



TECHNOLOGY ADOPTION: THE GOOD, THE BAD AND THE UGLY

NACWA

Dr Piers Clark
Chairman Isle Group
July 2017



IDENTIFYING CHALLENGES



We collaborate with the world's leading utilities. After establishing their challenges we find solutions through the independent sourcing of innovative technologies.

CONNECTING TECHNOLOGIES



We provide market intelligence for technology providers, helping them commercialise new solutions through dialogue with end users.

COLLABORATIVE EVALUATION



Our Innovation Forums collaboratively review emerging technologies resulting in demonstrations and trials for technology companies globally.

SECURING EXTERNAL INVESTMENT




We connect the right technologies with the right investors and provide support through technical and market due diligence.




ALL OUR SERVICES REVOLVE AROUND THE STRATEGIC IMPLEMENTATION OF EMERGING TECHNOLOGIES AND INNOVATIONS

Why Isle?



Innovation collaboration on a global scale

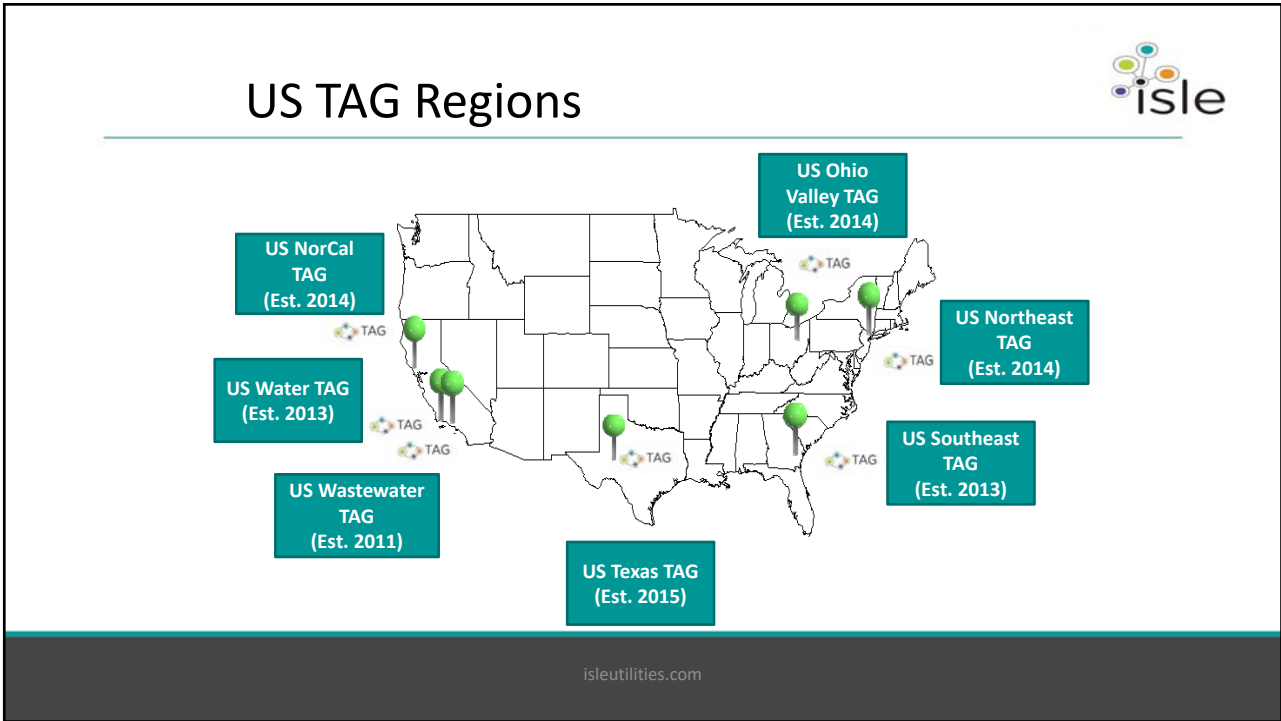
There are very few challenges today that haven't been tackled in some way, by somebody, somewhere in the world. It is with this knowledge that Isle identified the need for utilities to work together globally.



- Office locations
- TAG Locations, Workshops and Events

21/	4,000+ TECHNOLOGIES REVIEWED	450+ TECHNOLOGIES PRESENTED TO END USERS	100+ TECHNOLOGIES COMMERCIALIZED	140+ END USERS	\$350M+ EXTERNAL INVESTMENT SECURED	4
-----	---	--	---	--------------------------	--	---

TOGETHER WE ARE
REVOLUTIONISING THE WAY
EMERGING TECHNOLOGIES
AND SUSTAINABLE SOLUTIONS
ARE COMMERCIALISED.





Rezatec (UK)

- Earth observation for catchment management and leakage detection
- Data analysis (predominantly satellite imagery) to provide dynamic, regularly updated, cloud-based decision support tools
- Used in water sector to:
 - estimate nutrient and pesticide input to catchments,
 - monitor peatland erosion,
 - assist drought planning and
 - potentially detect pipeline leaks
- Also used in food production, energy, forestry and carbon management sectors

isleutilities.com



LG Sonic (Netherlands)

- Water treatment through different uses of ultrasonic characteristics to control and prevent the formation of algae, including cyanobacteria
- MPC-Buoy incorporates sophisticated sensors and telemetry to determine and predict algal blooms
- Action diameter of 500 meters; can provide a more effective solution to algal blooms in large surface waters, without harming the ecosystem
- Monitoring data is reported online being readily accessible to end user in real time
- Analysis provides the interactive algae control in all the units of the system
- Units are self-powered by solar energy

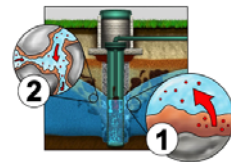


isleutilities.com



Blue BioLabs – MIDAS (Germany)

- Blue Biolabs is an accredited water analysis laboratory, utilizes analysis of bacterial DNA. This offers a 'near' complete identification/quantification of bacterial pops
- Various product (MIDAS, BioSeq, GenoTrial....).
- MIDAS - Molecular Iron Bacteria Detection And Screening
- Helps to assess the best time for well regeneration or pump cleaning by determining the level of microbial activity in well foundations and surrounding soil
- The sampling is simple without the need to switch off the well. The samples are analyzed in a BlueBiolabs' lab
- Midas can be applied to quantify well bio fouling. Being trialed/applied in the UK water sector



isleutilities.com



Enviplan (Germany)

