HVAC Maintenance Solution

Shift in thinking – A new Paradigm

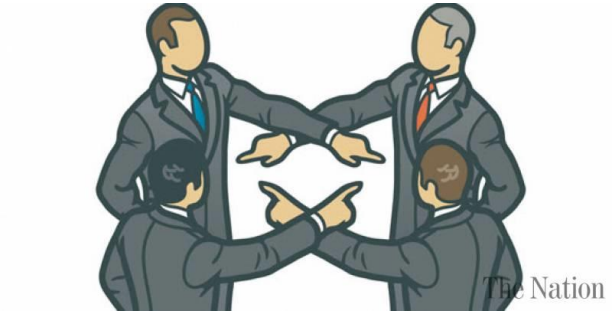
Different way of managing maintenance contracts

Nelson Mandela

Why the change

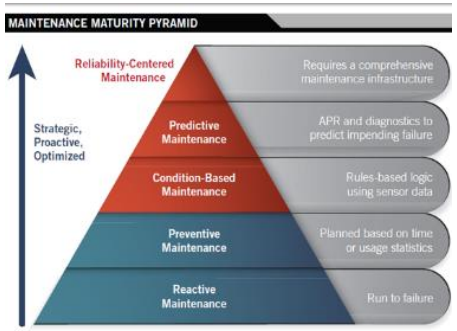
CM Costs increasing

Contractor Performance



Poor accountability

Assets under management



Little asset performance

Many contractors

Task based work

What we saw coming

Rising Utility prices

Likelihood				
	Medium	High	High	Extreme
	Low	Medium	High	Extreme
	Low	Medium	High	High
	Low	Low	Medium	Medium
	Low	Low	Low	Medium

Consequence

Need to understand risks

Ageing Facilities

Figure 1: PAM decision-making methodology phases

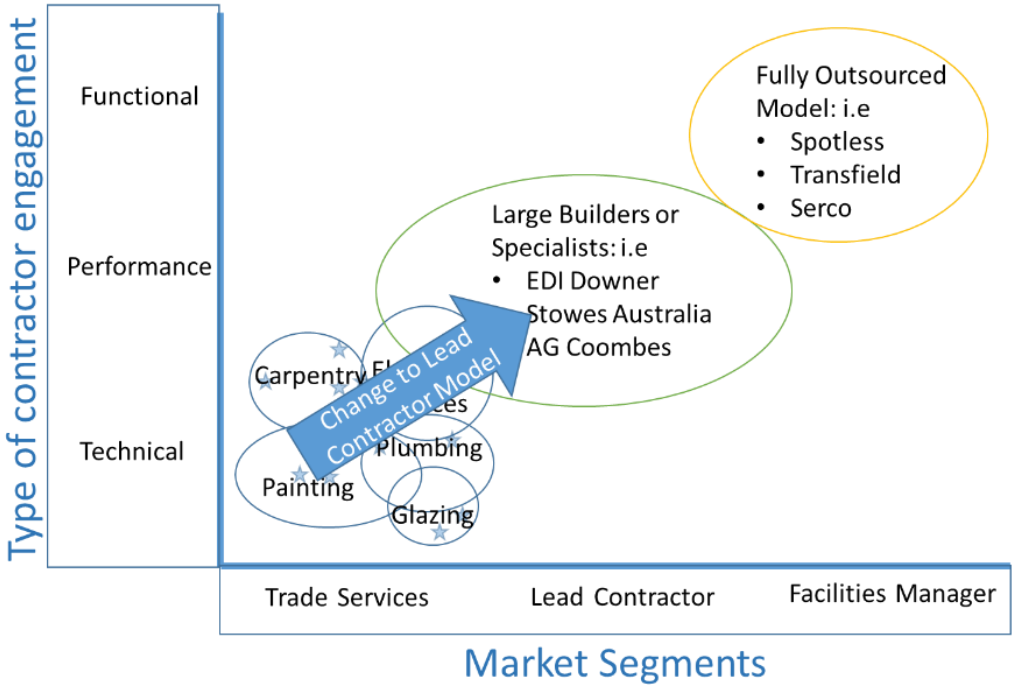
Need for prioritise assets

Reducing budget

Student Experience

Objectives

- Holistic asset management
- Focus on asset performance
    - Reliability Centred Maintenance Strategies
    - Predictive Maintenance Strategies
    - Risk Based Strategies
- Incorporate Life Cycle programs
- Focus on collaboration
- Establish Lead contracts



Process

- Engaged consultant to manage process
  - Contract documents and Legal
- Expression of Interest
  - Asset List and scope based on DA19
  - Q Tender
  - Undertook a mandatory briefing
  - Review EIO via evaluation criteria
  - Short list
  - Interviewed
  - Financial viability check
- Request for Tender
  - 5 year + 2
- Year 1 – Transition year
  - Condition assessment and Asset priority
- Year 2 and onwards – Performance based

The Deliverables - Year 1

- Asset audit & Verification (first 90 days)
  - Barcoding of all assets
  - Asset data structures, hierarchies, & definitions
  - Asset condition assessment
  - Identified critical assets & associated risks
- Development of 10 Year Asset Lifecycle Plan
- Delivery of performance based preventive maintenance plan
- Corrective maintenance reduction plan.

University of Queensland

Campuses

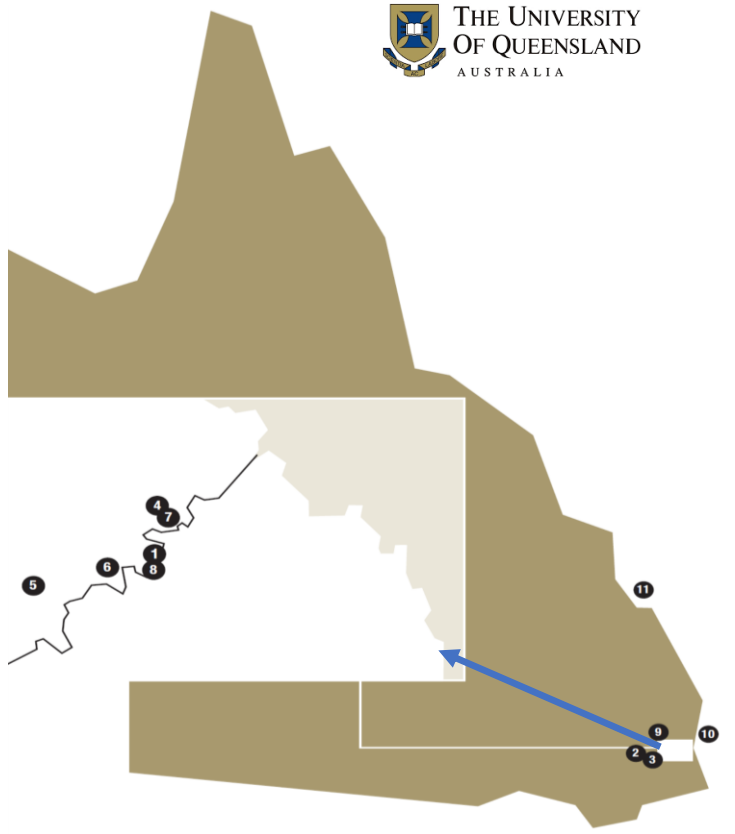
1. St Lucia campus
2. Gatton campus
3. Herston campus

20 Other Locations including:

- Pinjarra Hills
- Long Pocket
- University Mine, Indooroopilly
- School of Dentistry, City
- Pharmacy Australia Centre of Excellence, Woolloongabba
- Veterinary Teaching Clinic, Dayboro

