EQUIPMENT EFFICIENCY AND SPECIFICATIONS OF ELECTRO-MECHANICAL EQUIPMENT

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OVERVIEW

- Induction Motors in the Industry
- Starting Methods of Induction Motors
- Efficiency of Motors
- Energy Cost
- Energy Saving Initiatives
- QUESTIONS/INTERACTIONS

INDUCTION MOTORS

- Motors used by the NWC are induction motors as they are:
  - Three-Phase, 50 cycle.
  - Self-starting.
  - High starting torque.
  - Robust, operates in any environmental condition.
  - Reliable, relatively maintenance free.
  - Economical, cheaper in cost to other motor types.

INDUCTION MOTORS

- Disadvantage of the induction motors
  - High inrush current during starting, 4-6 times the full load amperage.
  - Operates under a lagging power factor, resulting in lower efficiency and higher power consumption.
  - Constant speed motors, unless operated with a variable frequency drive.
  - Efficiency of three-phase induction motors can vary from 85% to 96%.

3-PHASE INDUCTION MOTOR STARTING METHODS.

- There are five general starting method for

Induction Motors:

  - Full Voltage/Direct-on-Line (10HP or less)
  - Star-Delta (motor must have at least 6 leads)
  - Autotransformer.
  - Electronic Soft Starters.
  - Variable Frequency Drive/ Adjustable Speed Drives

Soft Starter

VFD

AMPERAGE ON MOTOR STARTING.

Motor Horsepower – 50HP Operating @ 415V.

Motor FLA – 65A

Max Current on Starting – 232A (Avg.)

Running Amperage – 62.4A (Avg.)

IDB ENERGY EFFICIENCY FOR CARIBBEAN WATER & SANITATION COMPANIES, JUNE 2010

- The main problems identified hindering energy efficiency were:
  - Low electro-mechanical efficiency.
  - Old motors (some more than 20 years old).
  - Motors rewound several times.
  - Operating procedures not geared towards energy efficiency, mainly due to lack of peak demand management.
    - Peak Hours – Monday to Friday 6pm to 10pm. Rate 44 J$10.99/KWH
    - Partial Peak Hours – 6am to 6pm, Monday to Friday & 6am to 10pm Weekends & Public Holidays Rate 44 J$9.61/KWH
    - Off Peak Hours – 10pm to 6am, Monday to Friday & 10pm to 6am Weekends & Public Holidays. Rate 44 J$6.87/KWH

IDB ENERGY EFFICIENCY ACTION PLAN

- One of the most important energy-saving opportunities for improving the efficiency of motor and pump sets is based on the electromechanical efficiency (EME) of the pumping systems.

- The EME results average to 46.7%, which is a very low value compared with the international standards and commercially available technologies that average at least 72% EME. This means that there exists a significant energy-saving opportunity to improve this parameter by about 25.7%.

IDB ENERGY EFFICIENCY ACTION PLAN

- **Right Sizing of Units**
- Right Sizing deals with the electromechanical efficiency of pumping units. Electric motors operate at their best power factor and efficiency when fully loaded, so purchasing a motor that is too big does not make any sense from an efficiency point of view.
- This will result in both low power factor and efficiency which is not beneficial to the company. This is a mistake that has been prevalent within the NWC and will have to be rectified as a part of the energy management strategies.

RECOMMENDATIONS FOR IMPROVED ENERGY EFFICIENCY.

- Specification are for motors rated at Premium Efficiency.

    These motors are guaranteed efficiency of 91% to 96%.

    Motor Nameplate to the right has an NEMA efficiency of 95.7%

- Use of accurate measuring instruments for control of pumping equipment.

- Use of Variable Frequency Drives in closed networks where no storage is available. During low demand from customers, pressure will increase and with VFDs the speed of the pump will reduce. Resultant of lower power consumption, lower system pressures (reduction in NRW) and lower flows.