- AquaTector fine-bubbled physical separation
- Dense, homogeneous micro-bubbles generate extremely high interphases and enable separation of almost 100% of the settleable material
- Approximately 100% of micro-bubbles 30-50µm diameter, operational pressure between 2 and 4 bar
- Pre-treatment in place of primary sediment, surplus sludge thickening, or tertiary treatment
 - TSS and FOG reductions (90-99%) (Pre-treatment)
 - 15x smaller footprint than primary sedimentation tank
 - Non-chemical treatment with low energy use
 - Multiple applications (ca 1000) in the municipal sector
- Austria: Replaced primary settlement tank, capacity increased from 80k to 120k PE.
- Thames Water: Trial under wide range of op conditions (with/wo iron, with/wo SAS, loading rates etc). Three sites identified
- Pilot plants available between 0.5m³/h to 10m³/h

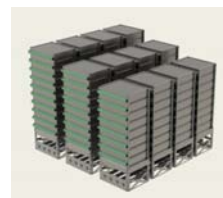


isleutilities.com



Cembrane (Denmark)

- Produces membranes in a flat sheet configuration rather than pressurized tubular/hollow fibre systems. The hollow plate is sealed off at the ends and immersed in water. A vacuum draws water into the middle via a suction pump outside the tank.
- Advantages of flat sheet configuration include better flux and lower energy consumption.
- Extremely hydrophilic and capable of transporting water through at high speed, resulting in a smaller footprint and lower ancillary equipment requirement.
- Applications in groundwater, surface and sea (pre-reverse osmosis, industrial WW, recovery of sandfilter backwash water, oil and gas).
- Have 30-50 operational installations worldwide.
- Others offer flat sheet ceramic membranes but the tech is not yet widely used in municipal water.

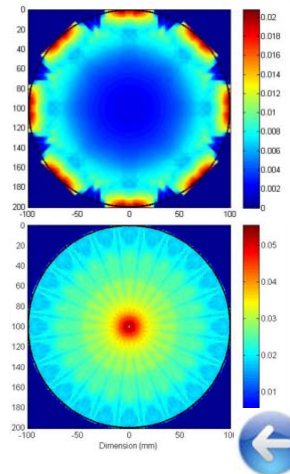


isleutilities.com

Typhon Treatment Systems (UK)



- LED UV disinfection and AOP
- Short wavelength ultraviolet (UV) light damages DNA and RNA
- UV mercury vapour lamps used to disinfect municipal drinking water for over 100 years but have multiple shortcomings
- Transmissivity loss in high capacity, large diameter UV systems results in insufficient dosing. Typhon claim to have solved this problem...
- It is expected that UV LEDs will be efficient and cost effective enough to enable Typhon's technology to be competitive in just over three years from now.
- Came to TAG at TRL3, when looking for prototype development funding. Now trialing with United Utilities.



isleutilities.com

Welltodo (Israel)



- Technology licensed from Technion University
- Proprietary catalytic reduction process for groundwater treatment; utilises hydrogen and a patented catalyst, supported by activated carbon cloth
- Converts nitrate to non-polluting compounds without generating any by-products
- Activated carbon cloth provides very high reactive surface area combined with a very low pressure drop
- Housed in standard modules, ready to be used in combination with off the shelf components in the assembly of complete systems
- Pilots in Israel and the US
- Lots of new, low/zero waste (brine) approaches to groundwater nitrate removal. Is this one of the winners?



isleutilities.com



3S Antriebe (Germany)

- Electrical actuators for buried valves in water, gas and district heating grids
- Convert manual valves into automated/remotely controllable valves
- Automated valves currently rare due to cost of installation (valve replacement, grid connection, PLC)
- 3S actuators attach to existing valve without interrupting supply, battery powered, wireless modem
- Enables low-cost smart water grid (€5-10k per valve)
- Helps maintain valves (regular opening and closing prevents sticking)
- Standby energy consumption is low enough to last 1 year (EU patent on energy saving technology)
- 100s installed (Germany, NL, Russia, Oz, Norway, Finland)
- Boring? But cheap, quick to install



isleutilities.com



Syrinx (UK)

- TrunkMinder is a fixed system that continually monitors the trunk main for small leaks that could escalate into bursts.
- Sensors are positioned in pairs and the section of pipeline between the sensors are protected.
- TrunkMinder is usually used where the trunk main is positioned near important infrastructure, such as hospitals, main roads, railways.
- Successful trials have been undertaken with Thames Water and Severn Trent Water .



isleutilities.com



Primus Line (Germany)

- High-pressure pull through liner designed for the trenchless rehabilitation of critical infrastructure
- Flexible, high-pressure hose has a multi-layered structure and very thin walls, providing both flexibility and ultra-high material strength, also allowing it to navigate bends.
- Fast, efficient, trenchless installation
- PE inner provides an extremely low K factor; does not need resin, UV or steam to set
- Cost: Material cost is comparable to CIPP. However, because there is no cure time or onsite wet out, labor and installation are dramatically reduced. A recent Installation in Seattle was completed in 2 days.
- Useful for long runs of pipe without service connections, under rivers or motorways for example.
- Not trying to be the best for every type of pipe rehab.



isleutilities.com

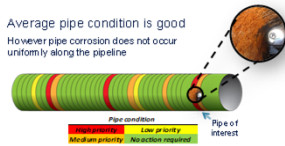


Detection Services: p-CAT (USA)

- Non-invasive and non-destructive pipeline condition assessment
- Based on inverse transient analysis – generating low pressure signals with pre-defined characteristics and measuring returning responses
- Screening tool for long distance pipe networks to identify small localised “hot spots;” can be used on metallic, reinforced concrete and/or cement based pipelines (AC)
- Can locate air/gas pockets, wall loss/thinning, lost lining, blockages and/or closed valves
- Good example of doing something in a new way – reading reflected pressure transients from a pipe fitting *instead of sending a pig-like device inside*



Average pipe condition is good
However pipe corrosion does not occur uniformly along the pipeline



isleutilities.com



Grundfos – BACMON (Denmark)

