Benchmarking mechanical and electrical maintenance: *key perspectives and emerging challenges*

Benchmarking work undertaken by the Water Services Association of Australia (WSAA) has attracted international interest and participation. In the March 2006 issue of WAMI the authors described the findings of the 2005 civil maintenance benchmarking programme; here, they report on the latest round of mechanical and electrical maintenance benchmarking carried out in 2006.

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In 2006, eighteen urban water utilities from Australia, New Zealand, and the US, 14 of which are WSAA members, embarked on a comprehensive process benchmarking study. The study was designed to measure the efficiency (cost) and effectiveness (service level) performance of, and identify leading practices in, several key mechanical and electrical activities.

The benchmarked activities were classified as breakdown, scheduled and renewal (capital) maintenance, and included activities relating to water and wastewater assets and operations. Table 2 shows the fifteen activities benchmarked on facility by facility basis, generally for the 2004/05 reporting period.

Due to its varying year-on-year nature, renewals maintenance was not quantitatively benchmarked on a cost versus service level basis (as per breakdown and scheduled maintenance), but cost and practices information was gathered for this area.

Results of the study threw into focus utilities that are leading and those that are lagging in performance, and the key drivers of such performance. All utilities, and the industry as a whole, were presented with perspectives, insights, and challenges that were immediate and likely to last well into the long term the next round of mechanical and electrical maintenance benchmarking, expected to be in 2010.

Project details and deliverables

UMS, with its alliance partner GHD, won the bid to carry out the contract, with the project overseen by a WSAA steering committee initially comprising representatives from six member utilities: Brisbane Water, City West Water, Hunter Water, Melbourne Water, Sydney Water, and the Water Corporation of Western Australia. Subsequently the committee was extended to include international representation from Seattle Public Utilities in the US, and Watercare Services of New Zealand.

All data and performance information was blind coded on an activity-by-activity basis to ensure that no utility was able to directly compare its performance to another utility. Utilities are able use their results in public or show them to their respective economic regulators.

Key project deliverables included individual data validation reports and teleconferences, one- to two-day on-site interviews, detailed individual utility reports and teleconferences, including customised improvement roadmaps, and a major industry report. The project concluded with a best practice workshop that was extremely well received, and which presented key leading mechanical and electrical maintenance practices, particularly in areas found to be of interest and priority to the industry.

Australia	New Zealand
ActewAGL Hunter Water Sydney Water Power & Water Corporation Brisbane Water SA Water Hobart Water Central Highlands Water City West Water Gippsland Water Melbourne Water Water Corporation of Western Australia	Christchurch City Council North Shore City Council Watercare Services Ltd **United States** Portland Water Bureau (Oregon) San Francisco Public Utilities Commission Seattle Public Utilities

Table 1
The benchmarked peer group.

Breakdown maintenance	Scheduled maintenance	Renewal maintenance
Water Pumping Stations	Water Pumping Stations	Water Pumping Stations
Wastewater Pumping Stations	Wastewater Pumping Stations	Wastewater Pumping Stations
Water Treatment Plants	Water Treatment Plants	Water Treatment Plants
Wastewater Treatment Plants	Wastewater Treatment Plants	Wastewater Treatment Plants
Water Disinfection Plants	Water Disinfection Plants	Water Disinfection Plants

Table 2
Benchmarked mechanical and electrical maintenance activities.

Comparison of 2001 and 2006 mechanical and electrical maintenance benchmarking programmes

A number of enhancements and changes to measures were made in 2006 compared to the 2001 study, making detailed quantitative comparisons difficult. An overall

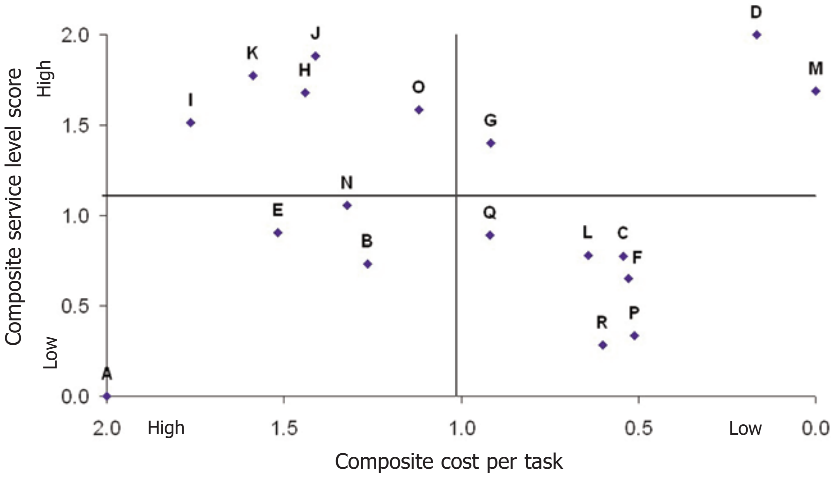


Figure 1
Overall cost and service level performance.

