Water Efficiency Technologies Research

Report Reference: UC13190.04
June 2018

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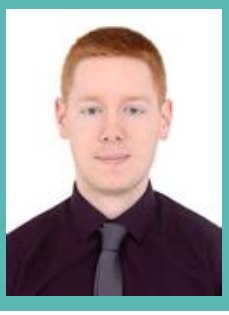

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Date:	June **2018**
Report Reference:	UC13190.04
Project Manager:	Sarah Homewood
Project No.:	16875
Client:	Scottish Enterprise
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Document History

Version number	Purpose	Issued by	Quality Checks Approved by	Date
V1.0	Draft presentation report issued to Client	Abraham Negaresh	Richard Addison	11th April 2018
V2.0	Final report issued to client.	Richard Addison	Sarah Homewood	30th April 2018
V3.0	Final report issued to client.	Abraham Negaresh	Richard Addison	1st June 2018
V4.0	Final report issued to client.	Abraham Negaresh	Richard Addison	25th June 2018

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i Reasons

Scottish Enterprise helps to identify and exploit opportunities for economic growth by supporting ambitious companies based in Scotland to compete within the global marketplace.

Whilst Scotland has a plentiful water supply, this country has a large number of industrial water users such as distilleries, food companies, agriculture, textiles, electronics etc. As a consequence, industrial water use is predicted to be the single greatest factor in increasing water demand and wastewater discharge. Both long term availability of fresh water and stringent regulations on the wastewater discharge are two potential limiting factors for the future growth of the industry sectors within the country.

WRc was engaged to assist Scottish Enterprise to identify the heavy water using industry sectors in Scotland and to understand the challenges of adopting new innovative water/wastewater technologies by heavy users of water.

ii Objectives

The objectives of the study were to;

- Identify major water users within Scottish industry,
- conduct a survey to engage with the water users and further understand the impact of fresh water availability and waste water production on their future operation and growth,
- assess the appetite of these water users in adopting new water and wastewater treatment technologies,
- attempt to engage with trade bodies to capture their industry wide, strategic, perspective on industrial water use particularly for major water users,
- highlight challenges and risks associated with adopting new technology solutions by the end-users,
- provide a list of available national and international innovation funds which could be used as an example to develop a similar concept in Scotland to support both industrial water users and technology providers. This will promote innovation and adoption of water efficiency technologies within the industry.

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iii Benefits

Finding more ingenious ways to efficiently use the available fresh water and treat the wastewater could lead to a two-fold benefit:

- Industrial water users can increase production capability.
- Technology providers are given the opportunity to demonstrate solution capabilities.

iv Conclusions

In Scotland water metering is not compulsory and therefore there is some level of uncertainly in the reported abstraction data.

For those companies who reported water being a barrier to the development of their product capacity, capability and capacity of wastewater treatment systems and the need for more water efficient technologies were identified as their main reasons.

There was demonstrable interest from medium and heavy water users to adopt new technology solutions particularly where local constraints exist either through expansion demands or environmental constraints identified by SEPA. However, the following barriers and risks have been identified in adopting new water/wastewater treatment technologies:

- Financial risks / Return on Investment
- Technology being fit for purpose ;
- Lack of proven examples;
- Safety consideration particularly in re-use applications for food and beverage industry; and
- In addition, WRc highlighted the need for further understanding of the regulatory risks and operation / production risks.

“Financial gains” through adoption of new innovative water / wastewater technologies was identified as the key driver of change. This was followed by regulatory changes, corporate responsibility, customer / stakeholder perception, climate change and resource efficiency.

70% of the participants had not received any support from public sector bodies for activities related to water or wastewater technology adoption. 79% of the participants expressed

interest in participating in Scottish Enterprise work which might lead to field trials and evaluations of new water / wastewater treatment technologies.

For a successful collaboration between the technology provider and the industrial water user the legal contract requirements need to be managed and considerations should be given to:

- Expectations management;
- Level of risk sharing;
- Level of involvement and support by each party;
- Level of collaboration;
- Realistic liability set on technology provider; and
- IP protection.

v Recommendations

In order to promote new technology adoption by heavy water users, Scottish Enterprise should consider the following:

Funding arrangements should be organised. This could be either fully paid by the Scottish Government or co-funded with the medium and heavy water users to minimise the financial risks. A list of similar funding programmes is provided in the report (Table 4.1).