- Monitoring biological water quality requires time consuming laboratory methods or indirect online measurements.
- Bacmon is online, automated, reagent-less biological monitoring system.
- 3D scanning optics classify all particles as bacteria or non-bacteria by automatically moving a digital microscope over a flow cell.
- Output is a total bacterial count available in minutes. Data is wirelessly accessible.
- Applications: water distribution networks, w/water discharges and industrial applications.
- Installed at over 30 sites, mostly in drinking water applications across Europe. Results correlate well with DAPI staining.
- We weren't excited by this before seeing the actual TAG presentation. ('Paul Rutter was practically in rapture')



isleutilities.com



Optiqua (Netherlands)

- EventLab is a water quality monitoring and early warning system (the MiniLab is for on-site sensing).
- Optical sensors monitor full spectrum of possible contaminants, such as pesticides and heavy metals
- The EventLab is installed as a network of sensors to monitor the distribution grid online. Wireless data comms provides network wide early warning system
- Accurate location, rapid response and real-time monitoring of the spread of contamination within the network
- EventLab arguably not ideal. It tells you something has changed in the water but not what it might be (the Minilab does this).
- Various units sold (PUB, Netherlands)



isleutilities.com

MTA Messtechnik (Austria)



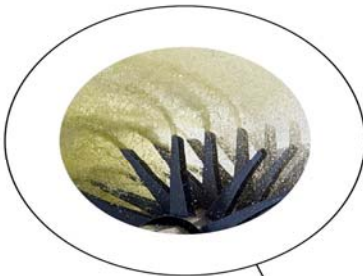
- Pipe Inspector is an untethered, wireless, battery powered, floating unit transported through pipe by flow of liquid; it is 40 % of pipe diameter.
- Visual condition assessment of pipelines from DN 100 upwards, regardless of the pipe material.
- Acoustic leak detection in pressurised, non-metallic pipelines up to DN 3000.
- Can inspect up to 50 km of pressurised sewer and 10 km gravity sewer without resurfacing.
- Since 2014 Pipe-Inspector has been used in nine sewer condition assessment projects.
- One of a few wireless pig-like products to emerge on the market. Great in theory...



isleutilities.com

Technology Trials:

The Good, The Bad
and the Ugly....



The Good



Orege and 'The Milk Round'

- SLG for sludge conditioning/enhanced thickening; a 'turbo DAF';
- 1 yr trial with Anglian Water. Operator '*Can you put legs on it?*'
- 3 units now bought (or in process) at c£250k each, 30 more planned
- 50% saving in sludge thickening costs. Ideal for satellites feeding STC

Bioplastics from Wastewater

- PHARIO Project, led by STOWA (The Netherlands)
- Can Ww bacteria produce good quality PHA?
- Actually they produce better quality than the established market!
- Most bioplastics are slow to degrade. PHA derived bioplastics breakdown quickly
- \$6/kg market price, production cost at \$3.5/kg
- 5 years research, full scale demo plant now up and running...

isleutilities.com

The Bad



Robotic cleaning/inspection of potable water storage assets

- 2003: Against the trends of the time (water quality regs were unsure about putting machines into clean water) one proudly innovative company did the work to prove the technology
- 15 years later robotics is normal/widespread activity in treated water assets and completely accepted by regulators. Obviously people still like to trial, esp if using it for the first time.
- Original water company who helped break open the market is now the only water company in the UK not using the technology. New personnel in new positions decided the risk was too high.
- Eventually agreed to a soak test (lasting number of weeks, locking up equipment).
- 2 months later admit they had accidentally tested the water from the test for the wrong experiment and needed to do the test again.
- The tech company refused.

isleutilities.com

And the Ugly



'A black hole of pain' Tech Co CEO when referring to large UK water utility

Wastewater Treatment Optimization Technology

- Long period of collaboration and testing, with \$5m invested by independent parties. Collaboration, collaboration, collaboration.
- Successfully proven at full scale. Big press launch (TV, papers, conferences etc). 1 unit purchased. Opportunity for many more (50+). Great celebration...
- 2 years on: No further units bought despite proven saving of <6months.
- This approach has killed all future sales as No one can understand why you wouldn't buy if you know it works
 - Investors feel cheated
 - Staff (in utility and in tech co) feel disillusioned

21/07/2017

isleutilities.com

41

It can always get uglier...



ANONIMITY PRESERVATION ALERT

Leakage Detection Technology, working for a large European Utility

- Product created in early noughties as a joint research project between utility and local university. Spun out as a separate company in 2004. Followed by 10 years of collaborative testing + piloting. All successful. Everyone happy.
- 2014/15: Major OJUE public tendering process completed. Very expensive but \$5m contract awarded for 140 units to be installed over coming 2 years. Tech Co 'gears up' to deliver contract
- Two years on the utility have bought 80, but installed only 3, none of which have been completely commissioned.
- Delays blamed on internal alliance 'delivery' partner (who also adds a fee of c\$80k to each installation (units cost \$40k)
- Twist No 1: For the first time in 9 years, in 2016 the company has missed its leakage target
- Twist No 2: Chairman of the National Regulator is a shareholder in the Tech Co, dating back to before he became chairman and all part of public record. He has a widely stated agenda on 'resilience and innovation'
- CEO for Tech Company fighting to retain position as board/investors ask 'how?'
 - **'I have truly taken it up the xxxx Deliverance-style. Banjos playing, backwoods fires burning...'** Tech Co CEO

21/07/2017

isleutilities.com

42

Better ways to work...



