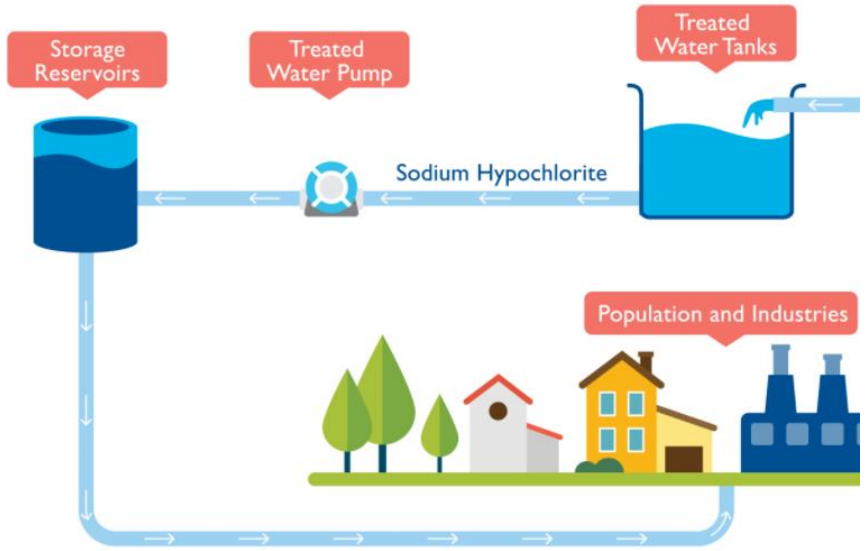
Monitoring Health of Assets

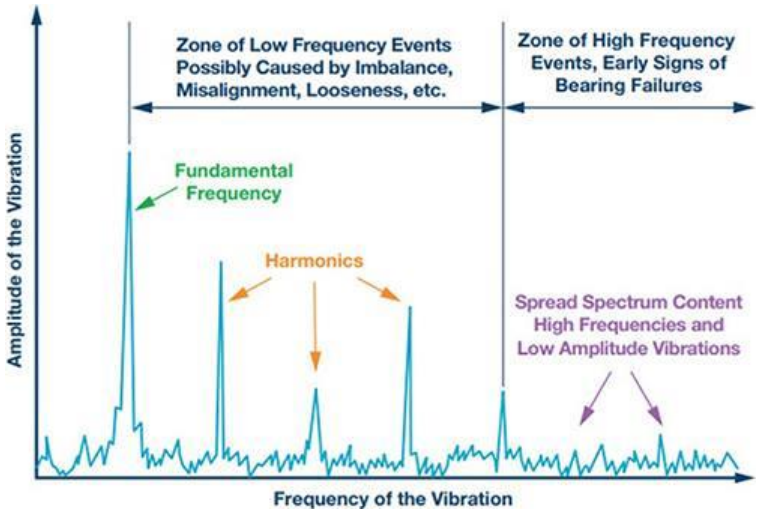


- Pump sets are indispensable as they keep water moving, inject chemicals into the water and perform a range of other functions
- There are more than 2,000 of pump sets across Singapore
- Engineers carry out maintenance at fixed regular time intervals or based on their accumulated running or operating hours

Source: PUB, Singapore's National Water Agency

Proposed Optimisation

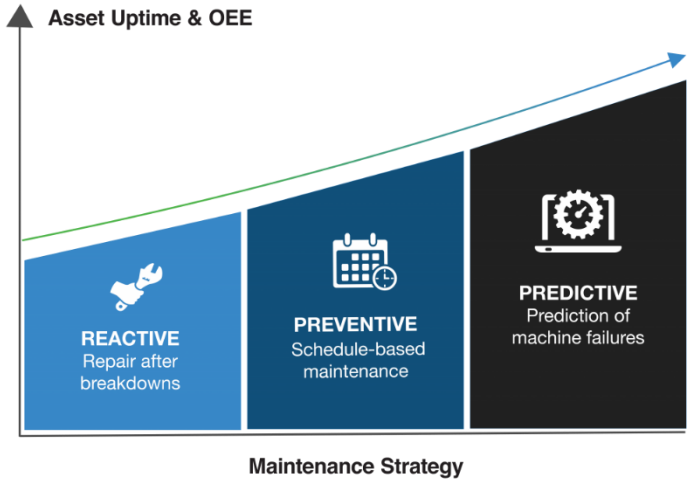
Internet-of-Things (IoT) sensor installed on pump set for condition monitoring