Marine Research Stations

- Dunwich, Stradbroke Island
- Heron Island



University of Queensland

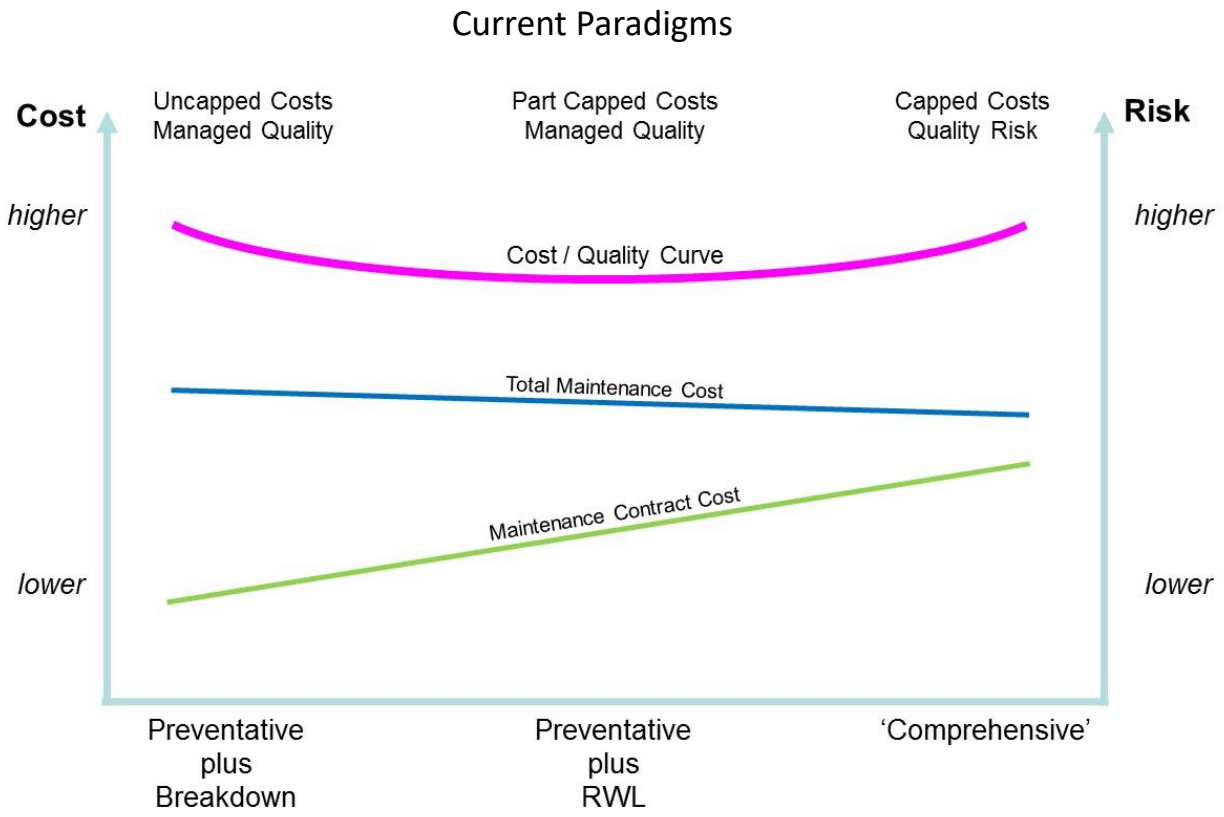
- Over 50,000 students
- 6703 staff
- 551 buildings
- 24% UFA Service & Equipment Intensive (SEI) buildings
- 782,216 m2 (gross floor area)
- Asset Replacement Value of $3.74 Billion
- 454 general teaching rooms and 1318 laboratories
- 1670 hectares

A.G. Coombs Journey

A.G Coombs awarded contract - Commenced 1 August 2015

Performance based contract using the combined expertise of A.G. Coombs Service and A.G. Coombs Advisory expertise to develop and implement a tailored HVAC Maintenance Solution.

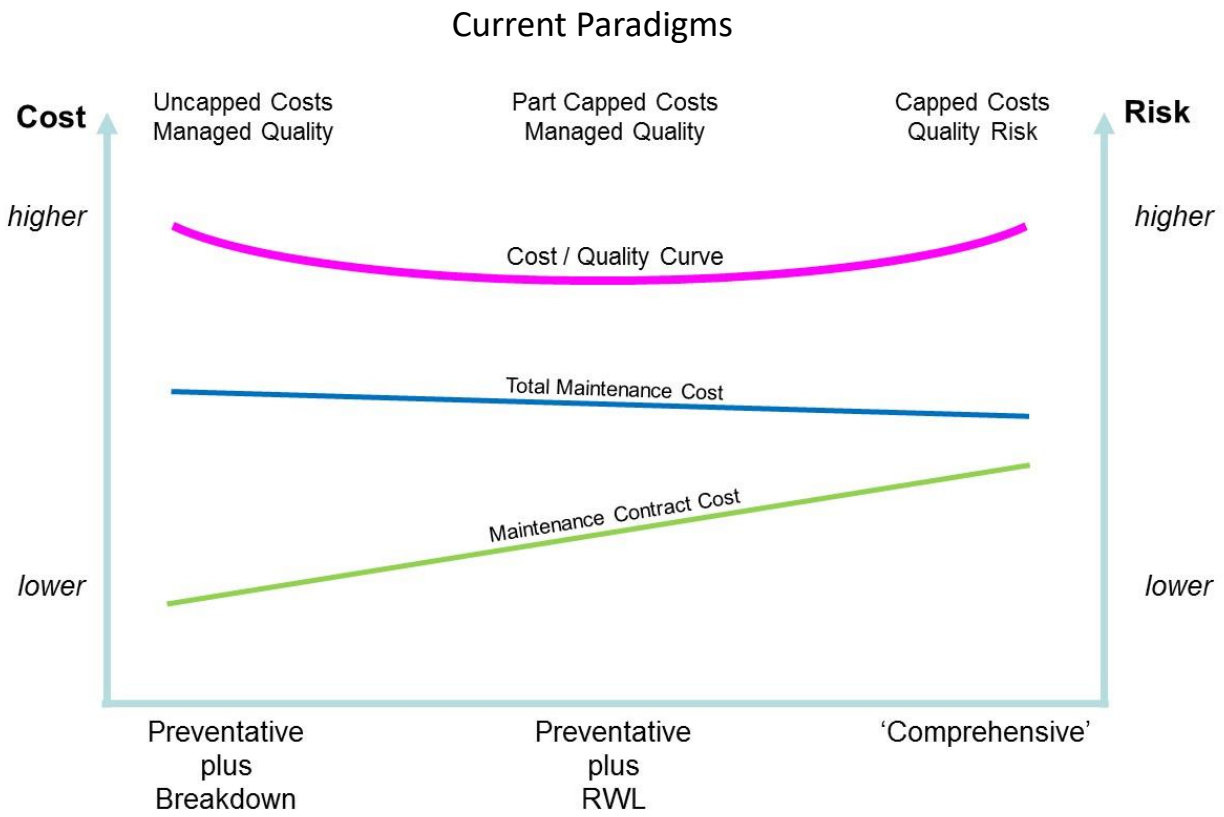
The old industry maintenance paradigms and the shortcomings



- Task based and founded on regulatory compliance
- Assets generally maintained as individual parts – *demarcation between asset systems and in turn Service Providers*
- Relatively short term focus, driven by budget constraints for the **NOW**
- Defined frequencies & tasks – *Prescribed and generally not engaging of maintenance provider capabilities*
- Largely reactive, not driven by longer term strategic objectives - *improve quality of outcomes (asset life and condition) whilst reducing costs, mitigating risk and maintaining regulatory compliance*

therefore……

The old industry maintenance paradigms and the shortcomings



….. generally

- No relation to facility outcomes
- No relation to the nature or condition of plant
- No direct correlation to risk – *cause and consequence*
- Total costs not attributed to the asset – little correlation to corporate commercial outcomes – budget/total cost of ownership
- Limited consideration to energy efficiency and sustainability outcomes
- Limited deployment of 'maintenance engineering principles'
- The ability to make decisions driven by both historical and forecast asset information "useful data"

How we transitioned to the new paradigm

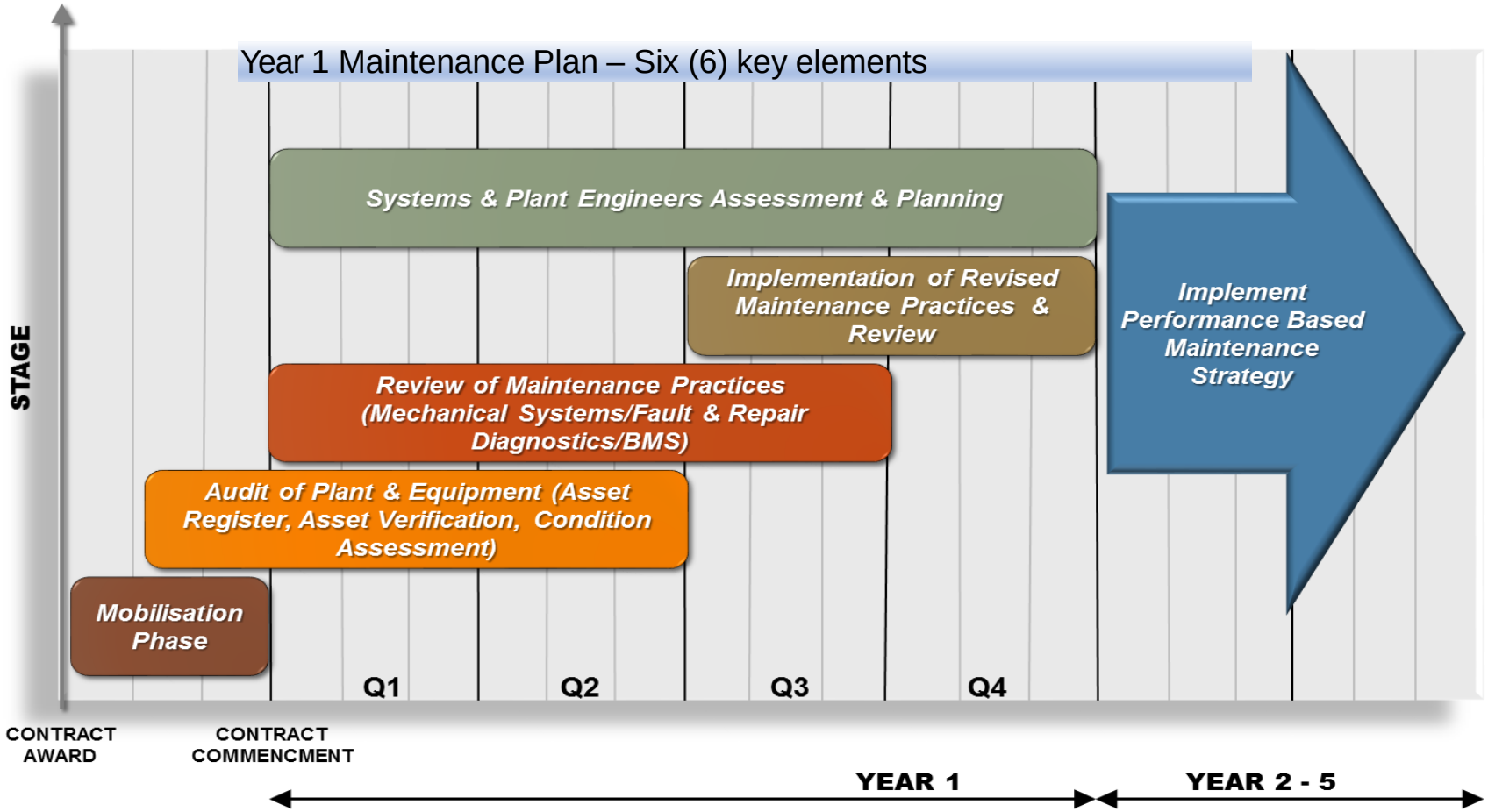
Year 1 Maintenance Plan – Six (6) key elements