- George Hawkins blog: <http://georgehawkins.net/moonshot/>
 - Tech providers always claim their solution will save money.
 - Frustration at the industry is misplaced.
 - There can be good reasons for slow adoption
 - We need a *platform* to drive better *collaboration* ('BlueWave')
 - Focus on US market initially
 - *Specifically about leveraging big utilities to small*

isleutilities.com

Collaborative Technology Trials by European TAG



Technology	Description
Greener Waste	Modular Reed Bed with P removal
Weedingtech	Trial to test effectiveness of weed killing system on water and wastewater locations
Ferrate (onsite generator)	Testing ferrate performance on multiple contaminants
ZAPS	Real time optical analysis of multiple parameters – validation and testing of system
LG Sound	Floating algae monitoring and Ultrasonic treatment
Puralytics	Decentralized / disconnected property water treatment
Hydro Industries	Electrocoagulation trial and comparison to chemical coagulation
Strathkelvin	Trial to verify instrumentation cleaning and calibration, as well as potential to control aeration system
Frog Environmental	Trial to test floating reed bed system and P removal media in final effluent lagoons
Water quality sensors	Comparison of multiple water quality sensors in distribution systems
Utilys	Satellite leak detection on images 50kmx70km, Specifically testing for 'Dutch circumstances', with 4 Dutch utilities paying 80 k€

isleutilities.com

Collaborative Trials by Australian TAG Members



Technology	Description
Echologics – LeakFinder	Leak detection and condition assessment
Thinkxtra - Sigfox	Intelligent Networks (IoT)
Assetic Predictor	Asset management software
Pure Technologies – PipeDiver	Leak detection and condition assessment
Rezatec	Water resource management (mapping pollution sources)
ENDETEC – Tecta PDS	Rapid microbiological contamination detection
Geointeractive – 3D mapping	Leak detection and condition assessment
Steinhardt - Hydroguard	Sewer flushing equipment
Ultrawaves	Sludge treatment
NNCo - LoRA	Smart meters
Salt Water – AqMB Prophet	Forecasting and optimization software
Sewer Batt	4 Utilities: Watercorp, Goulburn Valley, Coliban, QUU. Comparison of acoustic tech vs conventional CCTV for sewers. Investment of c\$150k
Syrinx	6 Utilities - Coliban, GWM, QUU, SA Water, SEW, Sydney Water, WSAA – c\$200k

isleutilities.com

Collaborative Studies Across Global TAG Regions



Technical theme	Description
In-pipe hydro	Reviewing microturbines installed in pipes and pressure reduction infrastructure
Leak detection and condition assessment	Benchmarking analysis of established and emerging technologies
Water quality sensors	Comprehensive review of water quality monitoring and analytics solutions
Pipe lining	Comparison of current and emerging pipe lining technologies
POU filtration devices	Evaluation of global technology solutions for lead and bacteriological contaminants (particular interest in public spaces, including schools)
Pipe cleaning	Comparison of current and emerging technologies to clean distribution pipes
Pure Technologies	Condition assessment tool for cement mortared steel pipes Led by Evides, sponsored by 16 utilities from AU, UK and EU. Investment in excess of £200k. The trial was a success technically.

isleutilities.com



The big question: Why is it so difficult?

- Lack of test sites?
- Lack of access to money?
- Lack of skills?
- Lack of need?
- Lack of technology?
- Not enough entrepreneurs?
- Not enough ideas?

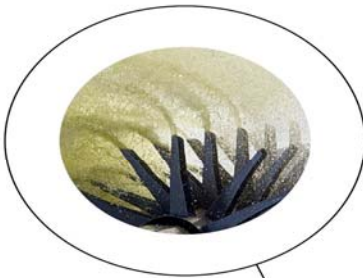


Utilities are good at trialling new technology

We need to get better at **adoption**

isleutilities.com

Technology Adoption Strategies



Approaches to Technology Evaluation



Research / Innovation Division



Committee / Working Group
(representing multiple divisions)



Champion / Disseminator

Key Components:

- Leadership support
- Staff engagement
- Communication
- Exploration resources
- Risk tolerance
- Strategic planning, prioritization and evaluation
- Realistic expectations