- Using low-cost vibration sensors to monitor and predict the condition of the pump sets
- Capture vital operating data from the pump sets, during their start-up transient state and their steady state operations
- The sensors take readings on a regular basis and generate alerts via SMS to engineers when vibration threshold values are exceeded

Source: PUB, Singapore's National Water Agency

Expected Benefit of Predictive Maintenance



- Collected data will be analysed to detect signs of impending failure and identify the specific fault ahead of time
- Improves maintenance regimes by allowing maintenance to be carried out on the pump sets based on the equipment's condition
- Optimise maintenance costs by pre-empting failures instead of reacting to them and minimising operational downtimes

Source: PUB, Singapore's National Water Agency

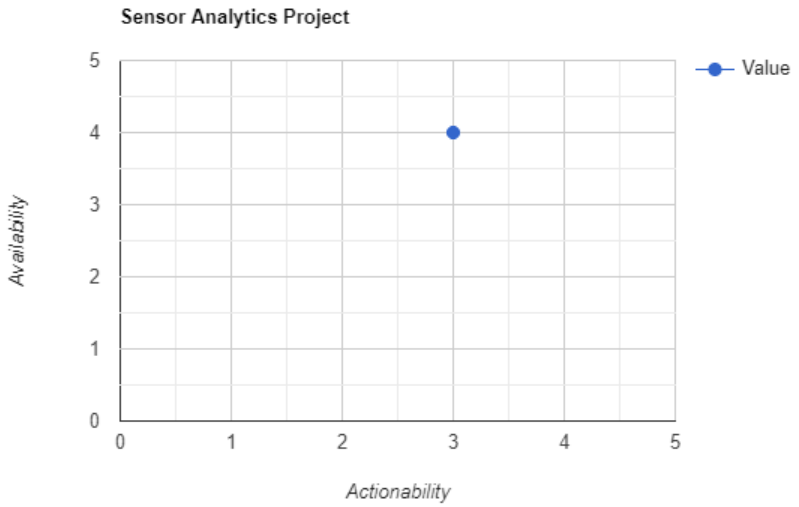
Data Value is measured with the following:

Data Availability

- Data from the sensors will be converted to the right format and goes through the analytical system automatically
- Sensors' readings and predictive output are available in near real-time, thus availability is high

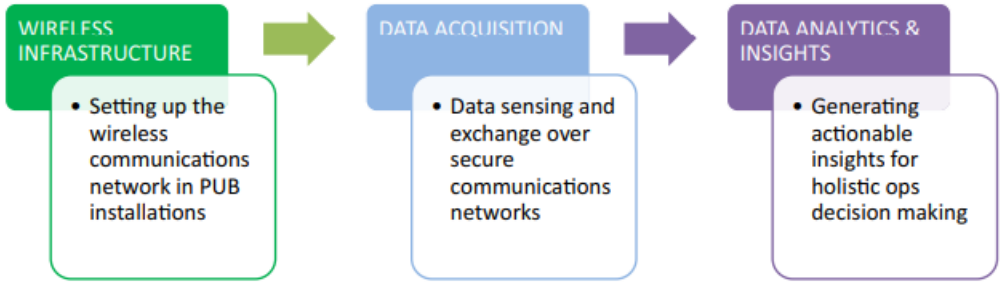
Data Actionability

- Other factors other than vibration may cause the pump sets' failure
- Failed component to be replaced may not be in stock, thus actionability is moderate



Source: PUB, Singapore's National Water Agency

Data Priority



1. Set up the secure wireless communications network to transmit data collected by sensors
2. Installation of the sensors on pump sets across Singapore
3. Engineer data pipelines to automatically convert the sensors' data to the right format
4. Creation of a machine-learning system that will analyse the collected data and generate the predictive output

Source: PUB, Singapore's National Water Agency