

The logo for ATWARM, featuring the word "ATWARM" in white capital letters on a blue rectangular background.

Carbon management system for NI Water

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Northern Ireland Water

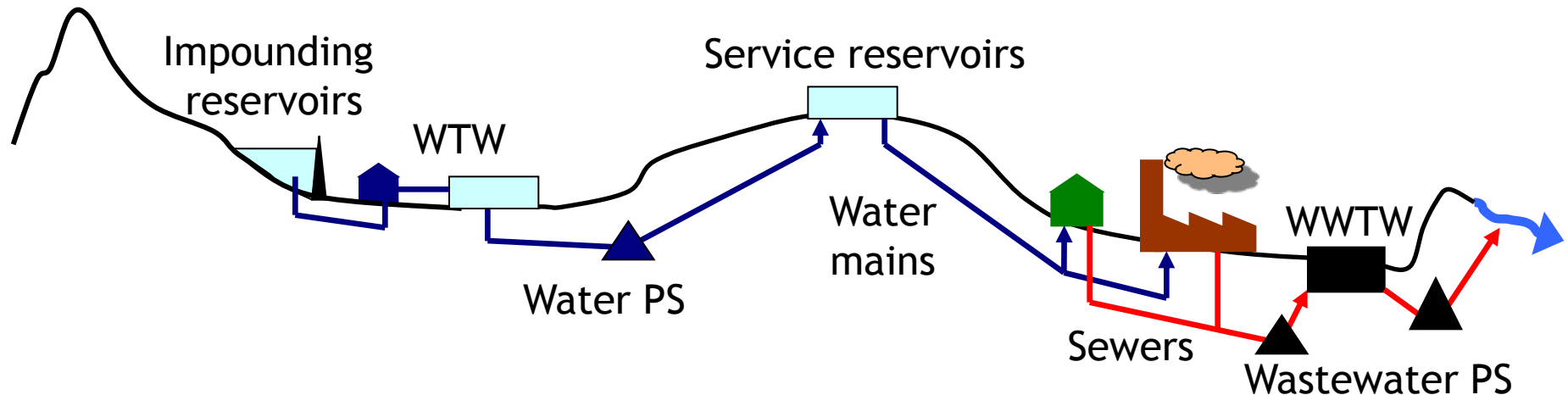
ATWARM International Conference
Water – The Greatest Global Challenge

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Dublin City University



NI Water – company profile

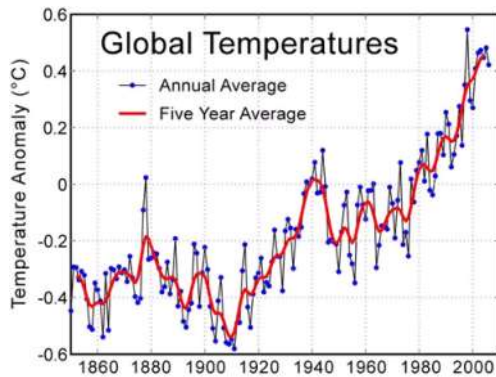
Water & sewerage services for Northern Ireland (1.8 million people)



| | |
|----------------------------|--|
| Impounding reservoir | 23 (+23 out of service) |
| Water treatment works | 25 (~600 ML/day) |
| Water pumping station | 365 |
| Service reservoir | 354 |
| Water mains | 26,442 km (~740,000 customers; 675,000 HHs) |
| Sewers | 14,905 km |
| Wastewater pumping station | 1,361 |
| Wastewater treatment wks | 1,045 (254 serve >250 PE; 140 Mm ³ /yr) |