Scottish Enterprise could adopt funding models such as BEIS Industrial Energy Efficiency Accelerator (IEEA) for any future support.

To minimise the barriers and risks of adopting new innovative technologies, a structured assessment procedure should be introduced to:

1- Assess the innovative technology in terms of its Technology Readiness Level (TRL) and to ensure that it is either at TRL 9 (commercialised) or ready to be commercialised shortly after the successful trials; and

2- Ensure the technology has been tested and / or obtained an accreditation from a third party validating the performance of the technology against the claimed specifications.

Provide incentives to the medium and heavy water users to adopt and trial new technologies.

The funding should in our view be awarded using a staged approach. At the end of each stage, Scottish Enterprise or its trusted third party should intervene and review the progress of the project against the defined targets. This will allow Scottish Enterprise and the industry partner to ensure targets are achieved or will be achieved by the end of the project. In order to accelerate the adoption of new innovative water / wastewater treatment technologies within the industry, sharing the positive stories and publishing case studies could be effective.

1. Introduction

Scottish Enterprise helps to identify and exploit opportunities for economic growth by supporting ambitious companies based in Scotland to compete within the global marketplace. Scottish Enterprise also works with a range of partners in the public and private sectors to attract new investment to Scotland and to help create a world-class business environment.

Scotland has ambitions to be a leader in sustainability and innovation with the Scottish Government's Hydro Nation Strategy encouraging new technology companies to locate to Scotland and develop solutions from Scotland.

Whilst Scotland has a plentiful water supply, this country has a large number of industrial water users such as distilleries, food companies, agriculture, textiles, electronics etc. As a consequence, industrial water use is predicted to be the single greatest factor in increasing water demand and wastewater discharge. Both long-term availability of fresh water and stringent regulations on the wastewater discharge are two potential limiting factors for the future growth of the industry sectors within the country. Finding more ingenious ways to efficiently use the available fresh water and treating the wastewater could lead to a two-fold advantage:

- Industrial water users can increase production capability.
- Technology providers are given the opportunity to demonstrate solution capabilities.

Scottish Enterprise understands that while the benefits are attractive for both parties, supporting large companies to use new technologies requires further investigation.

WRc was engaged to assist Scottish Enterprise in identifying the Scottish heavy water using industry sectors and understanding the challenges of adopting new innovative water / wastewater technologies by the heavy water users.

In this report the heavy water using industry sectors in Scotland will be identified based on the available literature and published information. The outcomes of a conducted survey focused on medium and heavy water users will be discussed. This will present the viewpoints of the medium and heavy water users on barriers and challenges associated with adopting new treatment technologies. In this section, additional factors that could impact the adoption of new innovative technologies will be highlighted. Moreover, a list of national and international innovative funding programmes and their arrangements will be provided.

2. Heavy industrial users in Scotland

Data on abstractions from water bodies in Scotland are held by the Scottish Environmental Protection Agency (SEPA). Such activities are licensed and governed by the Controlled Activities Regulations (CAR) 2011. CAR is a risk-based approach to control with four tiers of authorisation for all controlled activities.

UK water consumption/abstraction has been presented in several reports. These reports were reviewed. However, they were found lacking regarding abstraction data for Scotland (WRc plc, 2011; Mathieson *et al.*, 2002; Rance *et al.*, 2012; WRAP, 2013).

Following Scottish Enterprise enquiry to SEPA, historical abstraction data from 2015-2017 for various companies/factories were made available to WRc. Each company/factory was categorised within an appropriate industry section (as listed in Table 2.1); for some companies, 2017 annual abstraction data was marked as “no return” suggesting that either the site was not operational in 2017 or the data was not provided to SEPA by the water user.