1. **Mobilisation**
   - Asset stock take
   - Asset data structures, hierarchies and definitions
   - Asset condition assessment & Barcoding
2. **Review of Operation of Mechanical Systems**
   - Review and reassign BMCS maintenance tasks
   - Assess trending, alarming and reporting functionality of the BMCS
   - Review Break down and repair maintenance historical data.
3. **Mechanical Systems Fault / Repair Diagnosis**
   - Analysis of the historic failures and review / assess likely anomalies
   - Identify any underlying factors requiring attention
   - Delivery of a corrective maintenance reduction plan

How we transitioned to the new paradigm

4. **Monitoring & Assessment of System Operation**
   - When should a system operate at given parameters?
   - Have these parameters existed over the previous reporting period?
   - How did the system perform against know parameters?
5. **Systems and Plant Engineering Assessment & Planning**
   - Development of 10 year asset life cycle plan
   - Implementation of maintenance and reporting systems
   - KPI development plan - Lead and lag indicators
6. **Implementation to Performance Base Maintenance Strategies**
   - Year 2 - Agreed planning and contract framework

How we transitioned to the new paradigm



How we transitioned to the new paradigm (cont.)

- Adopted a systems-based approach to maintenance, as opposed to looking at individual assets
- Maintenance methodologies considered each component as a part of a larger system to ensure these systems integrate in the best possible way.
- TEFMA category for building type used to prioritise maintenance of assets, identify assets for replacement and measure reactive works KPIs
- Improved integration between electronic systems BMS and DV15 co-ordination improved –reporting and messaging on essential alarms
- Engineering assessments of critical equipment Eg: Industry best practise Cooling tower risk management plans.
- ALL assets tracked in a asset lifecycle plan which includes a detailed lifecycle analytic program

How we transitioned to the new paradigm (cont.)

The buildings were divided into 5 priority categories each with its own maintenance regime.

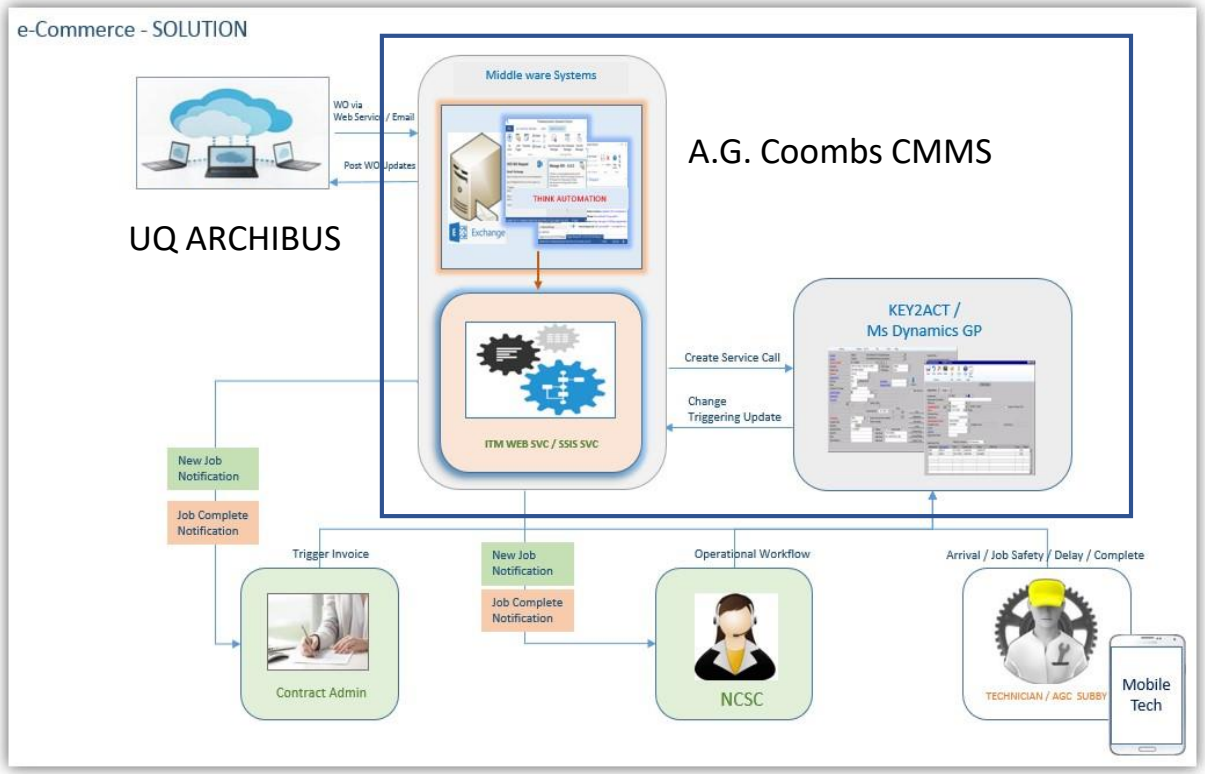
Category 5	Above normal maintenance to ensure reliability
Category 4	Normal maintenance
Category 3	Essential Services Maintenance
Category 2	No maintenance – reactive service calls only. (Building earmarked for redevelopment or under warranty)
Category 1	Run to fail – Building to be demolished / removed in the future.

How we transitioned to the new paradigm (cont.)

Management Information Systems

ARCHIBUS - “SINGLE POINT of TRUTH”

Think Automation - extracts information from inbound messages received from UQ including (emails and SMS)



Performance Based (Proactive) Maintenance Regime

Asset based analytics:

- Utilises physical asset information
- Factors in many attributes of the asset and its installation
- Considers maintenance, breakdown and repair history
- Life cycle, redundancy and obsolescence issues

Operational focused analytics:

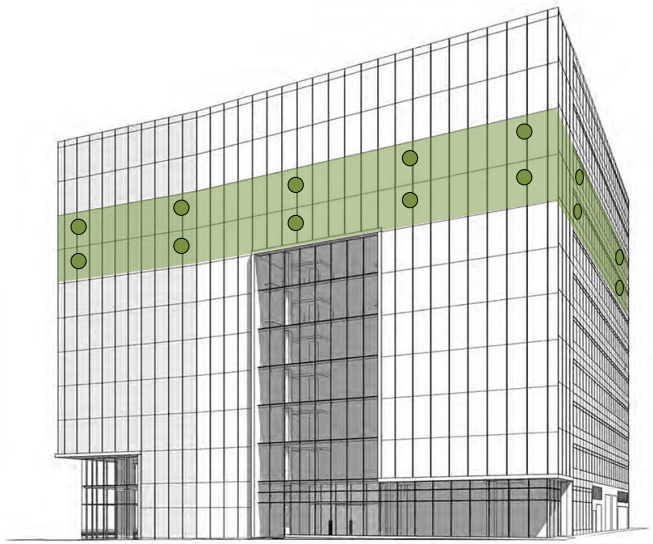
- Applies rules to identify issues
- Uses operational data from building management and control systems
- Identifies poor equipment performance and energy efficiency
- Use technology tools to assist – Movus vibration analysis
  - Instant alarms
  - Data incorporated into lifecycle assessment

