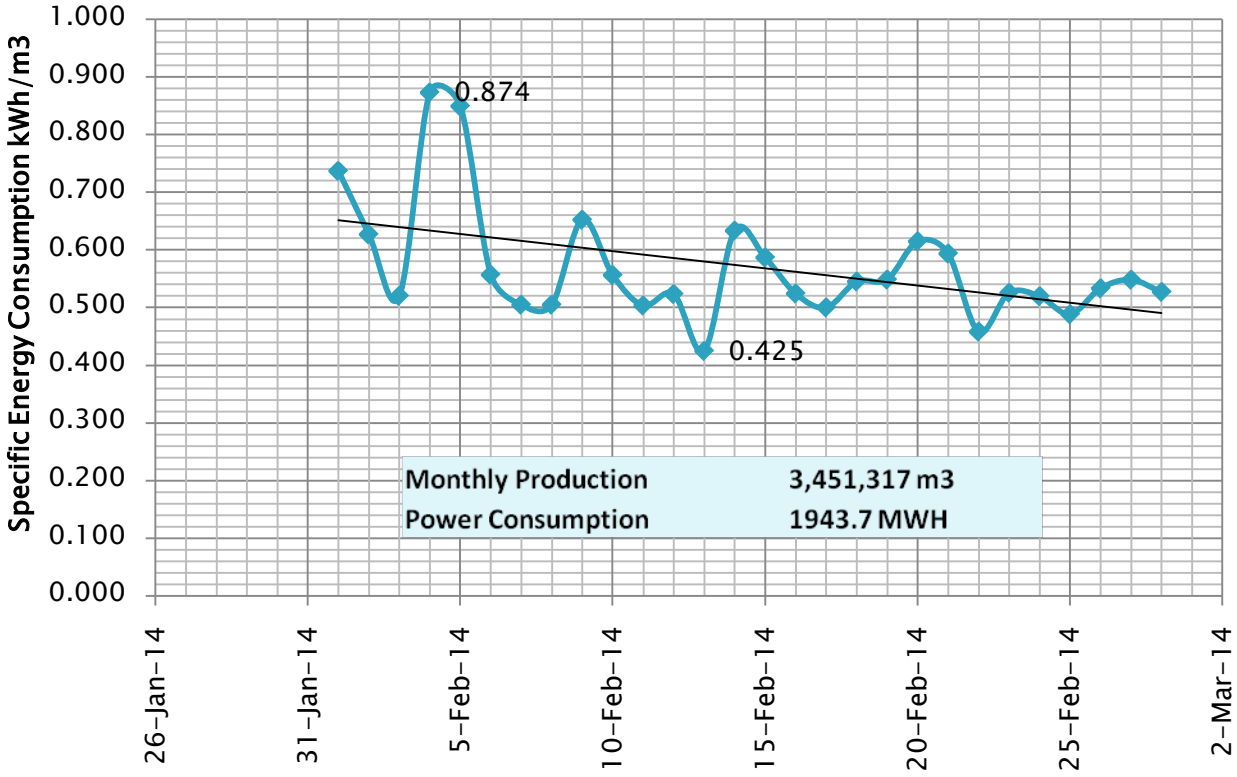
Figure No.2:- NPS # 1 & NPS # 2 POWER CONSUMPTION – FEBRUARY 2014

Water Production in February-2014

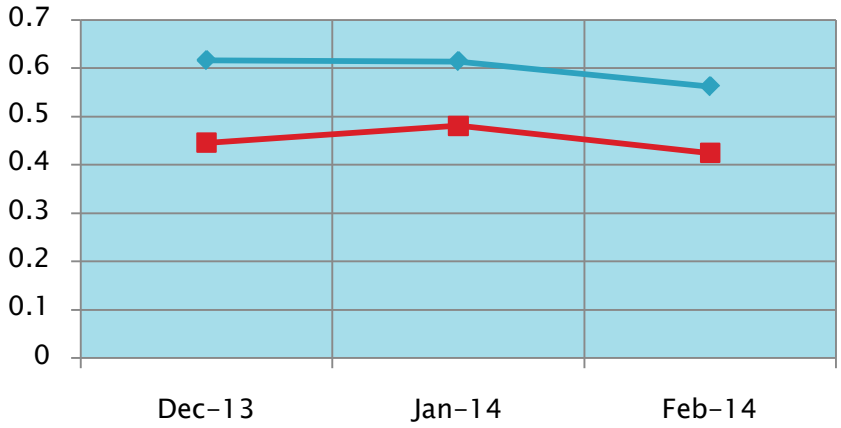
Power consumption in February-2014


Specific Energy consumption kWh/m3
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.768
0.481
Monthly Production 3,927,648 m3
Power Consumption 2425.1 MWH
27-Dec-13
1-Jan-14
6-Jan-14
11-Jan-14
16-Jan-14
21-Jan-14
26-Jan-14
31-Jan-14
5-Feb-14


Specific Energy Consumption kWh/m3
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.711
0.446
Monthly Production 4,026,682 m3
Power Consumption 2475.1 MWH
27-Dec-13
1-Jan-14
6-Jan-14


Specific Energy Consumption kWh/m3
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.874
0.425
Monthly Production 3,451,317 m3
Power Consumption 1943.7 MWH
26-Jan-14
31-Jan-14
5-Feb-14
10-Feb-14
15-Feb-14
20-Feb-14
25-Feb-14
2-Mar-14

Specific Energy Consumption (kWH/m3)



	Dec-13	Jan-14	Feb-14
Average. Specific Energy Consumption	0.617	0.615	0.563
Recorded lowest Specific Energy consumption	0.446	0.481	0.425

	Production Month	Monthly water Production m^3	Monthly Power Consumption Power MWH	Specific Energy Consumption kWh/m^3	Lowest specific energy consumption recorded	Monthly Power consumption if pumps operated at Lowest SEC
1.	December-2013	4,026,682	2475.1	0.617	0.446	1711.34
2.	January-2014	3,927,648	2451.1	0.615	0.481	1669.25
3.	February-2014	3,451,317	1943.7	0.563	0.425	1466.80

Month	Monthly Power Consumption Power MWH	Specific Energy Consumption kWh/m^3	specific energy consumption assumed can operate to kWh/m^3	Monthly Power consumption if pumps operated at assumed value MWH	Monthly Power saving MWH	Total amount of CO_2 emission due to waste of power (Tons)
December	2475.1	0.617	0.525	2114.0	361.1	158.5
January.	2451.1	0.615	0.525	2062.0	389.1	170.8
February	1943.7	0.563	0.525	1812.0	131.7	57.9

Emission amount of CO_2 and other gases during natural gas combined cycle power generation system.

Green House gases	Emission amount g/kWh
Total CO_2 emission	439.7
Total CH_4 emission	59.2
Total N_2O emission	0.00073

The non revenue water percentage in Sultanate in 2012 was considerably high and it is recorded 30%
Reason for high: Leaks in Pipes, Overflows in reservoirs, meter errors, theft etc..

Demand side losses	**Saving of Power(KWh) due to the reduction leaks in network (Monthly)**	**Total CO_2 generation that can be avoided (Tons Monthly)**
Reducing Distribution network losses (NRW)from the prevailing rate 30% to 25%	102375	45

Conclusion

- Energy consumption in most water systems could be reduced by at least 10%-20% through cost effective actions. Also can minimize negative environmental impacts.
- By reducing losses in the network another 10%-15% of energy could be saved annually.
- Correctly designing the system ,correctly system controlling, monitoring and maintaining equipment are essential .

THANK YOU