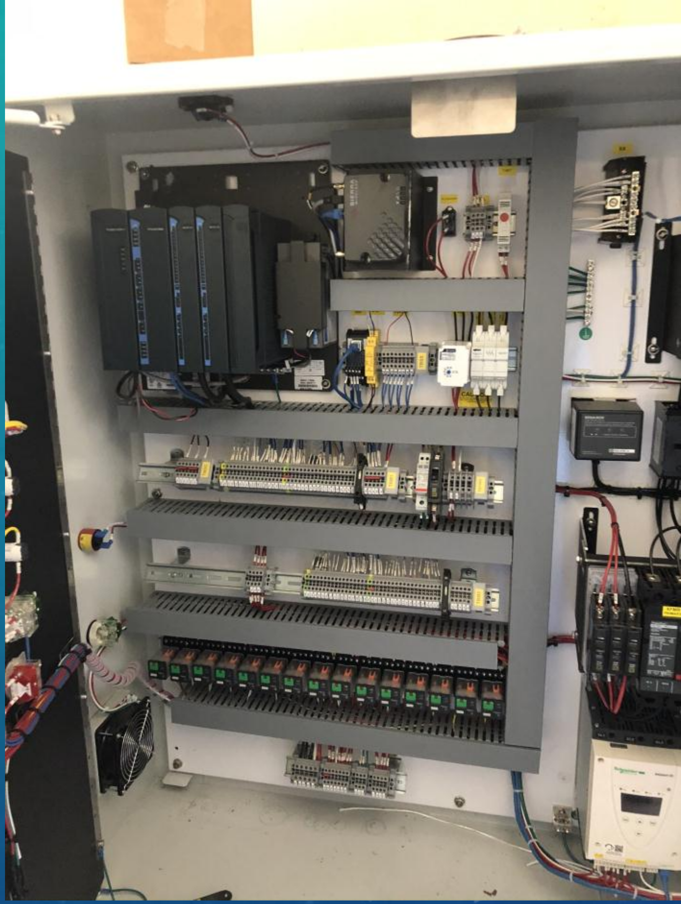
- Use of Supervisory Control and Data Acquisition Systems (SCADA) for communication among interlinked systems.

USE OF VFD IN WASTEWATER

For our aeration equipment we can utilize VFDs to reduce the speed of mixer based on the dissolved oxygen present in the mixed liquor.

At Eltham Wastewater Treatment Plant, dissolved oxygen sensors start/stop blowers based on oxygen levels and hence reduce energy consumption during low inflows.

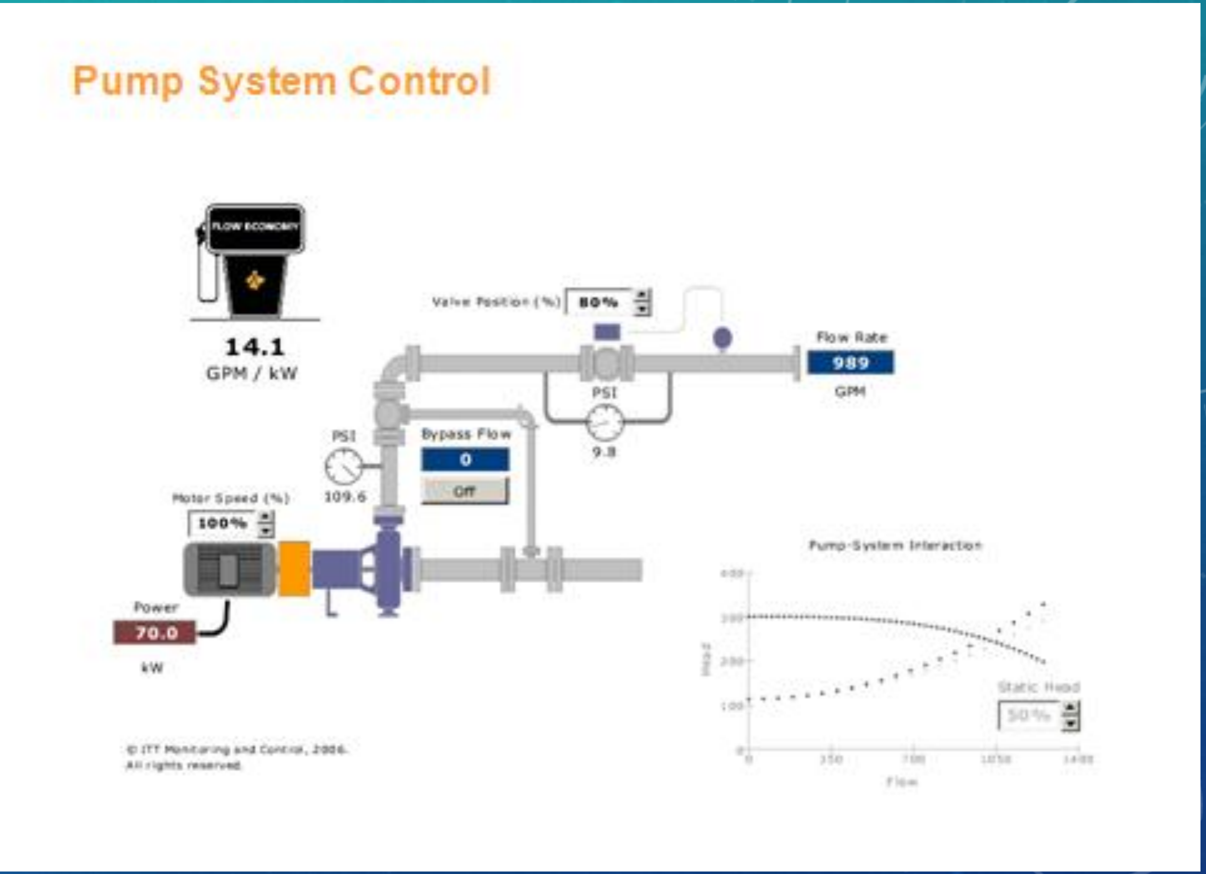
WHAT IS SCADA?