Movus Vibration Monitoring

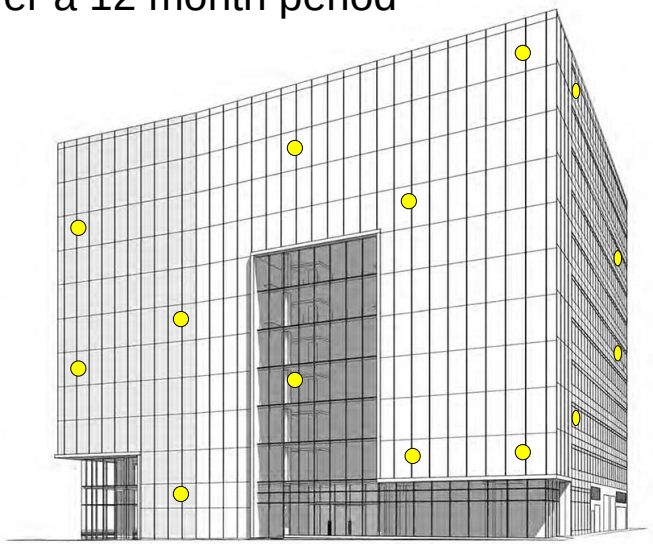
Performance Based (Proactive) Maintenance Regime

Exception Based or Targeted Maintenance

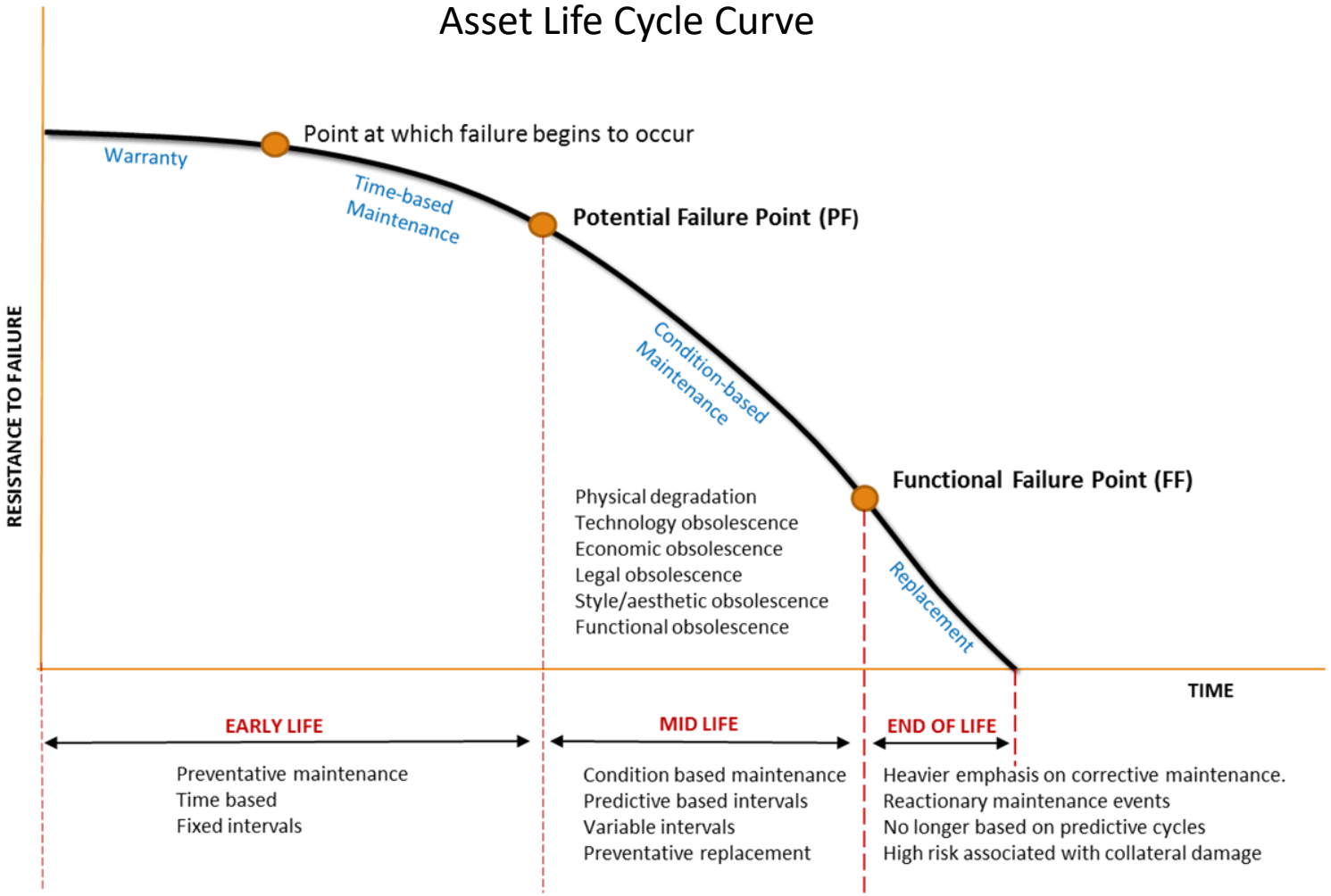
Scheduled based maintenance indicates 14 VAV boxes on levels 8 and 9 and due for servicing based on date



Pro-Active based maintenance indicates these 14 VAV boxes require servicing based on performance - all items serviced over a 12 month period



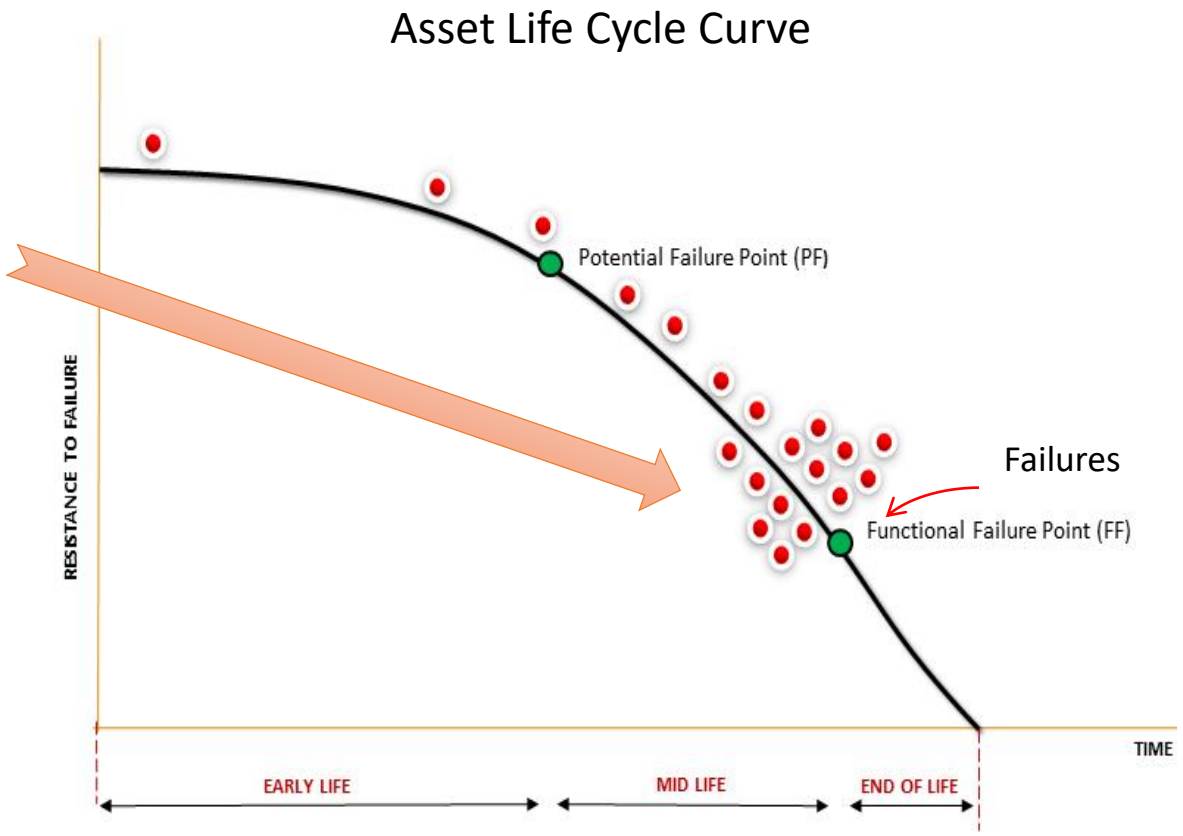
Performance Based (Proactive) Maintenance Regime