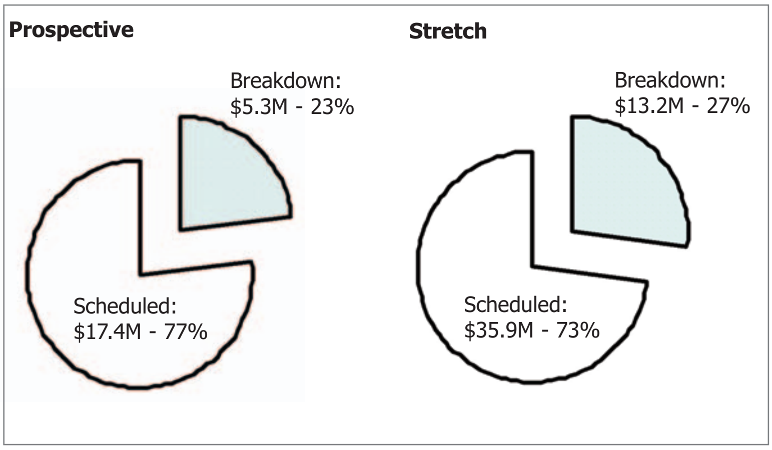


Figure 2
Potential savings range: prospective to stretch target levels.

comparison, however, was able to be made showing the relative movement in cost and service performance of the ANZ utilities that participated in both 2001 and 2006, when compared to each respective year's industry average. Overall, the industry appears to have improved its cost performance by 9%, with some 5% apparent decline in maintenance delivery service level. Some utilities continue to improve whilst others have lagged this cost service trend.

From a qualitative perspective, since 2001 the industry has identified and made fundamental changes in a number of key strategic and operational areas relating to mechanical and electrical (M&E) maintenance in two domains: asset management and service delivery. These include:

1. Asset management domains

- **Asset management structures:** Low-cost asset management utilities have matured and gained greater sophistication in key asset management processes, have a greater scrutiny on costs, strong links to asset owner expectations, cultural development and alignment, and so on. However, a number of utilities have still to embrace and effectively apply asset management structures to their M&E operations, and as such the gulf between leading and lagging utilities is likely to widen.
- **Asset plans:** Detailed asset plans are now commonplace, particularly as regulators and key stakeholders are demanding them for monitoring purposes. Dynamic M&E asset plans will be required to keep pace with and stay ahead of regulatory demands in prudently demonstrating effective management of cost and service levels.
- **Maintenance optimisation and planning:** Low-cost utilities are increasingly improving their sophistication in applying maintenance optimisation techniques on a regular and formalised basis and incorporating them into their day-to-day decision making processes. A key factor will be understanding the cost and service level impacts of scheduled and other proactive maintenance, and developing appropriate maintenance regimes based on asset criticality, redundancy and availability requirements.
- **Risk management:** Risk-based decision making is continuing to improve among better performing utilities, particularly as regulatory and environmental risks are increasingly transparent. Many lagging utilities have yet to implement effective risk management frameworks.
- **Service level agreements:** Service level agreements (SLAs) have been increasingly scrutinised for value. Trends are to remove the internal costs of managing such agreements and simplify them to a point that allows consistent delivery and quality between internal and external workforces
- **Performance management:** Performance measures are well established in the industry but effective application of measures still varies significantly among the M&E utilities. Better performers are updating and translating measures down to the field level to better influence and incentivise behaviour
- **Data capture and systems:** Effective data management is becoming a strong challenge for many utilities as they seek to cope with increasing demands for accountability and information, and particularly M&E data where assets

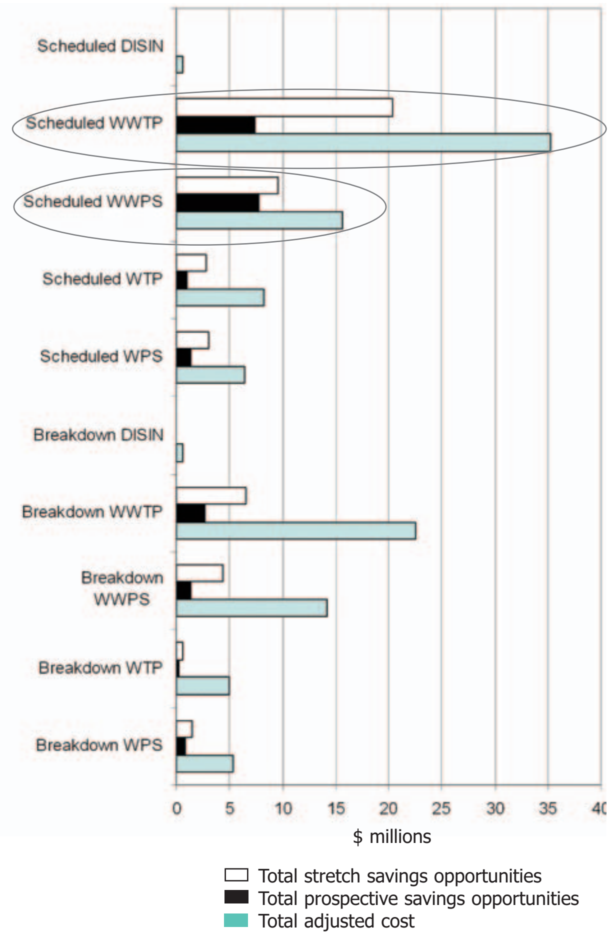


Figure 3
Spend levels and potential prospective stretch savings by benchmarked activity.

are complex and varied. Maintenance management and asset management systems continue to be widely deployed in the industry with some utilities now moving to newer technologies and IT platforms, and developing better data management and systems integration models.