isleutilities.com

Emerging Technology Integration Challenges



Time / Competing Priorities



Risk Adversity / Culture

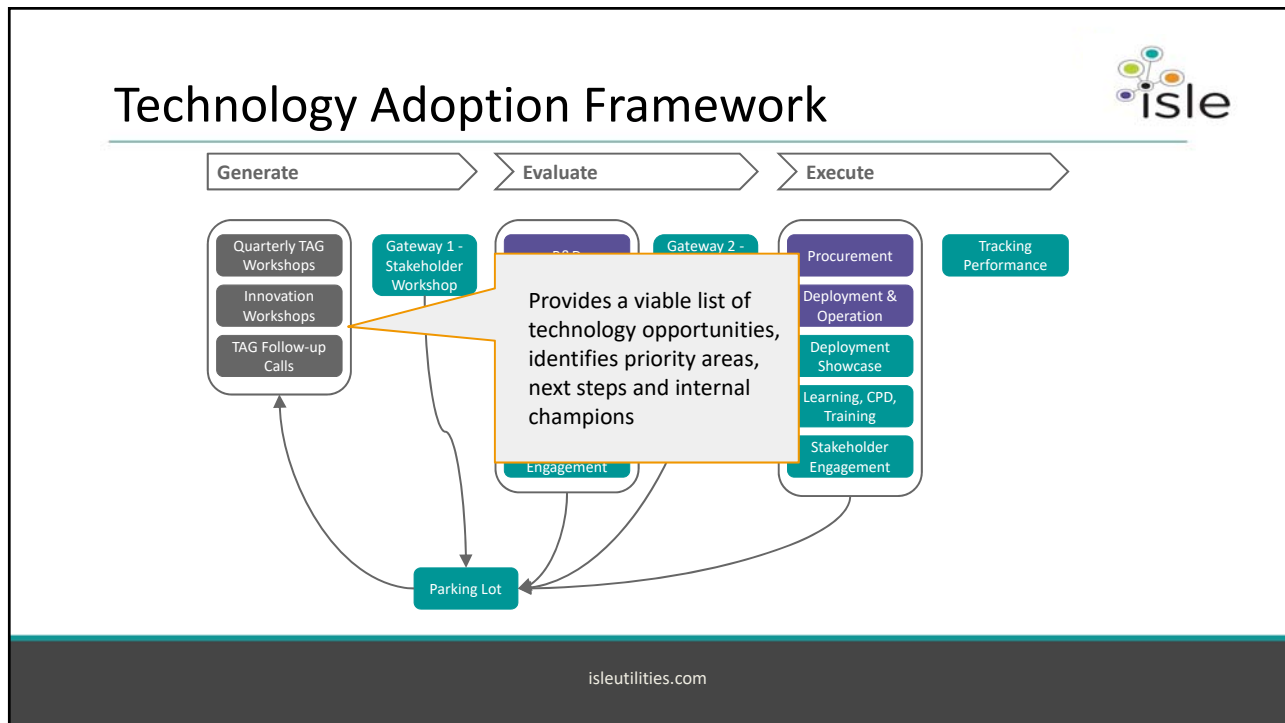
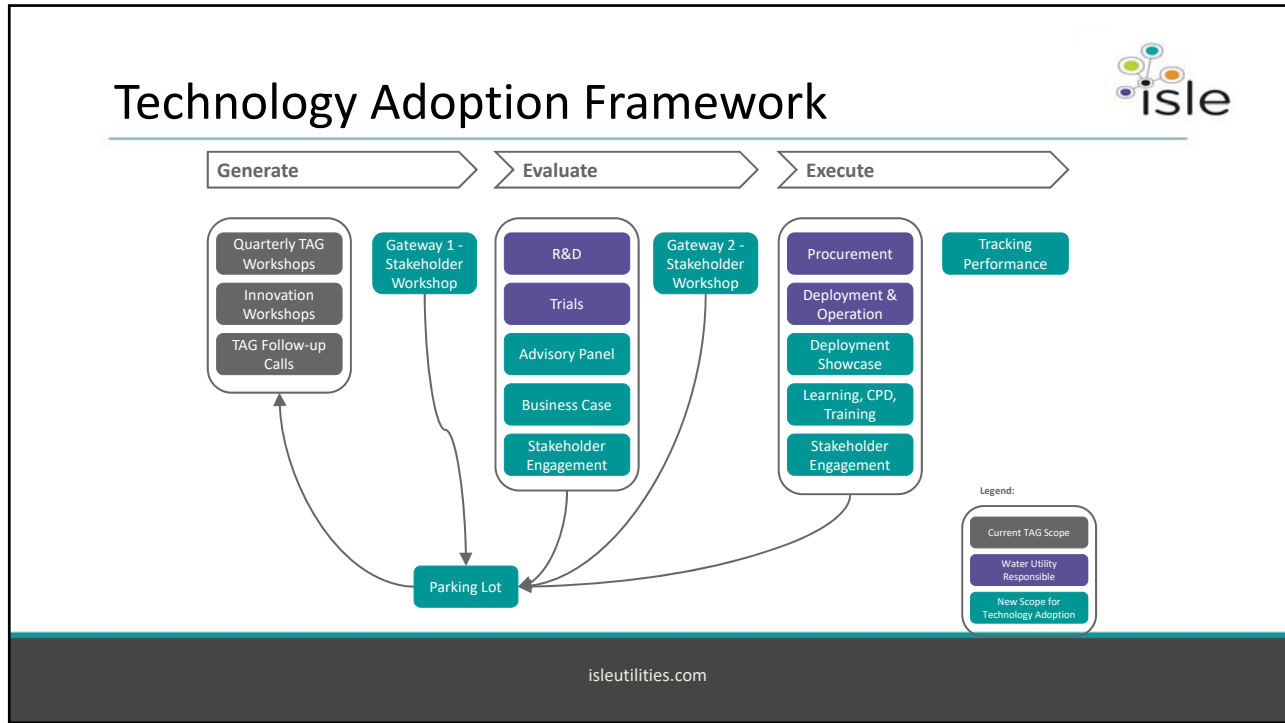


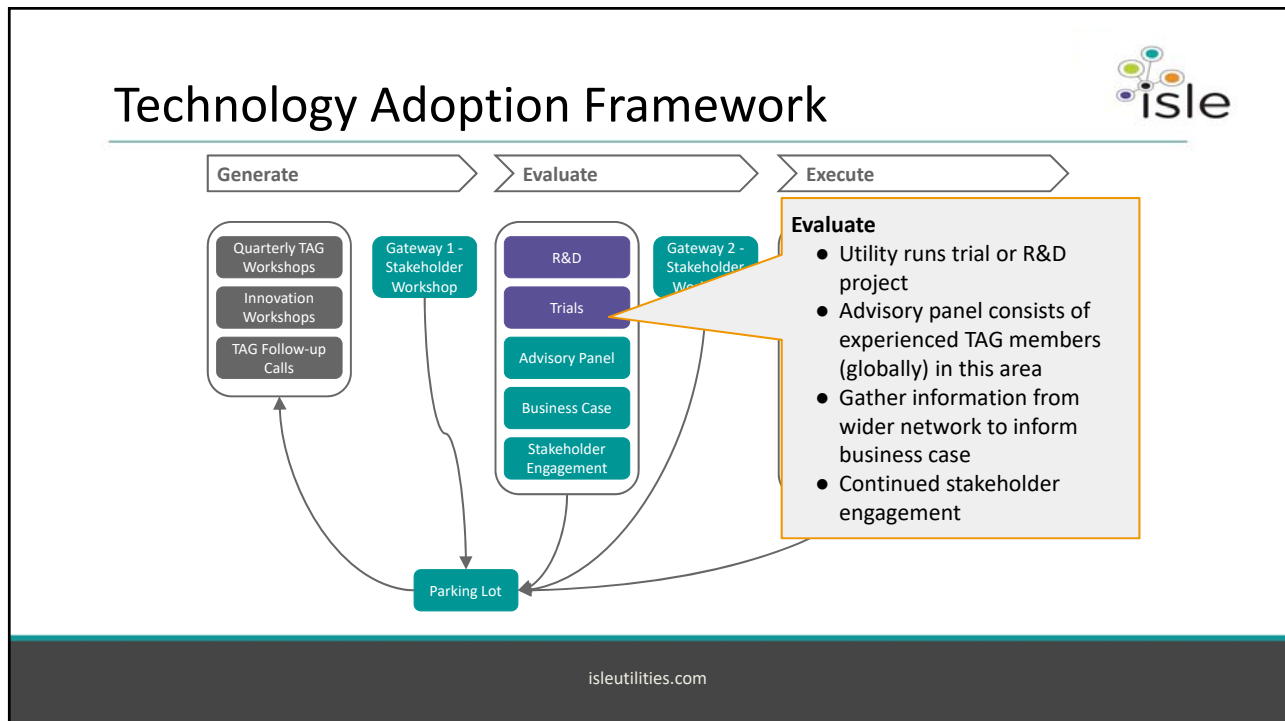
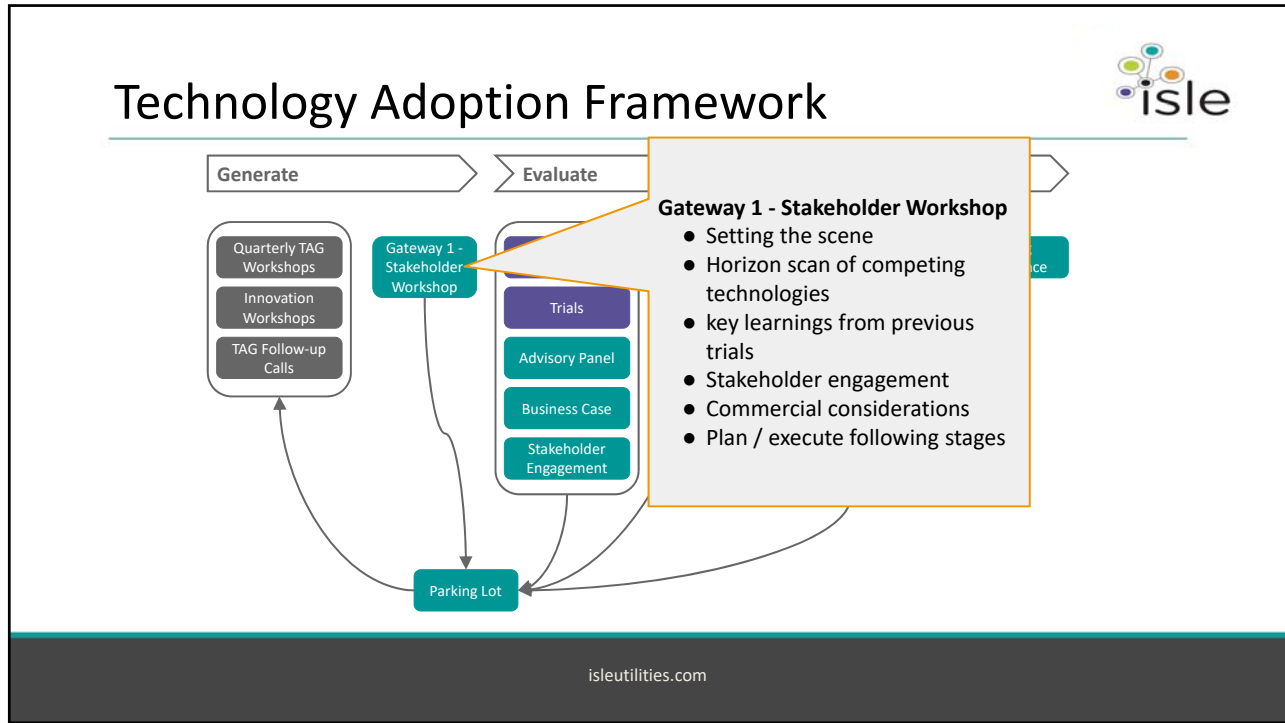
Integration Requirements