Performance Based (Proactive) Maintenance Regime

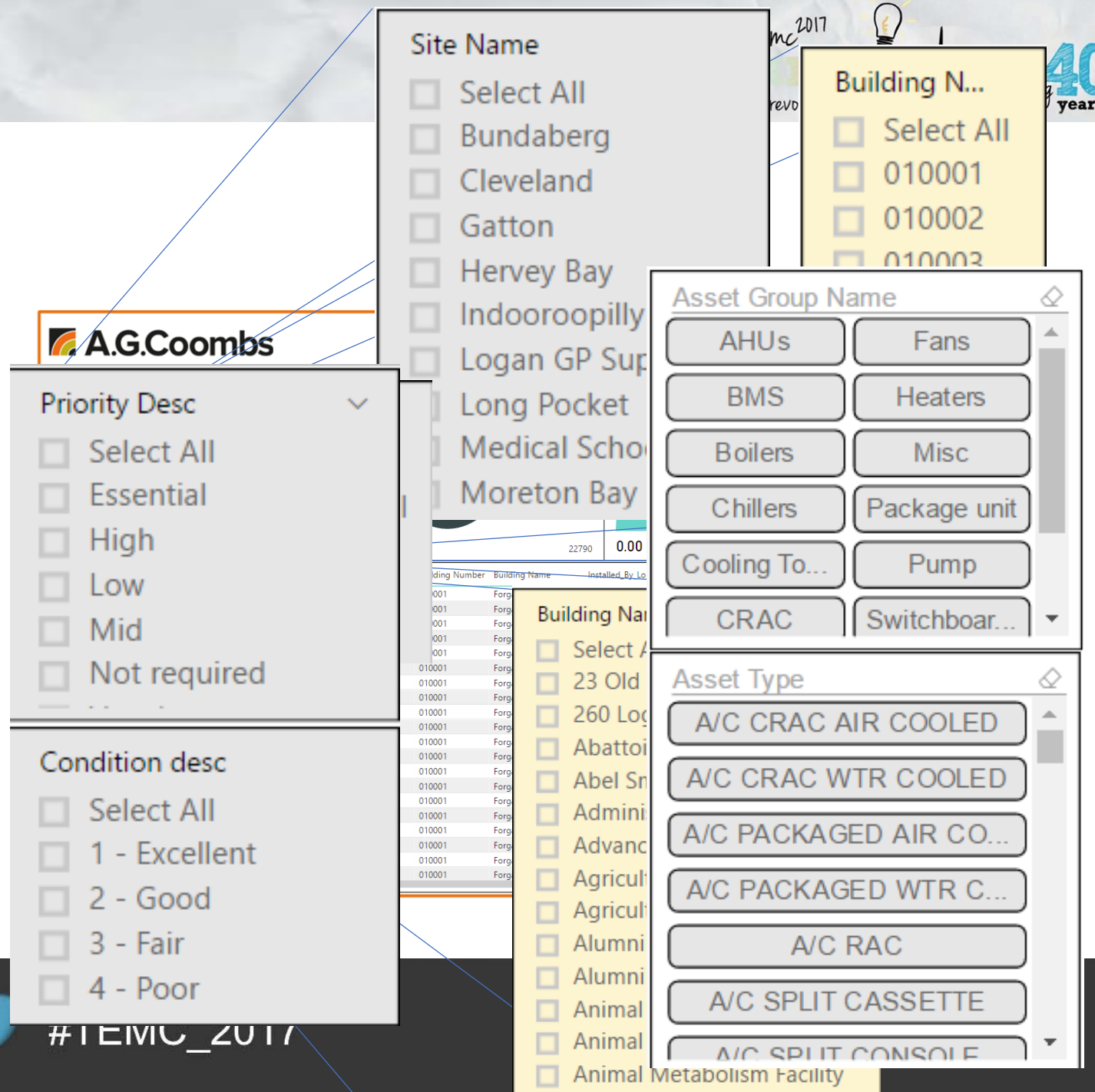
What are we looking for?

- We looking to predict replacement before it fails
- Record maintenance & breakdown against the assets
- Analyse the data
- Project routine & replacement expenditure
- Identify trend abnormalities
    - Energy
    - Breakdown
    - Conditions
    - Replacement



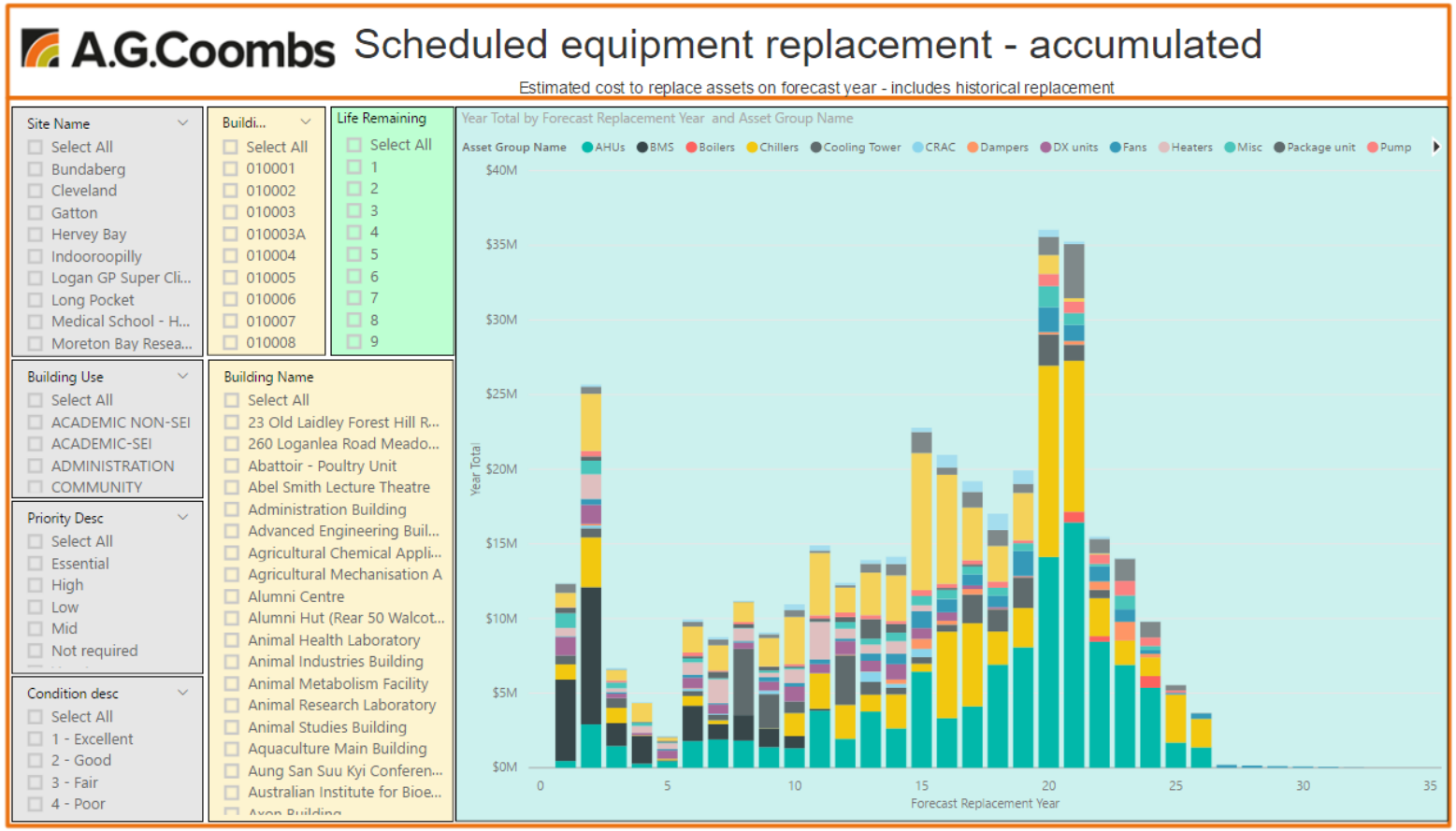
First Year - Lifecycle Plan

- Development of a computerised model to manage all asset life cycle costs
- Ability to filter based on campus or building
- Ability to filter based on Asset types
- Ability to filter based on Building use (benchmarking similar facilities)
- Ability to filter based on Condition and/or priority



First Year - Lifecycle Plan

- Good understanding of total asset replacement costs
- 25 year replacement program down to component level
- Enabled a prioritised asset replacement program