2. Service delivery domains

- **Resource planning:** Various mixes of internal and external workforces have been adopted, with no 'one size fits all' solution. Low-cost utilities are tailoring their M&E resource strategies to the strategic needs of the business.
- **Crew sizing:** Many within the industry have moved towards adopting single person crews on several M&E maintenance tasks, with an emphasis on multi-skilling and better balancing specialisation needs between internal and external workforces.
- **Partnering:** The use of contractors has grown appreciably. Some utilities have established alliance contracts for the delivery of the full range of M&E maintenance services. Best practice suggests fully leveraging the capability of contractors to maximise the value from their experience and expertise in areas such as innovation and asset management.
- **Direct overheads and supervisory:** With the reduction of staff, increased use of contractors, more complex information and asset systems and so on, there has been a trend for supervisory and clerical M&E overheads to increase.
- **Succession planning:** Succession planning has become a significant issue as the average age and years of service increase and the decision making and service delivery skills are becoming a premium. Apprenticeship and graduate programmes have proliferated, and proactive human resources and knowledge management planning and implementation will be key for a successful future.

Industry performance: cost, service level and safety analysis

Cost and service level performance

Cost and service level performance highlighted key differences in the industry. Based on water and wastewater composite mechanical and electrical service level and cost performance, there are two clear groups of performers: those with better than average cost per task, with varying service levels depending on how they treat task definition and scope (particularly for scheduled maintenance); and those with worse than average cost, who are generally clustered around average to high service level (suggesting their higher service level comes at a higher cost) – see Figure 1.

In terms of quantifying overall cost saving opportunities, one reference utility was identified as the 'prospective' target, that being Utility G as the highest cost performer in the group that exists to the right of the vertical line in Figure 1. 'Stretch' performance was based on the cost average of this peer group.

This group also represents those utilities exhibiting an overall lower than peer group average cost per task, and contained a wide set of utilities from small retailers to the larger wholesalers. Figure 2 highlights the significant opportunities that may be on offer for the industry. The largest prospective and stretch opportunities lie in the scheduled maintenance area, which constitutes $17.4 million (77%) and $35.9 million (73%) of the total prospective and stretch savings respectively.

Figure 3 breaks down the savings into their constituent benchmarked activities for prospective and stretch savings respectively. Note that the high spend areas have also given rise to the high opportunity areas. Prospective and stretch savings are dominated by opportunities in scheduled wastewater treatment plants (savings estimated from $7.3 million to $20.4 million respectively), and scheduled wastewater pump stations (savings estimated from $7.7 million to $9.5 million respectively).

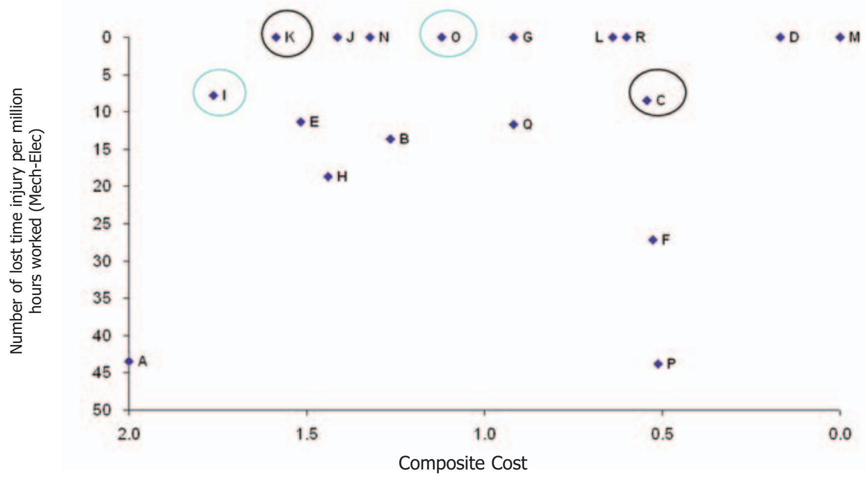
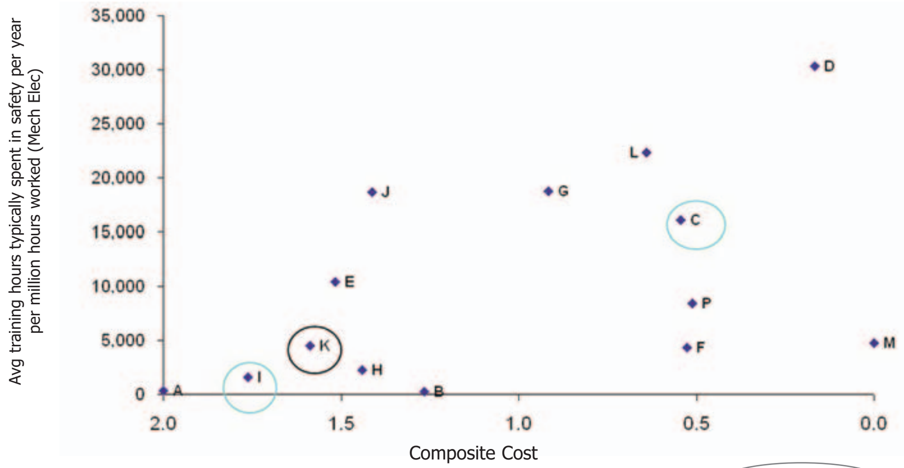


Figure 4a: M&E internal and external staff - lost time injury frequency rate.