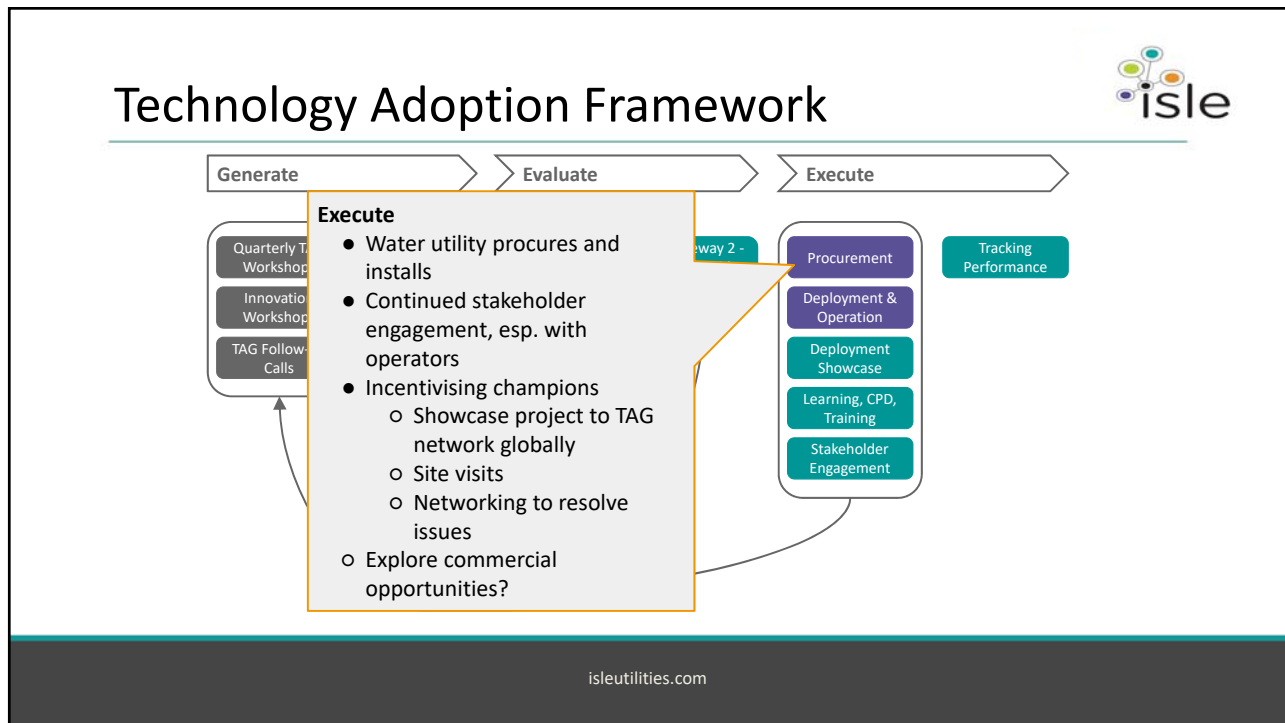
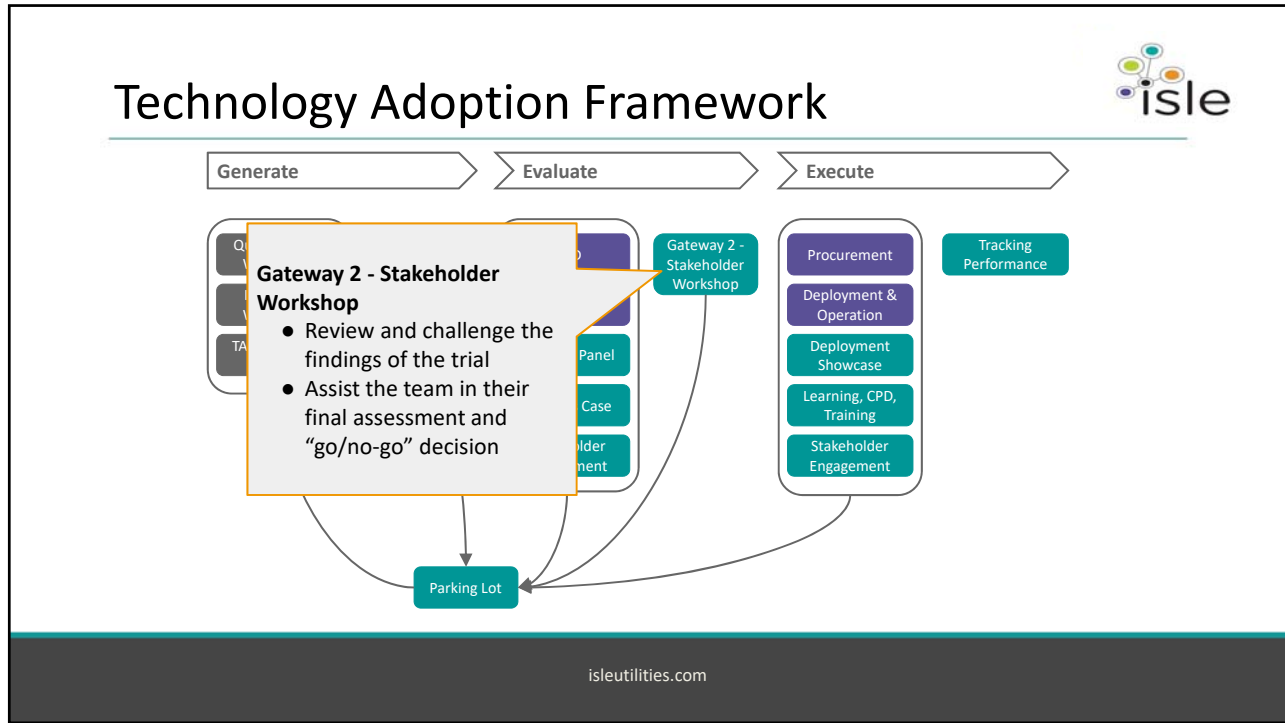
Common Barriers:

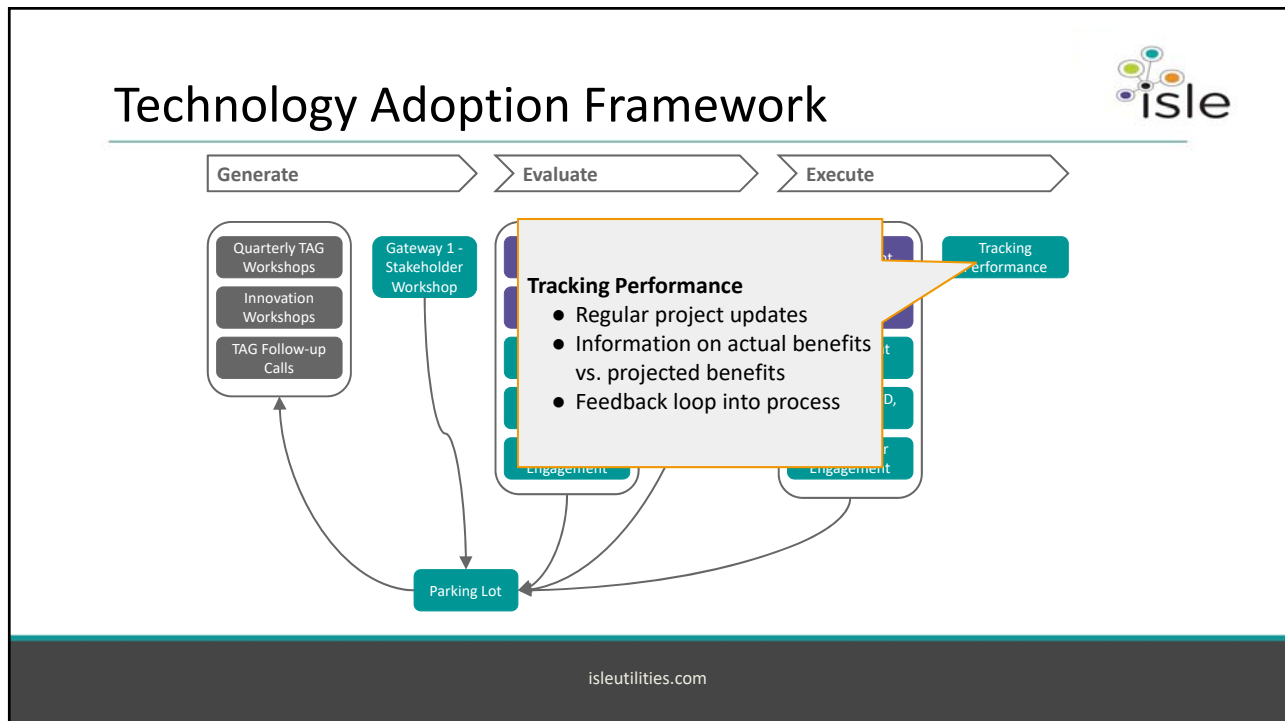
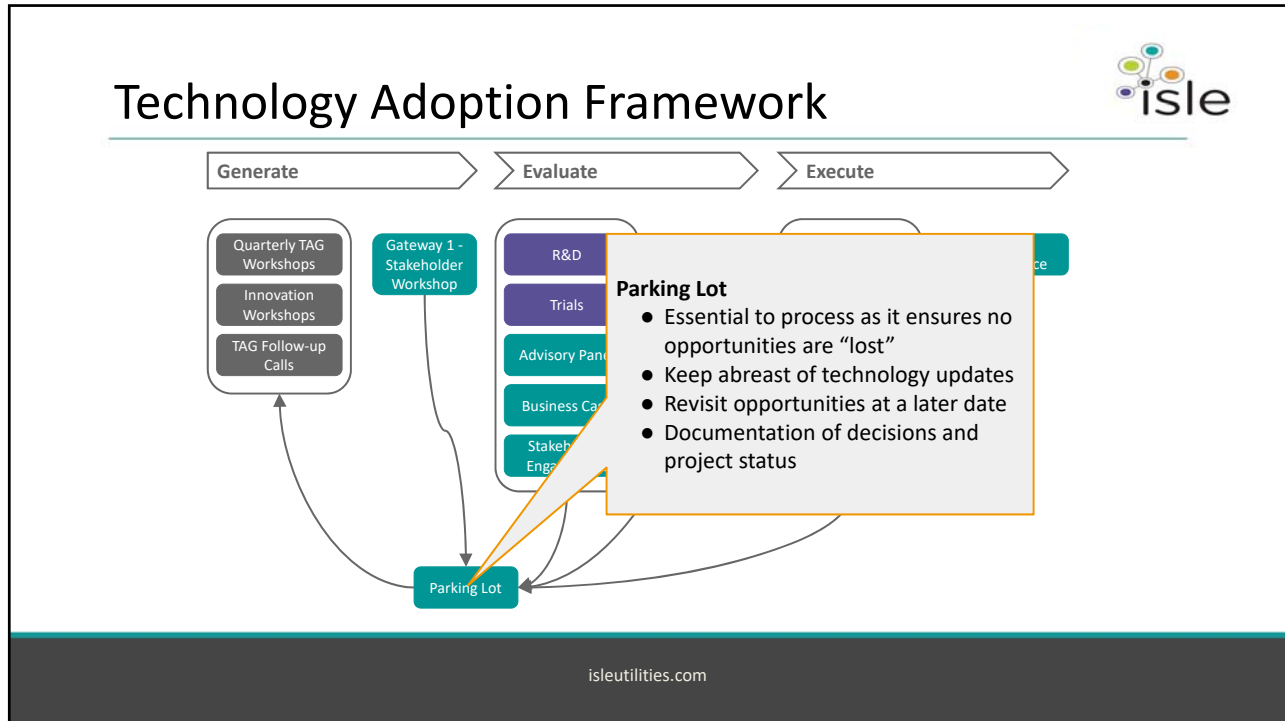
- Staff time and engagement
- Reactive approach to challenges / priorities
- Risk adversity
- Public perceptions / buy-in
- Procurement
- Lack of internal consensus
- Technology immaturity
- Systems integration