- Supervisory Control & Data Acquisition
- SCADA is the process by which real time information is gathered from remote location for analysis and the process by which equipment is controlled.
- SCADA generally refers to an industrial computer system that monitors and controls a process.

SCADA

- In a Basic Way
  - It collects information.
  - Transfer Information remotely.
  - It carries out necessary analysis and control if so setup.
  - Allows user to be informed about system operation to make an informed decision.

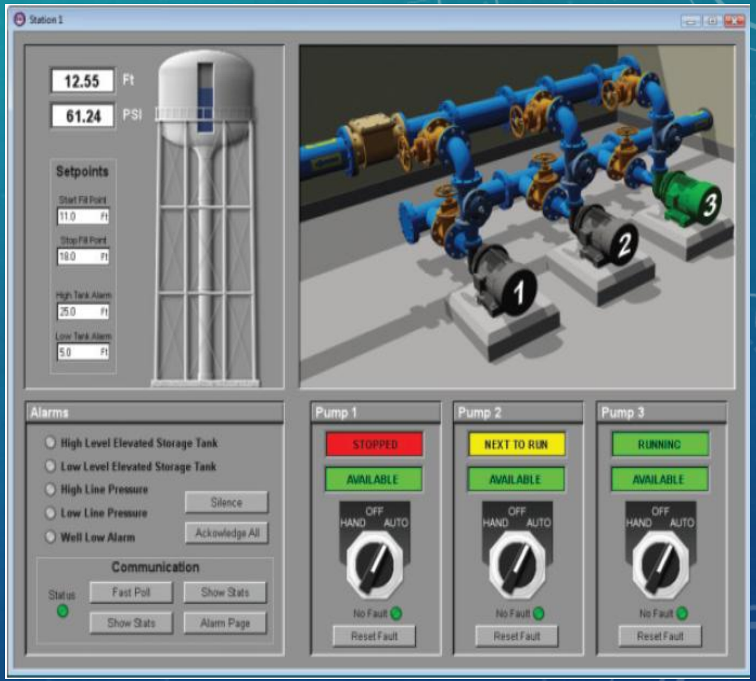


SCADA BENEFITS

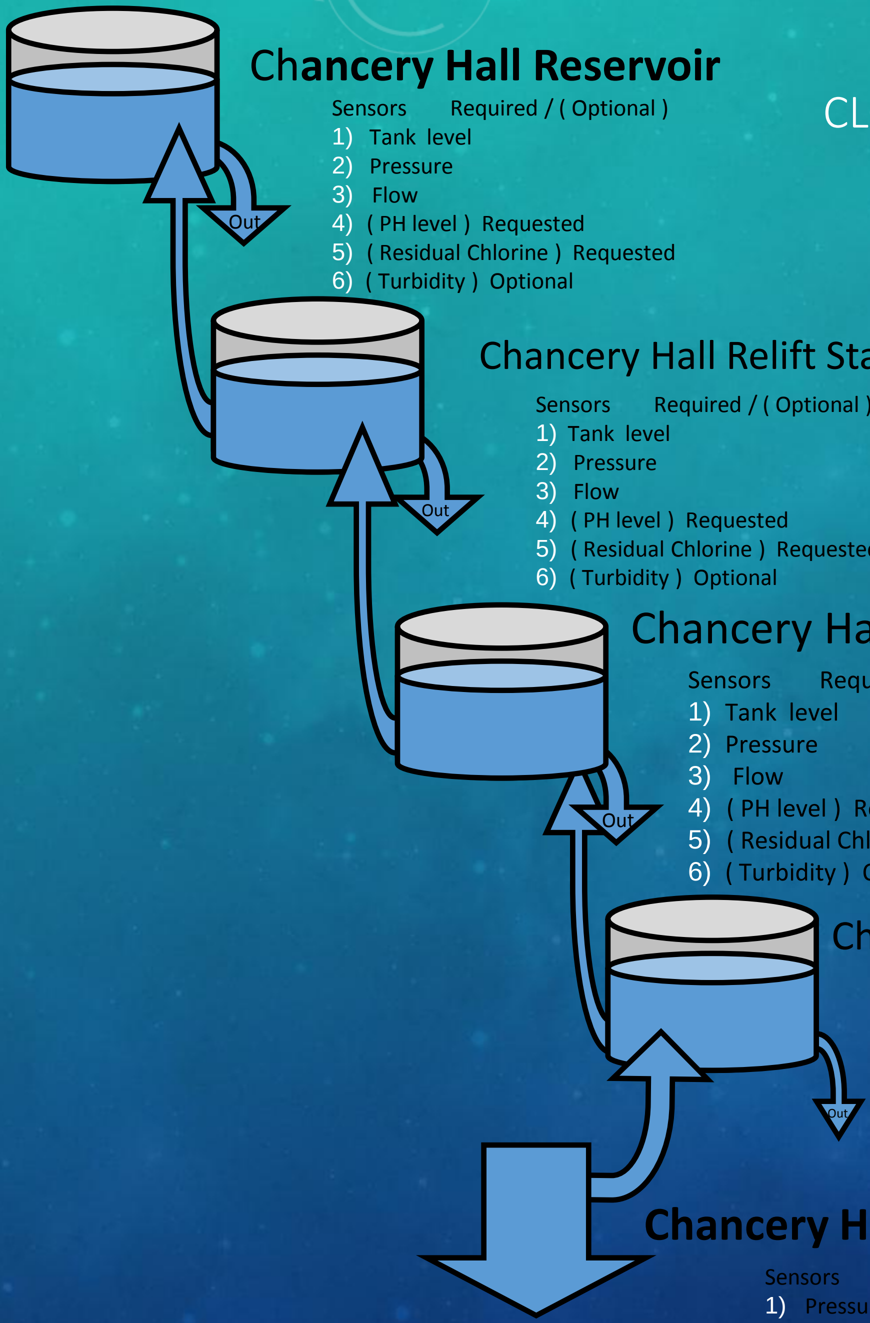
Since the implementation of system in partnership MIYA Jamaica commencing August 2017. The following benefits has been derived:

- There has been a significant reduction in overflow from tanks and thus reduction of Non-Revenue Water (NRW). This is due to the communication between sites that are interlinked and automatic shutdown of pumps as necessary.

- The NWC is now able to real time monitor the operation of their facilities.



CLOSED LOOP SYSTEM



Chancery Hall Reservoir

Sensors Required / (Optional)

1) Tank level
2) Pressure
3) Flow
4) (PH level) Requested
5) (Residual Chlorine) Requested
6) (Turbidity) Optional

Chancery Hall Relift Station #3

Sensors Required / (Optional)

1) Tank level
2) Pressure
3) Flow
4) (PH level) Requested
5) (Residual Chlorine) Requested
6) (Turbidity) Optional

Chancery Hall Relift Station #2

Sensors Required / (Optional)