Outliers: Co Q (0.92; 56, 936), N (1.32; 59, 796), R (0.6; 91, 335), O (1.12;5, 81, 823)

Figure 4b: M&E internal and external staff - safety training hours per million hours worked.

Safety

The overall safety performance of the industry is good, with nine of the eighteen utilities recording no lost time injuries. As shown in Figures 4a and 4b, there is also no correlation between lost time injuries and cost per task, or lost time injuries and typical training hours.

Key themes and leading practice attributes of high service and least cost

Based on overall and functional quantitative results and qualitative observations, there are five key industry themes that highlight the attributes of high service and low cost as found in

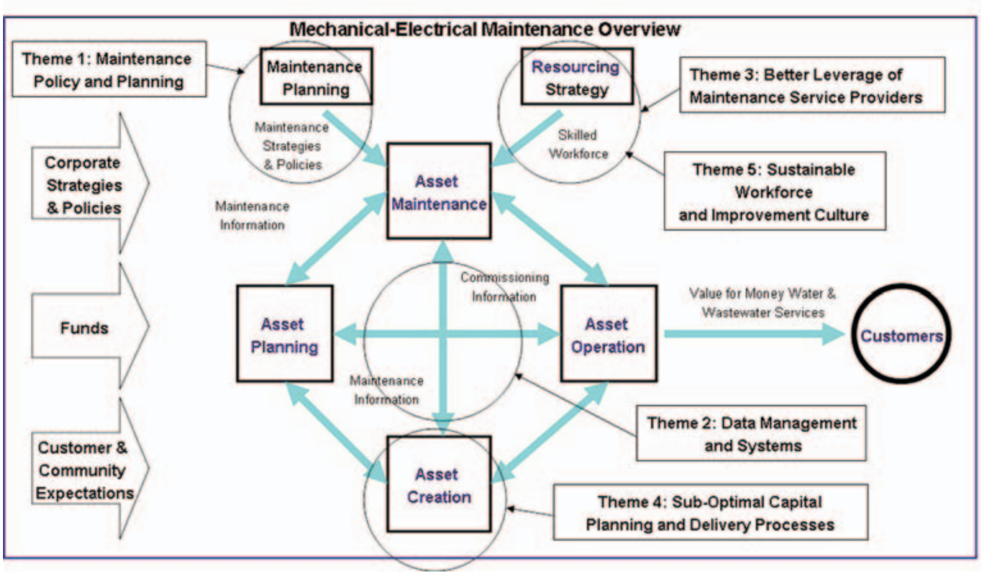


Figure 5
Asset management activities with other related maintenance activities.

low cost performing utilities:

1. Maintenance policy and planning
2. Data management and system integration
3. Better leverage of maintenance service providers
4. Sub-optimal capital planning and delivery processes
5. Sustainable workforce and improvement culture

The industry themes can be depicted in the context of a typical asset management model. The relationship of asset management activities with other related maintenance activities is shown in Figure 5.

1. Maintenance policy and planning, comprising the following sub themes.

Maintenance policy and strategy

Most utilities developed asset plans with varying degrees of centralisation and accountability, which had a strong link to corporate and service-level objectives. Most of the low cost performers are adopting risk based decision making at the corporate, asset, and project levels, with several low cost performers also using a risk based approach in developing maintenance policy through the use of asset condition based analysis techniques such as RCM.

Scheduled maintenance represents the largest savings opportunity in the industry. All water utilities need to conduct a rigorous review of their scheduled maintenance processes, noting that:

- Most utilities in the peer group used a moderate to large definition of task scope (centred on plant asset or facility), whereas some of the low cost performers used a small to moderate definition (centred on an asset component). This impacted their service level and cost per task, particularly for scheduled maintenance
- Water utilities do not have the asset condition information to vary their scheduled maintenance procedures, standards and policies
- The current maintenance arrangements are based on inconsistent application of procedures, standards and policies across scheduled activities, which can ultimately drive over-servicing and lead to increased costs and possibly lower service levels (that is, they can contribute to longer repair times)
- Many are unable to quantify the cost and service level impacts of scheduled activities, and therefore justify the current high expenditure levels

Most utilities within the peer group did not have formal cost-to-serve strategies based on assessments of regulatory and customer outcomes, cost and service level drivers, and business risk. In particular:

- In mechanical and electrical maintenance there tends to be a very strong focus on meeting service level imperatives (odour control, overflows and spillages, and so on)
- Many water utilities in the peer group did not have a sound understanding of their cost-to-serve strategy for mechanical and electrical maintenance at an aggregate water versus wastewater level, or breakdown versus scheduled level (that is, how much it would cost the organisation to meet increased service levels for certain asset classes or tasks, or how much the organisation could save by relaxing service levels for certain asset classes or tasks)

Several low cost performers have implemented or are attempting to standardise their equipment, particularly instrumentation and controls, but this is not practised extensively. Corporate procurement policies that used multiple design and construct contracts were cited by some utilities as leading to non-standardised plant and equipment, and consequently high maintenance costs. In general, this is an area that was poorly addressed across the peer group.