Summation of the 2017 reported abstraction data was calculated for each industry sector and presented in Table 2.1. In this table calculations were conducted based on two assumptions:

1- When abstraction data marked as “no return” was assumed to be zero (Actual Abstraction Data); and

2- When abstraction data marked as “no return” was assumed to be equal to the average abstraction data of the previous two years if available (Analysed Abstraction Data).

In this table, in addition to the latest information provided by SEPA, figures from a report carried out by CJC consulting in 2002 is presented. This report estimated water use by various industry sectors in Scotland based primarily on a postal survey to Scottish industries (CJC Consulting, 2002). Moreover, total abstracted water plus mains water consumed by various industry sectors is also presented. This data was presented in a report conducted by SEPA in 2003 focused on economic analysis (SEPA, 2003).

For some sectors in the CJC report the sample size was small (electronics, mineral water, metals) or known to be biased as was the case for breweries where all respondents but one were micro-breweries. As such the figures for these sectors should be taken as indicative only.

It is important to note that the reported numbers in Table 2.1 are only estimates and not suitable for one-to-one comparison. This is mainly due to the fact that is Scotland there is no compulsory requirement for water metering. As a result, there is a level of uncertainty in the reported data both by SEPA and other organisations.

Table 2.1 Water users in Scotland

Sector	SEPA Reported Annual Abstraction Data 2017 ('000m^3)				Abstracted water ('000m^3) (CJC Consulting, 2002)	Total abstracted plus mains water ('000m^3) (SEPA, 2003)
	Number of data	Number of "no return" data	Actual Abstraction Data	Analysed Abstraction Data		
Food processing	15	3	2,727	3,322	2,622	12,266
Maltsters	8	2	981	981	1,566	3,150
Breweries	1	0	122*	122*	46**	364
Mineral water	28	2	877	877	859	980
Chemicals	18	0	4,444	4,444	5,491	29,239
Metals (mining)	45	23	4,509	5,696	3,980	5,950
Textiles	5	3	407	649	448	957
Paper	6	3	3,367	3,367	69,281	82,667
Fish farming	99	30	244,373	319,700	1,617,350	1,617,350
Distillers (malt)	149	14	43,209	48,327	76,490	-

* Only one brewery (Belhaven Brewery Co Ltd, Dunbar)

** All but one company were micro-breweries

Note: The reported numbers in this table are only estimates and not suitable for one-to-one comparison.

3. Survey Analysis

3.1 Methodology

In this project, a survey was conducted allowing engagement with the industrial water users and to further understand their challenges for growth, particularly the impact of fresh water availability and wastewater production on their future developments. In addition, their appetite to adopt new water and wastewater treatment and reuse technologies was assessed.

Scottish industry was categorised in various sectors as per Table 3.1. For each category various companies were identified. The contact details of the best people within each company were either obtained through calling the company and requesting the details or through Scottish Enterprise's assistance providing the best point of contact. Finding the personalised contact details was not successful for a small number of companies either because the company was not able to provide them or there was no phone number available on their website to facilitate further enquiries. In these cases, an email was sent to the general enquiry email address and / or by filling in the online enquiry form on the company website.

The personalised contacts were typically either at executive level such as director and general manager or at technical managerial levels such as technical manager, engineering manager, sustainability manager and environmental manager. The aim was to target positions with decision making authority to achieve a more realistic and comprehensive understanding of industrial water users.

Table 3.1 Targeted industries for survey study

Distiller / brewer	Mining, quarrying and construction
Manufacturing	Oil & gas
Pharmaceutical	Food and Drink
Textiles	Other
Paper	

Survey Preparation

A survey containing 8 questions was prepared (Appendix B). The questions were designed to:

- Capture the level of water consumption (light, medium and high) of each participating company;
- Identify barriers to production capacity development;

- Understand potential barriers to adopt water efficiency technologies such as water re-use and recycling or other water efficiency technologies;
- Gauge the appetite to measure water efficiency / water consumption by the water users;
- Identify the drivers of change within each participating company relating to the adoption of new water and wastewater treatment and reuse; and
- Assess the willingness of the water users to participate in any future Scottish Enterprise work which might lead to field trials and evaluation.