1) Tank level
2) Pressure
3) Flow
4) (PH level) Requested
5) (Residual Chlorine) Requested
6) (Turbidity) Optional

Chancery Hall Relift Station #1

Sensors Required / (Optional)

1) Tank level
2) Pressure
3) Flow
4) PH level
5) Residual Chlorine
6) (Turbidity) Optional

Chancery Hall Deep Well

Sensors Required / (Optional)

1) Pressure
2) Flow

SCADA BENEFITS

- Downtime of facilities have been significantly reduced and consequently improved production to customers.
- The monitoring of our storage tanks and production wells being done in real time. The NRW team and distribution engineers are able to know how much water in available to customers, where there are shortfalls in the supply and where water can be diverted to customers that are in need.
- Interacting with other telemetry system such as the HWM Online program that monitors the pressures and flows (where available) all over the KSA region to actively inform the NWC where there are water in the network, availability to customers and potential NRW.
- Energy Savings Realized

SUMMARY

- Improve energy efficiency by right sizing your motors/equipment.
- Request motors rated at Premium Efficiency.
- Implement Power Factor correction for Inductive Loads.
- Integrate Renewable Energy initiatives such as Solar (Grid-Tie, Hybrid)
- Integrate technology and software within your enterprise such as SCADA (VT SCADA, Wonderware, etc.) and Enterprise Management Software (Microsoft Dynamics, IFS, etc.

THANK YOU- QUESTIONS??