Maintenance planning techniques and tools

Some low cost performers increasingly use risk and condition-based assessment techniques and tools such as FMECA, RCM, RCA, LCA and CBM. They have carefully considered the application of sophisticated tools, trialed them on critical or major assets and/or facilities, and have found that careful application appeared to result in improved reliability and availability, amended maintenance schedules and reduced life cycle costs.

However, most utilities are not systematically using these tools and remain unclear about their maintenance strategies based on asset criticality, redundancy and availability requirements. Further, a shortage of skills exists within the industry in relation to knowledge of application of maintenance planning techniques.

Resourcing

All low-cost performers were adopting small crew sizes (see Figure 6a) for first response tasks with many attaching extra people as required, particularly for safety and confined space reasons. Low-cost performers are adopting multi-skilling to minimise crew size. Many utilities within the peer group adopted the resource strategy of an optimised mix of internal and external labour (see Figure 6b) supported by high degrees of specialisation for high volume and/or specialist tasks.

To minimise confined space impacts some utilities have critically re-evaluated their confined spaces against the regulations to ensure that only genuine confined spaces are classified as such, and proactively designed out as many confined spaces as possible by changing design requirements and standards.

2. Data management and system integration, comprising the following sub themes.

Data management

Most low cost performers, and indeed, many utilities in the peer group had asset management systems that did not meet the full range of maintenance management requirements. Typical issues include:

- Insufficient asset management, maintenance management and

performance management functionality
- Data hierarchies structured to meet financial or other corporate requirements, rather than operational
- An inconsistent approach to data management for different maintenance functions, particularly between treatment plants and pumping stations. This was particularly evident for asset condition data, with many different approaches utilised (different tools used for assessment and different approaches to the capture and storage of information)
- A lack of formal asset management systems strategies that linked with corporate IT strategies.

Whilst several low cost performers were generally collecting some cost and service level data, most utilities in the peer group had a predominant focus on cost data collection and management. Significantly less focus was afforded to service level and workload data collection and management (impacting on the ability of a water utility to develop cost-to-serve strategies).

The focus on cost data collection and management was further compounded by a general lack of formal data collection and management resources and processes in some parts of the industry. Most low cost performers were addressing this issue and making available analytical expertise and processes for the collection and utilisation of critical cost by function and service level data.

System integration

Most low-cost performers, and indeed the industry in general, had low levels of system integration across mechanical and electrical asset management, maintenance management and field-based activities. Many still adopt paper based processes and manual data entry of key maintenance information (for instance, a low level of use of field resource management systems existed in both treatment plants and pumping stations across the peer group, resulting in paper-based communication of work orders and schedules and manual data entry of maintenance information). System upgrades are now the norm for the industry, however, many are struggling with the associated data migration issues as follows:
- Loss of asset history
- Changed data definitions
- Reduced functionality
- Reduced reporting capabilities
- Reduced mechanical and electrical specific asset and maintenance management capabilities.

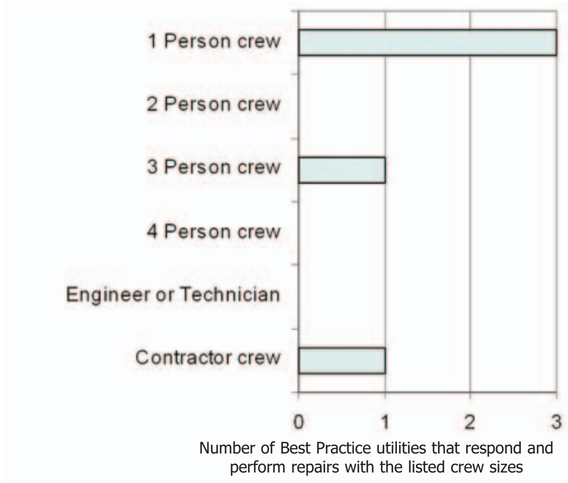


Figure 6a
Best practice crew sizes for scheduled maintenance at wastewater treatment plants.

The industry challenge is to select systems that support their business and facilitate effective and efficient asset management and maintenance management.

SCADA systems

A majority of utilities in the peer group had more than one SCADA system for pumping stations and treatment plants. The degree of implementation and use of SCADA systems varied across the water industry. All of the low cost performers have either fully or partially adopted SCADA systems on their pumping stations and treatment plant facilities that incorporate detailed fault advice capabilities.