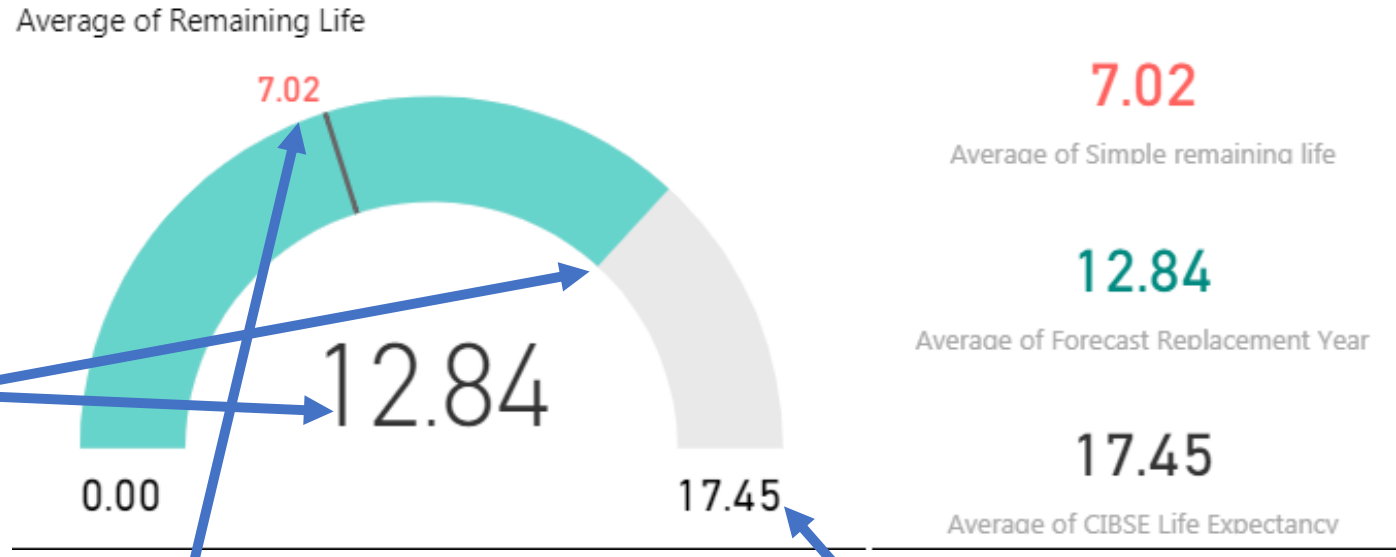


Second Year - Lifecycle Plan

- Asset lists updated and refined
  - More data = better resolution of reports
  - Improved accuracy
- Metrics were refined to include
  - Building benchmarking (size / use / location)
  - Incorporated corrective maintenance faults down the square metre
- Provided the ability to tune the model into “what-if” scenarios

Second Year - Lifecycle Plan

- Average remaining life of Assets



Average of the Lifecycle model remaining life based on:

- Current Condition
- Deterioration model calculations
- Cost to maintain
- Fault history

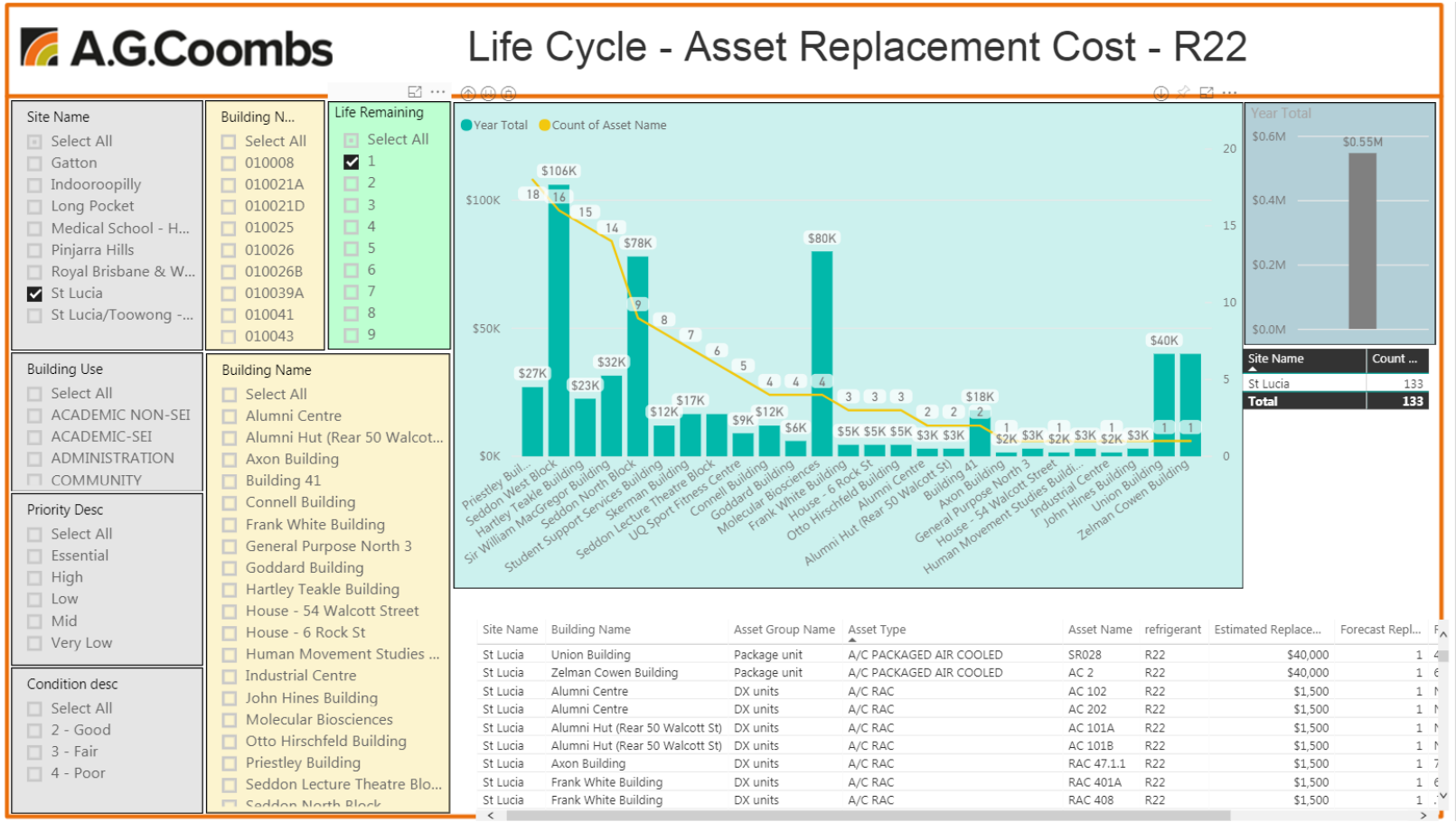
Average of the calculated remaining life based on “standard” industry data (CIBSE)

Average of the assets expected life (ie from new)

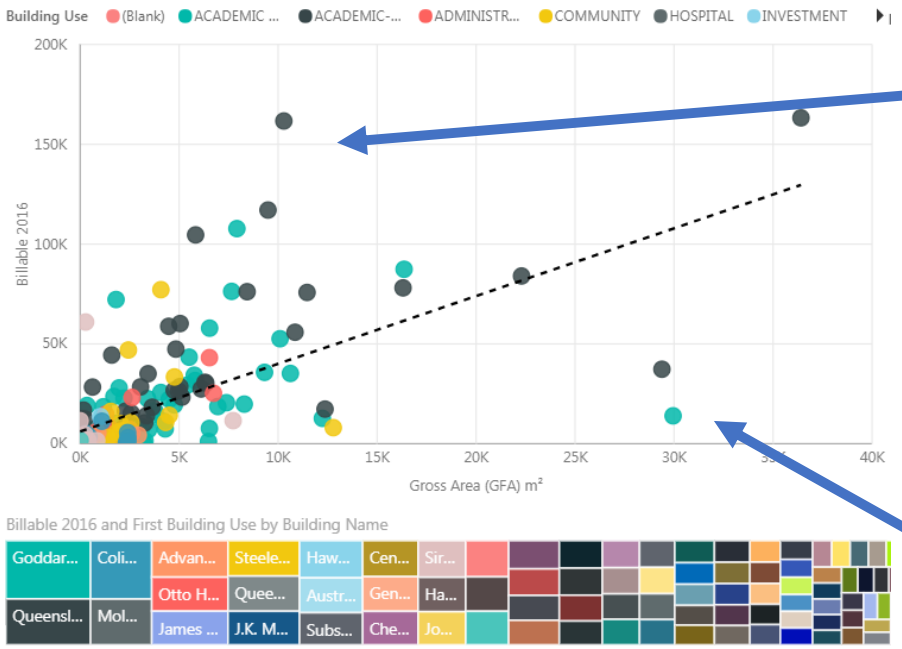
Second Year - Lifecycle Plan

R22 – phasing out

Strategy to stockpile gas from large central plant to support smaller equipment replacement program