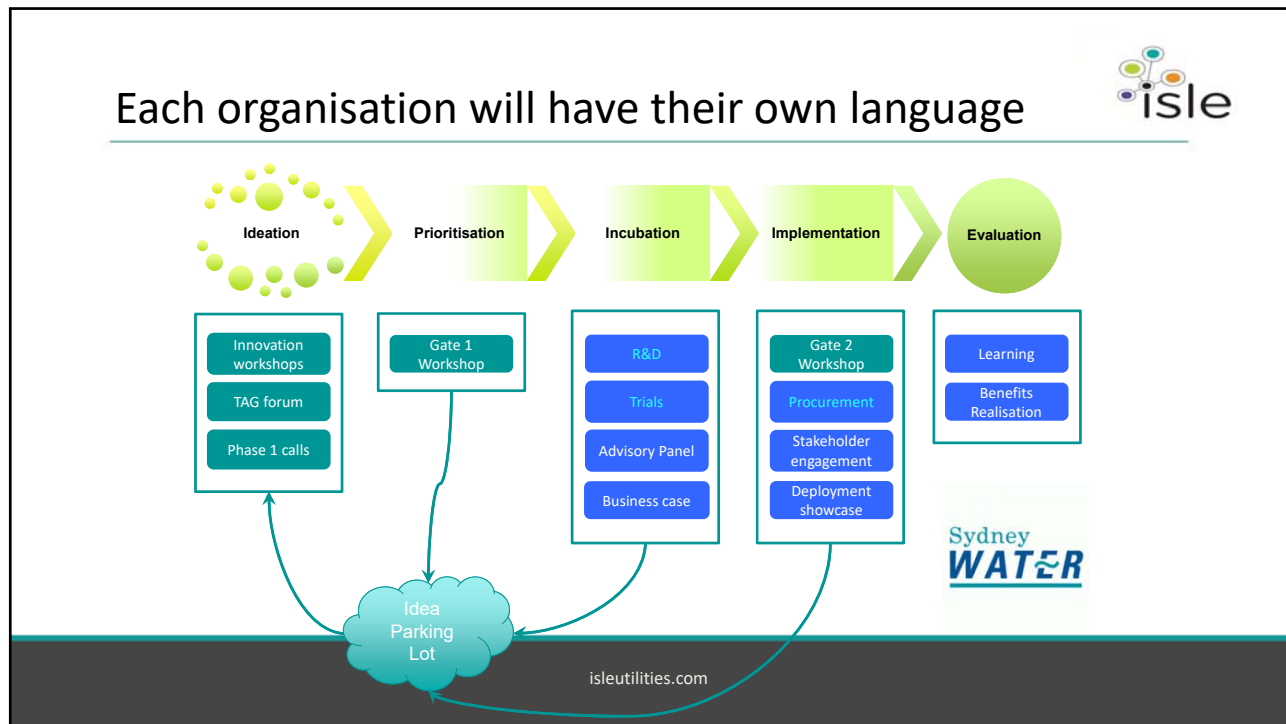
isleutilities.com











Conclusions

- Our industry is very innovative.
- There are game-changing inventions covering in every part of water cycle
- The water industry is engaged, committed and mobilised around innovation
- The investment community is ready to help (and they understand risk)
- But we need to:
 - Leverage our skills and capabilities
 - Assist the smaller/less able organisations? (G Hawkins blog)
 - Consider working beyond local or national boundaries
 - Demonstrate genuine market pull by being better at technology adoption
- THE GOOD NEWS: this probably doesn't mean changing your risk profile

isleutilities.com

Thank you

Piers Clark, Chairman, Isle Group

Piers.clark@isleutilities.com

+44 7976 344233