Introduction to carbon

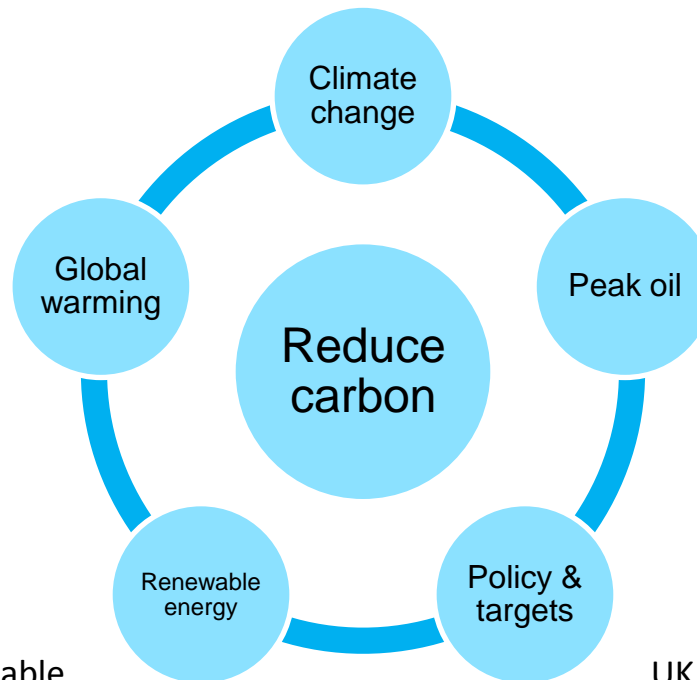
'Carbon' refers to the basket of 6 GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6)



Source: NewScientist (2007)

Kyoto Protocol

UK: 15% renewable energy by 2020



Remaining reserves:

45 years oil

60 years gas

120 years coal Source: BP (2010)

NI: 40% renewable electricity by 2020

UK: 80% cut in GHGs by 2050

Why reduce carbon in NIW?

- Climate change has a direct impact on NI Water
 - Flooding, droughts, fires
- Legislation
 - NI Climate Change Bill
 - Utility Regulator
 - Department for Regional Development
- Business reasons
 - Cost efficiency, leadership, reputation