Second Year - Lifecycle Plan

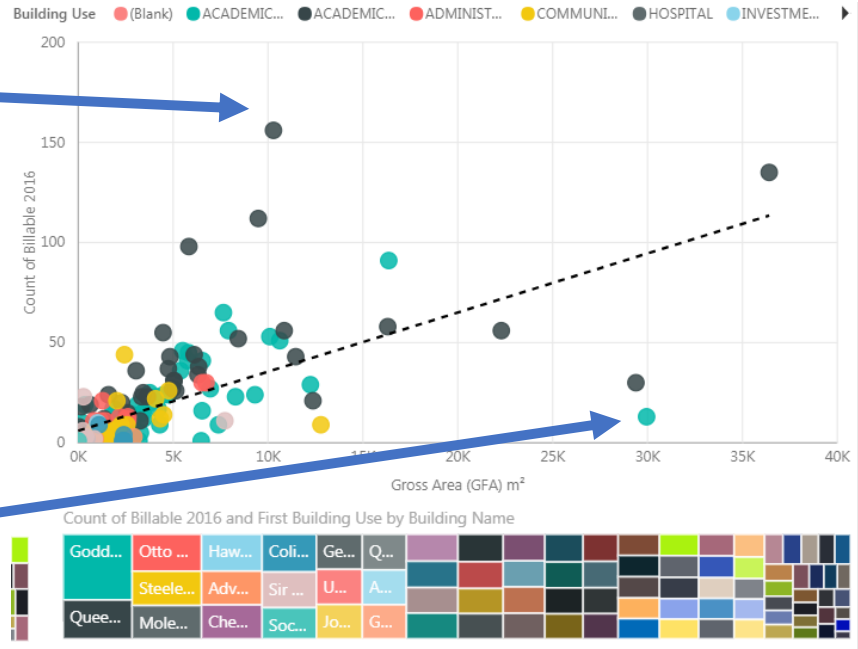


Number of Calls

Identify the worst performers

Dotted line indicates average of selected filter

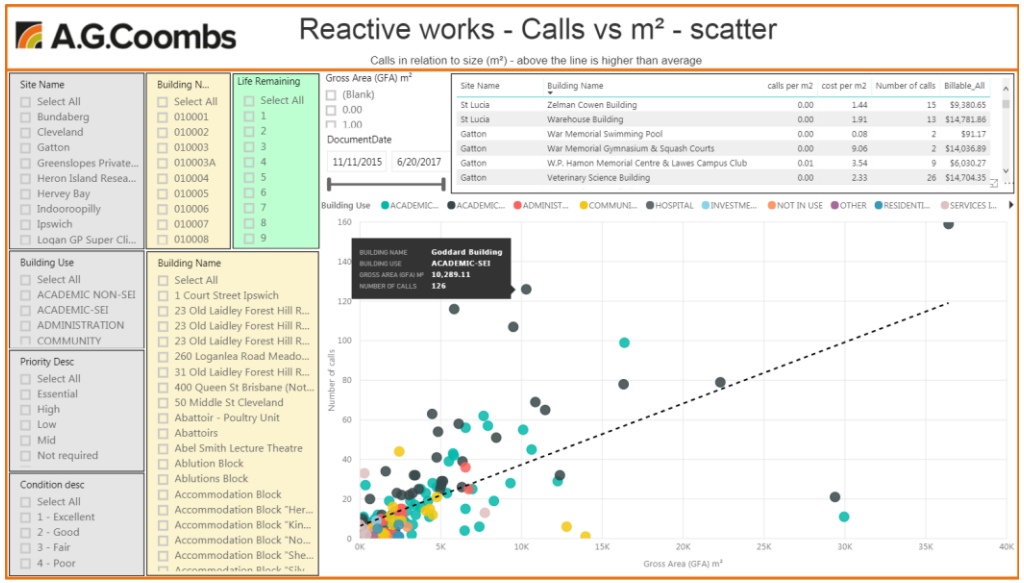
Learn what is going right in the best performers