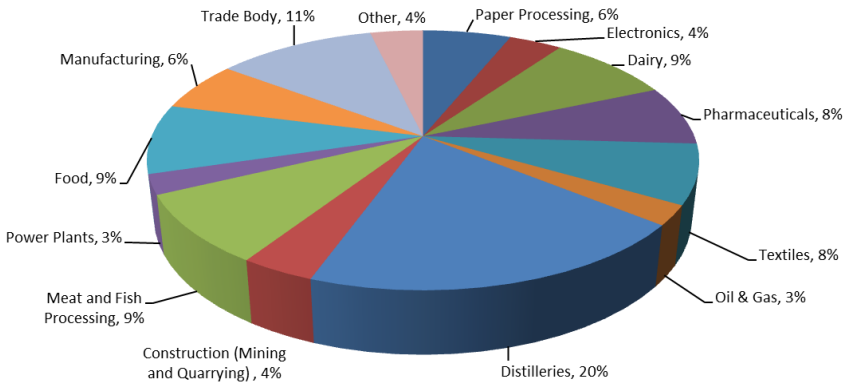
The survey was emailed to the contacts and where possible a follow up phone conversation was organised.

In addition to the survey, a list of questions was sent to Industry Trade Bodies. The questions were specifically designed to gain the trade bodies industry wide, strategic, perspective on industrial water use particularly for major water users. If the contact was available a phone interview was organised.

3.2 Survey Analysis

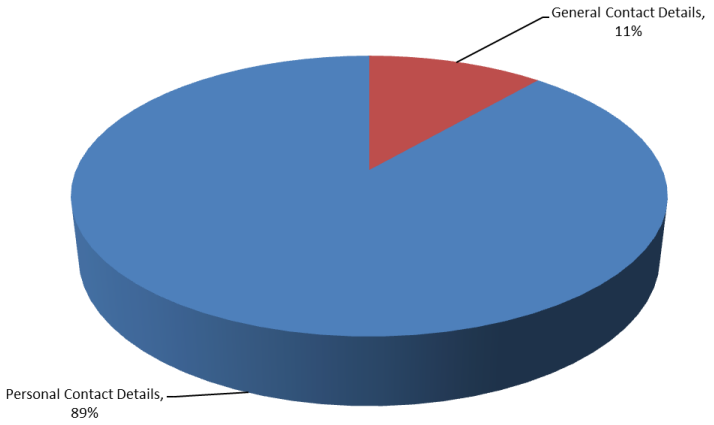
The survey was sent out to 79 Contacts from various industry sectors. The breakdown of the contacted industries is presented in Figure 3.1.

Figure 3.1 Breakdown of contacted industries



Out of the 79 contacts made, 70 (89%) were personal email addresses and phone numbers whilst 9 (11%) contacts were made through emailing an enquiry email address or requesting through company website (Figure 3.2).

Figure 3.2 Quality of contact details



Including the follow up emails and phone calls, in total, more than 200 emails sent out and more than 100 phone calls were made. As a result, 40 contacts responded to the sent emails. 20 participated in the survey by sending the completed survey back, 12 expressed lack of interest to participate and 8 either forwarded to others or promised to respond later. Follow-up emails and phone calls (as of 22/06/2018) have not been effective in eliciting further responses. The breakdown of responses is presented in Figure 3.3.