7 mths



5 mths



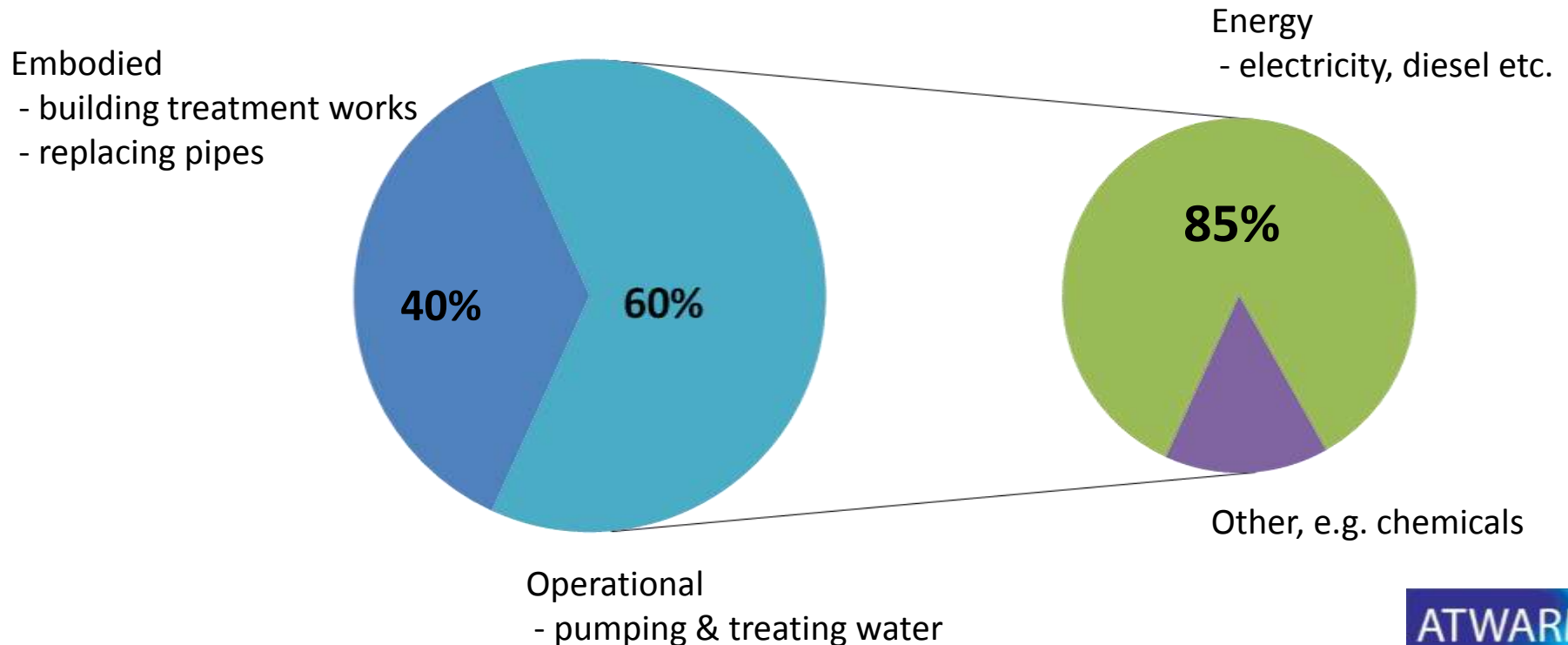
CARBON = £

£ = CARBON

NI Water's annual electricity bill is £34 million

Carbon in the water & sewerage industry

Successful management requires information and therefore measurement



Operational carbon

- Database of carbon factors developed for project appraisals
 - Carbon factors of chemicals and other consumables
- Data collection implemented for WWTP trials to analyse
 - Carbon emissions chemical, electricity and other energy usage with respect to final effluent quality and discharge consent standards
- Data collection systems put in place for carbon reporting
 - Annual Information Returns (AIR), Carbon Reduction Commitment (CRC)

| Description | Unit | NIW | PPP | TOTAL | CG |
|--|------------------------------|-------|-------|-------|----|
| Annual operational emissions intensity ratio per ML of treated water | tonnes CO ₂ e/ ML | 0.350 | 0.369 | 0.357 | B2 |
| Annual operational emissions intensity ratio per ML of treated sewage (FFT) | tonnes CO ₂ e/ ML | 0.522 | 0.523 | 0.523 | CX |
| Annual operational emissions intensity ratio per ML of treated sewage (DI Input) | tonnes CO ₂ e/ ML | 0.801 | 0.803 | 0.803 | C4 |

Annual Information Return (AIR)

Source: NIW (2011)

Operational carbon

2012-4-2 GN20 Unit Cost Opex Schedule V22 30-03-12 Working 85myth - Microsoft Excel