3. Better leverage of maintenance service providers, comprising the following sub themes.

Asset management

Very few low-cost performers were leveraging the international, domestic and local skills and experience of their contractors to improve the management of their assets. Areas where contractor expertise could be better used by the utilities for asset management include:
- Asset management practices such as asset investment planning and spend optimisation
- Data management and systems (that is, advice on the efficient collection of cost, service level, productivity and asset condition data, the selection and integration of asset management, maintenance management and field based systems, and management of data quality)
- Effective use of advanced maintenance planning techniques such as FMECA, RCM, RCA, LCA and CBM
- Performance management (that is, implementation of productivity and utilisation measurement)
- Risk management

Service delivery

Few low cost performers leverage the skills and expertise of the contractors in service delivery areas, particularly as very few of the utilities had single contractors to extract benefits. Areas where contractor expertise could be better used by the utilities for service delivery include:
- Resource planning (that is, advice on crew strategy for breakdown, scheduled and renewal tasks, in order to optimise crew allocation and utilisation)
- Data management and use of field-based systems
- Knowledge management and training (that is, areas such as formal staff rotations or secondments, succession planning, ageing workforce, knowledge management and skills replacement, workforce retention and recruitment strategy, and professional and technical training)
- Improved design of plant and facility

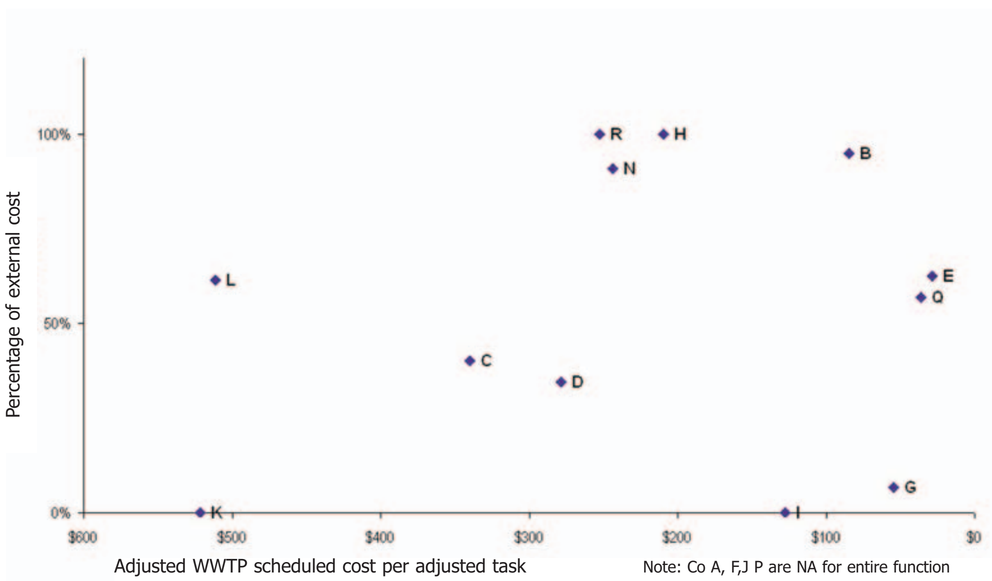


Figure 6b
Internal / external resource mix for scheduled maintenance at wastewater treatment plants.

Breakdown Maintenance

Policies	Practices and technology
• Effective breakdown priority systems in place for customising breakdown response • Strong governance and policies designed to optimise and produce greater spend accountability • Leverage or bundling of orders when purchasing materials and/or services • Greater standardisation of equipment and procedures and reducing the costs associated with managing complexity (for instance, complex skill sets, documentation, contract negotiations, breakdown repair time and task standards and so on) • Detailed documentation and robust documentation control in critically understanding requirements, allowing ease of access to key information, effective knowledge transfer, and effective feedback processes (such as easy to use templates, electronic information flows and so on) • Intelligent and centralised alarming and SCADA systems linked to appropriate staff • Real or near real-time field computing and feedback • Use of lower-paid staff for extra person attendances in meeting confined space safety requirements • KPI-driven culture focusing on productivity and job cost as part of the KPI mix, and effective performance management of contractors. Incentives are formalised and based on key cost performance criteria.	**Mechanical** • Limited electrical qualification • Single (one) person crews (for instance, using cranes on trucks for removal of submersible pumps rather than two people using lifting chains and so on) • Ready access to containment (for example, to alleviate risk of overflow), emergency pumping station **Electrical** • Multi-skilled with instrumentation and control • Usually rostered for out of hours and can deal with most issues **Instrumentation and control** • Ability to multi-skill with electrician • Optimal standardisation of instrumentation and control equipment

Table 3a
Specific leading attributes for breakdown activities.

layouts
- Review of maintenance schedules

Most low-cost performers, and indeed most utilities in the peer group, did not have processes in place to support collaborative improvement efforts between internal and external resources in order to share knowledge, or enable process or practice improvements across both workforces. The internal and external workforces tended to work in geographically different areas and rarely interacted.

Contract form
Most utilities in the peer group have adopted lump sum, schedule of rates or time and materials type arrangements with their contractors. Few utilities in the peer group have alliance-style contracts in place. Some of the low-cost performers achieved better outcomes from their contractors if contracts were structured to include some of the alliance principles as follows:
- Reward for innovation
- Collaborative work arrangements such as staff rotations and secondments
- The development and implementation of formal knowledge-sharing processes and systems (particularly in the areas of asset management, maintenance management, FMECA, RCM, RCA, safety, training and so on)
- Risk-based performance incentives
- Performance drivers and measures that directly support the utilities' corporate outcomes.