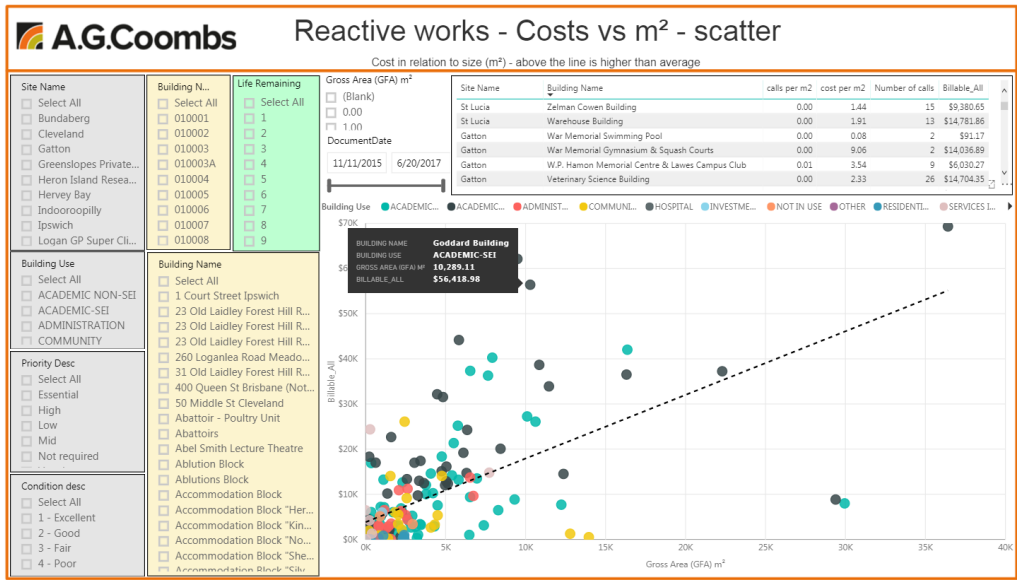
Cost to repair

Second Year - Lifecycle Plan

Analysis down to the square metre
for benchmarking on similar space

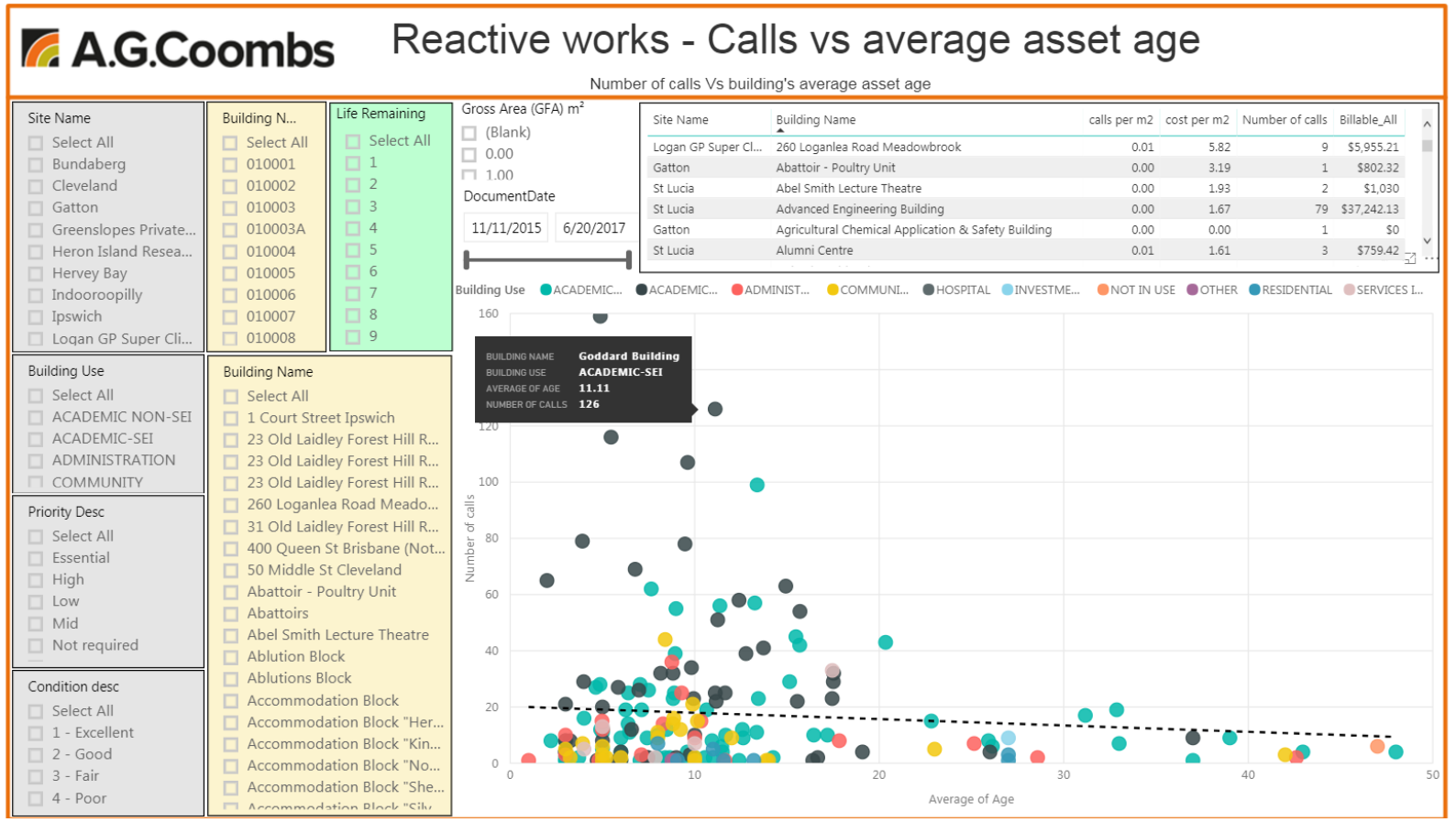


Number of Calls



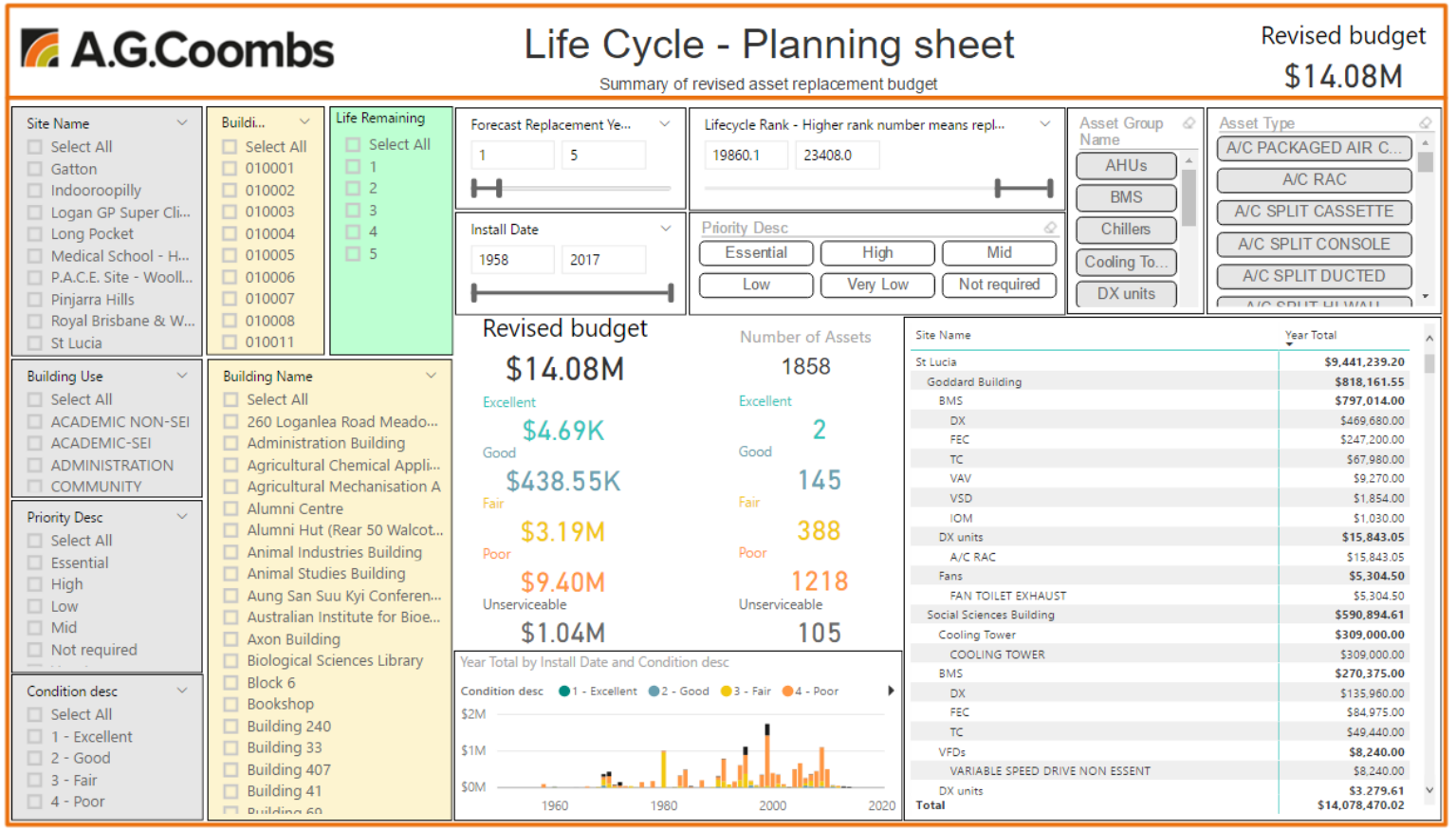
Cost to repair

Second Year - Lifecycle Plan



Second Year - Lifecycle Plan

- Ability to identify the priority of asset replacement according to available budget



Future work

- Operational stress
  - Short cycling – BMS integration
  - Undersized equipment – performance data (BMS or other)
  - Vibration monitoring – rate of degradation
  - Runtime, hours of operation per week – Movus integration and BMS integration underway
  - Costs of each asset compared to purchase price

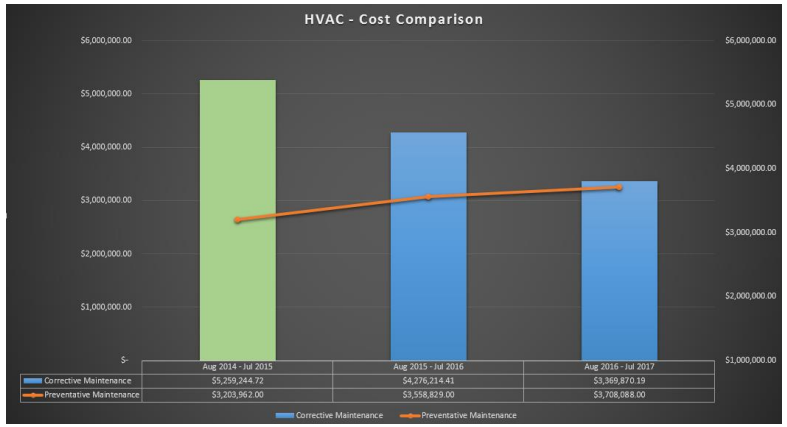
Learnings

- Q tender
- Corporate scorecard
- All work co-ordinated through one point of contact
- Capabilities to do large urgent work
- DA 19 basis for contract basis
    - Need to be clear about items that could be preventative or corrective maintenance eg. belts and filters

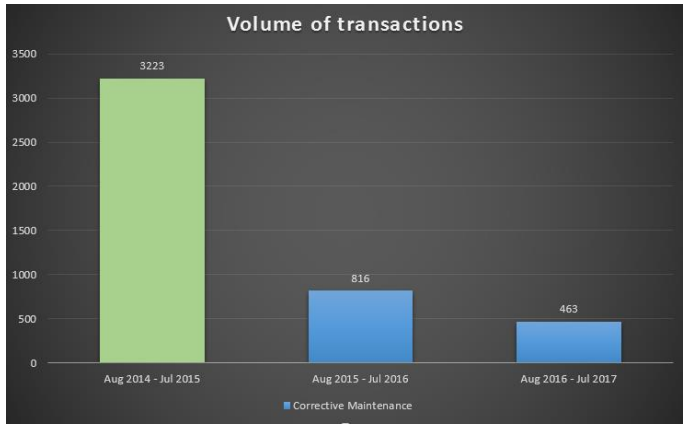
Overall Benefits

- Reduction in corrective maintenance costs
- Reduction in corrective work orders
- Reduction in invoice transactions

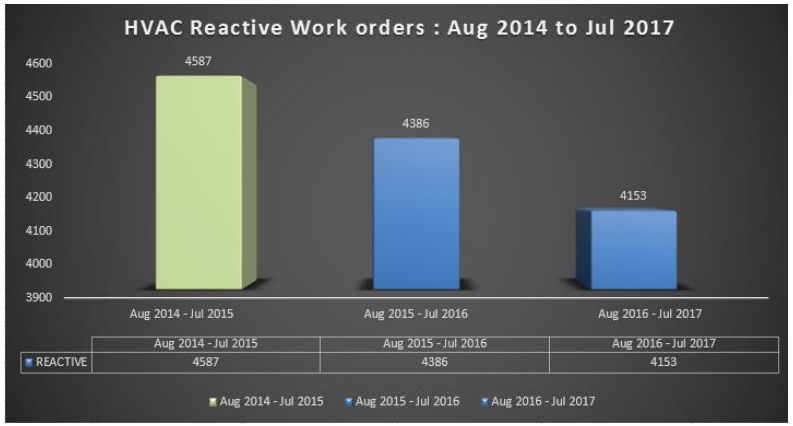
Preventative and Corrective Costs



Invoice volume



Corrective maintenance Work Orders



Overall Benefits

- Holistic asset management
- Robust information on asset life cycle
- Better understanding of asset performance
- Better method of prioritising asset replacement based on risk
- Single accountability for asset performance
- Good service performance which is regularly monitored

The collaborative journey between UQ and A.G. Coombs has required an ideological shift to performance based maintenance strategies

Delivered through a staged approach

A shared commitment and effort from both organisations to ensure the processes match to the outcomes

Questions