Figure 3.3 Breakdown of the responses as of 22/06/2018

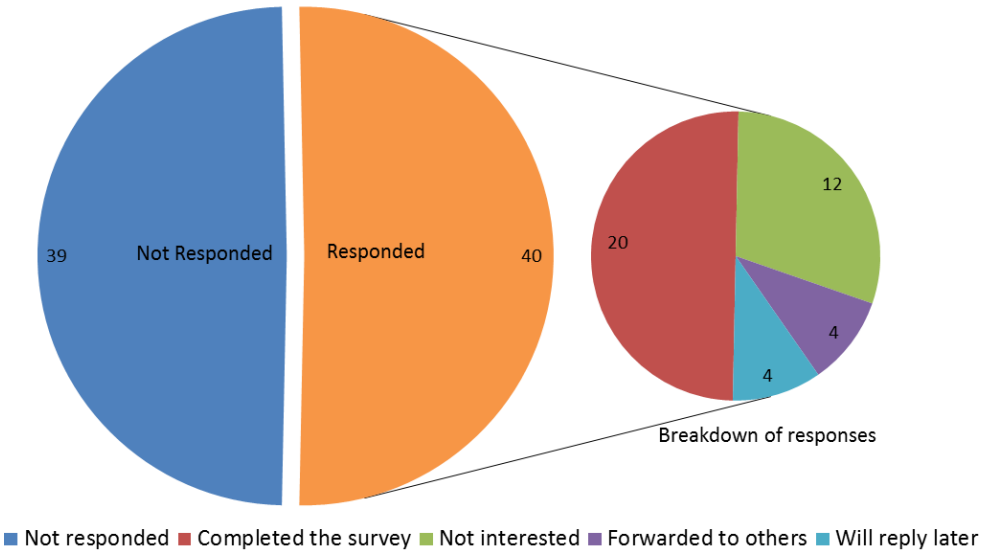
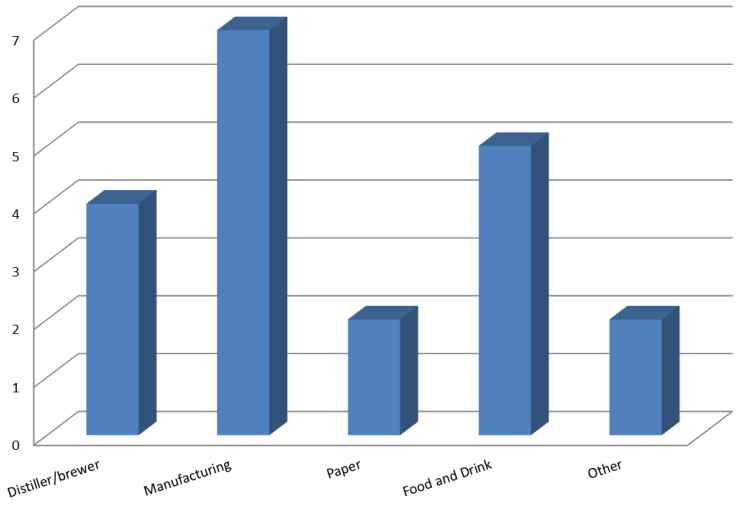


Figure 3.4 presents the number of participating companies in the survey from each industry sector.

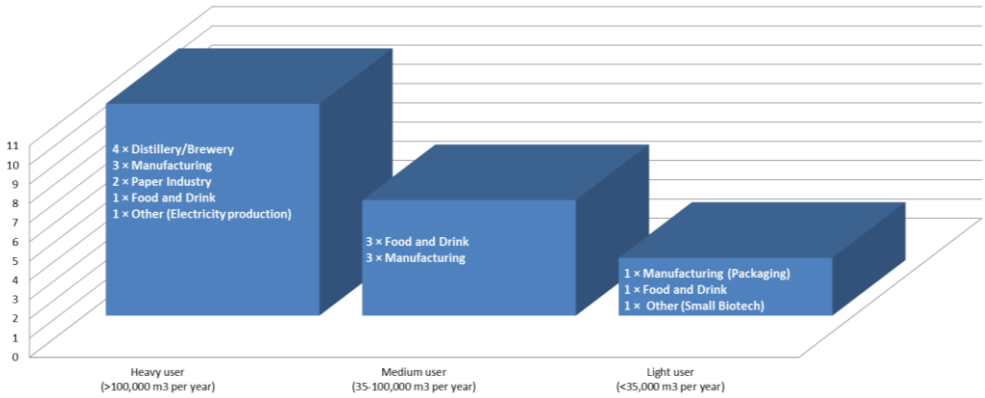
Figure 3.4 Participating companies from each sector



Other: 1×electricity production company, 1×Small Biotech company

The survey targeted various industry sectors including the heavy (>100,000 m^3 per year) and medium (35,000-100,000 m^3 per year) water users. 55% of the completed surveys were from heavy water users including companies in paper industry, distillers / brewers, food and drink industry, chemical manufacturing and industrial electricity production. 30% of the completed surveys were from medium water users including companies form food and drink industry and manufacturing. The remainder were from light water users including packaging, food and drink and small biotech companies. The breakdown of the participating companies in terms of their water consumption is presented in Figure 3.5.