4. Sub-optimal capital planning and delivery processes, comprising the following sub themes.
Capital planning process
The majority of utilities had formal capital planning, delivery and approval policies and processes in place. This process was generally sub-optimal due to poor procedures in relation to spend optimisation, equipment standardisation and project planning. Further observations include:
- Only low-cost performers focus on spend optimisation as it relates to the maintenance and capital trade-off
- For some high cost utilities, corporate procurement policies have driven competitive design and construct tenders for every project rather than bundling of like projects, which has resulted in a multitude of different plant, equipment and control systems that all require different parts, skills and knowledge to maintain
- Some high cost utilities have contracts for capital projects that do not have clear processes and requirements for the handover of documentation including as-built drawings, O&M manuals, commissioning results, plant information, and so on. This has resulted in receipt of incomplete information, commissioning delays, additional maintenance cost and difficulty in conducting appropriate staff training.

Key stakeholder involvement
The capital planning processes used by most utilities were typically either asset management or maintenance-centric and lacked collective input from asset planners, project managers, design staff and operational staff. This caused several issues including: lack of standardisation with respect to plant design and technology, an inconsistent view of project management responsibilities and approach, and a lack of streamlined handover and commissioning of new plant.

5. Sustainable workforce and improvement culture, comprising the following sub themes.
Training and skills availability
Staff training is focused on technical aspects, with a lesser emphasis on professional training and succession planning. Most utilities are using nationally recognised training programmes for their maintenance or field staff. Further observations include:
- There was a strong emphasis on technical training (safety, equipment usage, and so on) across the peer group
- There was a lesser emphasis on formal professional training (management training, asset management, analysis, presentation skills, communication skills, and so on)
- There were very low levels of formal succession planning conducted across the utilities in the peer group, with most limited to management levels
- Few utilities in the peer group had formal secondment or staff rotation programmes in place to support technical and professional training and development initiatives, either with their internal workforce or contractors
- Many utilities in the peer group are unable to attract high-calibre recruits and are also having problems retaining skilled resources (given competition for resources from IT, mining and so on)

Ageing workforce
A few better-than-average utilities are highly dependent on employees with considerable experience and knowledge. An ageing workforce and lack of formal knowledge management systems is presenting an immense sustainability challenge to the entire industry. These challenges are beginning to be addressed by most low cost performers. A high proportion of internal and external mechanical and

electrical staff are in the 35 to 54 age range, with those in the 45 to 54 age range representing approximately half the staff numbers. Furthermore, there was a limited application of formal knowledge management systems throughout the industry (for instance, documented details and records of assets, documented operational procedures and history for problematic assets, detailed descriptions of work policies and practices for complex tasks, and so on).

Specific policies, practices and technology: breakdown, scheduled and renewal maintenance

Tables 3a, 3b and 3c provide a summary of specific technical leading policies, practices and technologies as used by the leading performers in the peer group for breakdown, scheduled and renewals respectively.

Industry improvement initiatives

Based on the findings of the study there are four key improvement initiatives for the industry, briefly summarised as follows:

1. Improved data management and system integration review

Many utilities struggle to access accurate cost, workload, service level and asset condition data. Effective asset and maintenance management is being undermined by poor data management approaches, and as such there is a need to identify and develop cost, workload and service level data appropriate for breakdown, scheduled and renewal tasks. It is recommended that utilities use the 2006 WSAA mechanical and electrical benchmarking study and current regulatory requirements as a basis for identifying relevant cost, workload, service level and asset condition data for collection and analysis.

2. Rigorous scheduled maintenance review

There are different approaches to scheduled maintenance tasks, based on varying the scheduled task scope (that is, maintenance at an asset level versus a plant or facility level), and differing crew strategies (specialisation versus multi-skilling). Undisciplined asset management applications also exists in the industry, leading to inconsistent procedures, standards and policies across scheduled activities, which can ultimately drive over-servicing and lead to increased costs and possibly lower service levels. It is recommended that utilities implement a comparative review of all scheduled tasks, investigating the number and scope of tasks, the size of mechanical, electrical and I&C crews, people, processes and technology. This should be complemented with well-targeted visits to best-performing water utilities to understand how scheduled maintenance is managed in these organisations.