| Consumable | Notes on what Typically Used For | Unit | Grade or Strength | Unit Cost Rate | Supply Account | Carbon kg CO ₂ e / unit | Explanation on the Consumable |
|--|--|-------|---------------------------|----------------|----------------|---------------------------------------|---|
| Sludge Dewatering | | | | | | | |
| Sodium Hypochloride | Cleaning MBR Panels/Odour Control/DISINFECTION | tonne | std 1415 | £280.00 | 5482 | 1043 | Delivery included - Tender C03 |
| Sodium Hypochloride | Cleaning MBR Panels/Odour Control/DISINFECTION | tonne | std 1415 | £172.00 | 5482 | 1043 | Intermediate Bulk Container (unit deliv |
| Sodium Hypochloride | Cleaning MBR Panels/Odour Control/DISINFECTION | tonne | std 1415 | £165.00 | 5482 | 1043 | Delivery included - Tender C03 |
| Sodium Hypochloride | Cleaning MBR Panels/Odour Control/DISINFECTION | tonne | LB 1415 | £235.00 | 5482 | 1064 | Intermediate Bulk Container (unit deliv |
| Sodium Hypochloride | Cleaning MBR Panels/Odour Control/DISINFECTION | tonne | LB 1415 | £228.00 | 5482 | 1064 | Delivery included - Tender C03 |
| Sodium Hypochloride | Cleaning MBR Panels/Odour Control/DISINFECTION | tonne | ULB | £420.00 | 5482 | 1064 | Delivery included - Tender C03 |
| Sodium Hypochloride | Cleaning MBR Panels/Odour Control/DISINFECTION | tonne | ULB | £177.00 | 5482 | 1064 | Intermediate Bulk Container (unit deliv |
| Sodium Hypochloride | Cleaning MBR Panels/Odour Control/DISINFECTION | tonne | ULB | £310.00 | 5482 | 1064 | Delivery included - Tender C03 |
| Sodium Carbonate | Cleaning MBR Panels/Odour Control/DISINFECTION | tonne | granular | £270.00 | 5482 | 303 | Delivery included - Tender C03 |
| Sodium Carbonate | Alkalinity for MBR Panels/PH ADJUSTER | tonne | granular | £279.00 | 5482 | 303 | Delivery included - Tender C03 |
| Thickening at another N/W site | | tds | From 2.5% to 4.5% | 100 | | 36.6 | Includes power, labour, chemicals etc |
| Dewatering at another N/W site | | tds | From 2.5% to 25% | 100 | | 45 | Includes power, labour, chemicals etc |
| Dewatering at another N/W site | | tds | From 4.5% to 25% | 100 | | 45 | Includes power, labour, chemicals etc |
| Sludge Disposal @ Omega PPP @ 25% dts | | tds | At 25% dry solids | £235.00 | | 401 | Disposal cost only |
| Acids | | | | | | | |
| Sulphuric Acid | PH ADJUSTER | tonne | 50% strength | £100.00 | 5482 | 137 | Delivery included - Tender C03 |
| Sulphuric Acid | PH ADJUSTER | tonne | 96% strength | £118.00 | 5482 | 163 | Delivery included - Tender C03 |
| Hydrochloric Acid | PH ADJUSTER | tonne | 30% strength | £388.00 | 5489 | 1471 | Intermediate Bulk Container (unit deliv |
| Orthophosphoric Acid | ELECTROLYSIS/ERADICATES PLUMS/OLYMOVI | tonne | 75% strength | £752.00 | 5486 | 1603 | Intermediate Bulk Container (unit deliv |
| Citric Acid | Cleaning MBR Membranes/DISINFECTION | tonne | standard product | £425.00 | 5489 | 4754 | Delivery included - Tender C03 |
| Odour Control Chemicals | | | | | | | |
| Activated Carbon | Odour Control/TASTE, ODOUR & ORGANIC REMOVAL | tonne | powder | £376.00 | 5487 | 7526 | Delivery included - Tender C03 |
| Activated Carbon | Odour Control/TASTE, ODOUR & ORGANIC REMOVAL | tonne | powder | £330.00 | 5487 | 7526 | Delivery included - Tender C03 |
| Jones & Athwood | Odour Control/TASTE, ODOUR & ORGANIC REMOVAL | tonne | filter media product | £1,705.00 | 5489 | 3635 | Specialist filter to fit J&A equipment (C |
| Jones & Athwood | Odour Control/TASTE, ODOUR & ORGANIC REMOVAL | tonne | filter media product | £4,605.00 | 5489 | 9532 | Specialist filter to fit J&A equipment (C |
| Carbon Granular | Odour Control/TASTE, ODOUR & ORGANIC REMOVAL | tonne | Bulk | £600.00 | 5487 | 10000 | Delivery included - Tender C03 |
| Carbon Granular | Odour Control/TASTE, ODOUR & ORGANIC REMOVAL | m³ | Bagged Tip-up GAC/240W | £600.00 | 5487 | 4500 | Delivery included - Tender C03 |
| Reactivated Carbon Granular | TASTE, ODOUR & ORGANIC REMOVAL | m³ | reactivated | £430.00 | | 1000 | Delivery included - Tender C03 |
| Magnetite (an iron oxide) | TASTE, ODOUR & ORGANIC REMOVAL | tonne | 20 tonne delivery | £946.09 | 5480 | 957 | Delivery included - Tender C03 |
| Miscellaneous | | | | | | | |
| Foam Control Agent | | kg | freefoamdpr | £3.18 | 5489 | 3.05 | Delivery included - Tender C03 |
| Poly Aluminium Chloride | COAGULATION | tonne | standard product | £217.00 | 5489 | 265 | Delivery included |
| Hydrated Lime (Primary/Supplier) | PH ADJUSTMENT | tonne | Hydrapure | £129.00 | 5481 | 596.7 | Delivery included - Tender C03 |
| Ferric Sulphate (sewage treatment) | To assist achieving P standard | tonne | 12.5% ferric liquid | £109.53 | 5489 | 133.6 | Sludge Thickening 12.5% conc (includ |
| Ferric Aluminium Sulphate Sewage Treatment | To assist achieving P standard | tonne | standard product | £77.84 | 5489 | 94.36 | Delivery included - Tender C03 |
| (Inc. Iron Content) | | tonne | standard product | £160.00 | 5482 | 344 | Delivery included - Tender C03 |
| Sodium Chloride | DISINFECTION | tonne | standard product | £174.10 | 5489 | 445 | Delivery included |
| CO2 | DISINFECTION | tonne | standard product | £3,168.00 | 5482 | 1221 | Delivery included - Tender C03 |
| Chlorine (cylinder) | DISINFECTION | tonne | standard product | £1,290.00 | 5482 | 1221 | Delivery included - Tender C03 |
| Chlorine (Drum) | DISINFECTION | tonne | standard product | | | | |