Scheduled Maintenance	
Policies	**Practices and technology**
• Identification of service level requirements for plants, critical assets, key stakeholders, etc. • Effective RCM maintenance policy in place (such as criteria for run to failure or time-based maintenance for critical assets, proactive policy on opportunistic repairs) • Strong governance and policies designed to optimise and produce greater spend accountability • Well-defined scheduled task definition based on plant complexity, knowledge of asset condition, application of a condition based or time based strategy and other key business criteria • Getting the right balance between scheduled work and the available breakdown resources who can conduct scheduled work as required • Leverage or bundling of orders when purchasing materials and/or services • Greater standardisation of equipment and procedures and reducing the costs associated with managing complexity (such as complex skill sets, documentation, contract negotiations, scheduled repair time and task standards and so on) • Detailed documentation and robust documentation control in critically understanding requirements, allowing ease of access to key information, effective knowledge transfer, and effective feedback processes (for instance easy to use templates, electronic information flows and so on) • Real or near real-time field computing and feedback • Use of lower-paid staff for extra person attendances in meeting confined space safety requirements • KPI-driven culture focusing on productivity and job cost as part of the KPI mix, and effective performance management of contractors. Incentives are formalised and based on key cost performance criteria	**Mechanical** • Planned refurbishment of critical pumps. • Online bearing monitoring, but with limited application to major critical assets • Efficiency testing of pumps, mixers and aerators • Noise and vibration monitoring of mechanical plant, but with limited application of fixed vibration monitoring to critical plant • Oil analysis, but with limited application and success or value in reducing maintenance costs • Containment testing • Limited electrical qualification **Electrical** • Battery replacement schedule • Generator testing. • Switchboard thermography (application on large switchboards). • Routine replacement of critical components • Megger (motor coil) testing, but with limited usefulness in some cases • Motor current analysis **Instrumentation and control** • Standardised PLC components • PLC monitoring • Standardised field devices • develop maintenance requirements with supplier partners • Regular alarm testing • Calibration of instrumentation given high priority, given increasing importance of criticality of plant, especially arising from application of HACCP processes to water quality and more recently wastewater treated effluent quality

Table 3b
Specific leading attributes for scheduled activities.

3. Developing a cost-to-serve strategy for mechanical and electrical maintenance

Many water utilities do not have a unique understanding of the relationship between mechanical and electrical cost and service level in their business and the possible trade-off options and implications. An agreed cost-to-serve strategy is the starting point for effective mechanical and electrical maintenance planning and delivery. It is recommended utilities take steps toward developing a cost to serve strategy for mechanical and electrical maintenance

4. Developing a sustainable workforce strategy

In both the 2005 civil maintenance programme and 2006 mechanical and electrical maintenance programme, issues were identified in relation to workforce strategy. It is recommended that the current workforce strategy should be reviewed in relation to sustainable workforce strategy, particularly in the areas of recruitment, staff development and training, the ageing workforce and knowledge management. Future strategies ought to include development of skills and competency matrices, clear succession plans, formal knowledge management processes, staff secondments and rotations, and so on.

The above four improvements coalesced from a wide range of improvement opportunities were seen to provide scope for major cost savings and business improvements across most of the utilities.

Further developments

A great deal of national and international interest continues to be generated as a result of the recent mechanical and electrical process benchmarking study. The reputation for developing keynote and incisive challenges for quantum business improvement also grows. Evidence of the increasing number of domestic and global enquiries could be seen by the

Renewal Maintenance

Policies

- Effective renewal policies in place that are tied to financial and life cycle requirements of plant (such as trigger points for replacement based on economic as well as technical and regulatory drivers, spares policy and so on)
- Strong interaction between internal and external capital and maintenance stakeholders during design, capital delivery planning, implementation and post implementation phases
- Designing out costly confined space areas and other safety requirements like rails and ladders, and searching for credible alternatives
- Full commercial scrutiny and application of best technical options (such as balancing standardisation and adopting new technologies)
- Effective project management to allow delivery to budget and cost standards
- Renewals are programmed well in advance to minimise cost, and allow effective outage management and resource balancing between breakdown, scheduled and renewal work
- Effective use of highly skilled, dedicated capital workforces based on optimal internal and/or external workforce arrangements
- Effective use of contractors based on innovation, credible timeliness of delivery, quality, cost and safety records
- Robust commissioning and plant handover procedures where requirements are well identified and communicated in conjunction with an efficient process for receipt of key documentation (such as as-builts, operating manuals, commissioning details and records, on going support information, asset and cost information, and so on)
- Regular process in selection of appropriate renewals practices and techniques and encompassing – investigation, awareness and documentation, seeking peer experience and assessing benefits
- Encouraging innovation and development.
- KPI-driven focusing on service requirements, and the long term cost–benefits of reductions in break-down and scheduled activity as part of the KPI mix. Incentives are formalised based on key service level performance criteria (such as timeliness of delivery, quality of works and so on)
- Identifying and understanding the service level components of renewal tasks for use in future forecasting and decision making in relation to renewals programmes

Practices and technology

Mechanical, electrical, and instrumentation and control

- Internal and external staff involved in the capital planning and delivery process
- Utilising theses renewals resources in breakdown and scheduled for resource balancing

Table 3c
Specific leading attributes for renewal activities.

interest shown at a recent presentation on WSAA process benchmarking at the 2006 IWA World Congress in Beijing, China.

In addition, arrangements and protocols are in place for those seeking improvements to meet with utilities that did particularly well in certain areas. These protocols have already proved helpful, particularly to those now actively developing their mechanical and electrical maintenance business strategies.

WSAA is now planning for the 2007 customer services process benchmarking programme, a co-initiative between WSAA and the International Water Association (IWA). The IWA will therefore be a member of the steering committee for the 2007 programme. IWA's involvement is expected to raise the programme's international profile and increase the number of international participants. ●