Carbon
factors

Carbon and water efficiency

| Water efficiency tool | Estimated savings (L/prop/day) |
|--------------------------------|--------------------------------|
| Cistern displacement devices | 31.5 |
| Dual/variable flush conversion | 25.4 |
| Shower timer | 5 |
| Efficient shower head | 29 |
| Tap insert | 20 |
| Trigger gun | 2 |



'Quick fix' programme

Total av. water savings = 59.6 L/prop/day

Hot water savings = 32 L/prop/day

Carbon savings from 15% uptake

Hot water 10,080 tCO₂e/yr

Treatment and pumping 1150 tCO₂e/yr

Total 6.2% net operational emissions

Embodied carbon

Construction of wastewater treatment plants and pumping stations

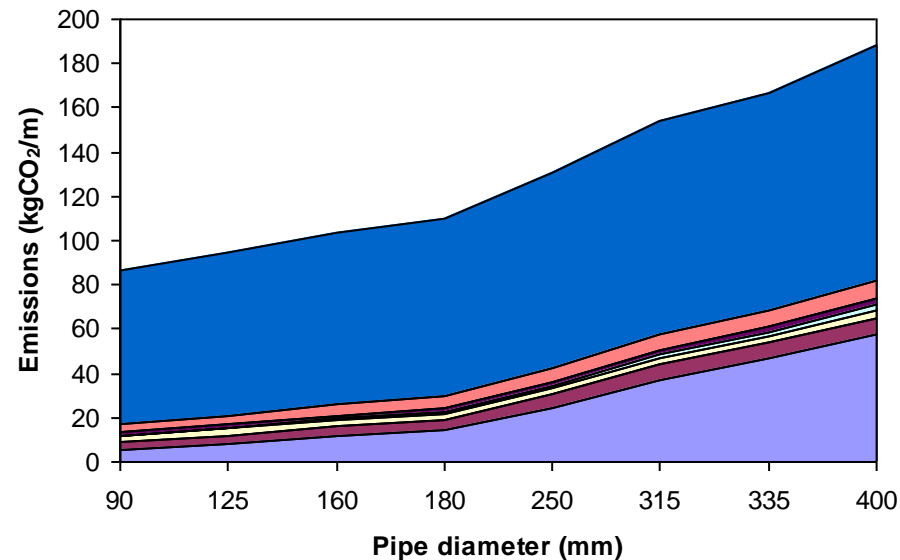
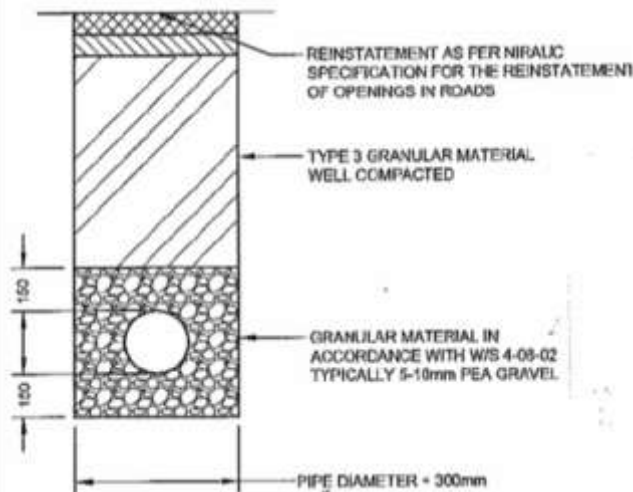
$$\frac{\sum (\text{BOQ item} \times \text{Carbon factor})}{\text{Total project construction costs}} = \frac{\text{kgCO}_2}{\text{£}}$$

Results

WWTPs: 1500 kgCO₂/£1000

WWPSs: 340 kgCO₂/£1000

Installation of pipelines and pipeline rehabilitation



PE pipe laid in road

- Road reinstatement
- Disposal
- Backfill
- Valves
- Manholes
- Bedding/surround
- Pipe

Application of research

- NI Water's **Capital Investment Appraisal System Whole Life Carbon Assessment**
- Methodology for **inclusion of carbon externalities** in 'Assessing the sustainable economic level of leakage' (NI Water guidance)
- **Carbon Reduction Commitment** and **Carbon Trust Standard** (carbon and energy efficiency schemes in NI Water)
- **UKWIR** (UK Water Industry Research) project CL01/B207 'A framework for accounting for embodied carbon in water industry assets'
- **WRc** (Water Research Centre) project CP443 'Carbon Abatement Scenario Strategy Modelling (CASSM)'

| Project | Costs | | | Carbon | |
|----------|-------|---------|----------------------------|------------------|---------|
| | NPC | Ranking | Discounted total Opex (£M) | Total carbon (t) | Ranking |
| Option 1 | | | | | |
| Option 2 | | | | | |
| Option 3 | | | | | |

Impact of research

- Benefits of project
 - **Complying with legislation: current and future**
 - Social & Environmental Guidance for Water & Sewerage Services 2010-13 (carbon assessment for capital projects, carbon targets)
 - NI Climate Change Bill (general duty on public bodies to reduce carbon)
 - Utility Regulator (carbon targets and carbon reduction delivery plan)
 - **Better measurement = better management**
 - Carbon reduction projects can be targeted to achieve greatest impact in terms of cost and environmental benefits



Carbon reduction projects include: intelligent pump control, pump efficiency, process and aeration control

Next steps: carbon targets

Assess current conditions

Assess existing carbon emissions, schemes and reduction measures



Set carbon reduction targets

Obtain management approval; set target boundary, base year, completion date and level



Develop roadmap for meeting targets

Set out a clear path for meeting target



Track and report progress

Measure and assess progress; revise roadmap if necessary

Conclusions

The water & sewerage sectors have an important role to play in reducing carbon emissions and contributing to the UK carbon target

Source: EA (2012)

- **Benefits of project**
 - Compliance with legislation
 - Better measurement = better management
- **Difficulties**
 - Carbon management requires considerable resources
 - External factors affect carbon management
- **Challenge is to reduce carbon emissions while**
 - Providing water & wastewater services for an increasing population
 - Meeting environmental standards for drinking water & water discharges
 -and doing so economically

Thank you for listening!

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