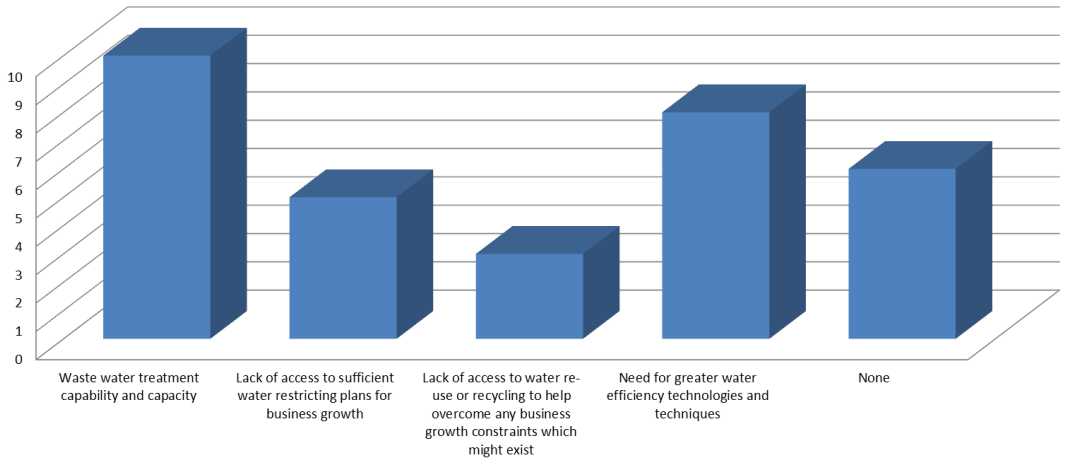
Figure 3.5 Participating companies from each sector



Participants were questioned on the main barriers for the future development of their company's production capacity. Figure 3.6 presents the list of barriers presented to the

participants and the number of marks each identified barrier received. Participants in the survey indicated that the capability and capacity of wastewater treatment systems and the need for more water efficiency technologies were the main barriers to the development of production capacity. Lack of access to fresh water and recycled water were of less concern in terms of production capacity development. This shows the appetite of the medium and heavy water users for the adoption of new technology solutions to improve wastewater treatment and increase water efficiency.

Figure 3.6 Barrier to the development of production capacity

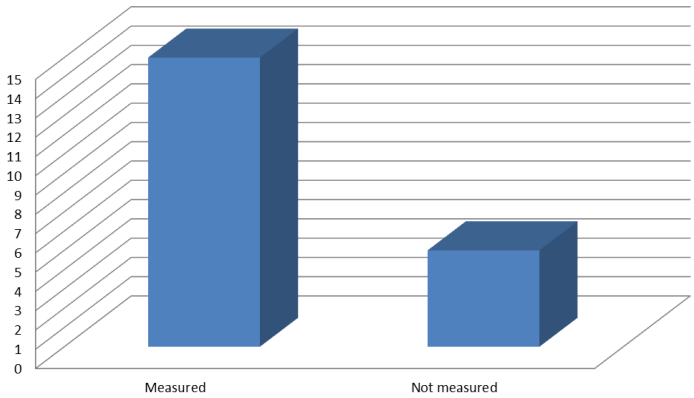


In another question, participants were asked to list the potential barriers to adopt water efficiency technologies such as water re-use and recycling or other technologies. Four main barriers were identified:

- Fitness for purpose
- Lack of proven examples
- Safety considerations
- Financial risks / Return on Investment and available funding for validation and trials

In order to understand the appetite of the participating companies in measuring water efficiency/water consumption within their facilities, they were asked if they measure their water efficiency status. Responses are presented in Figure 3.7. 75% of the participants measured their current water efficiency status while 25% did not.

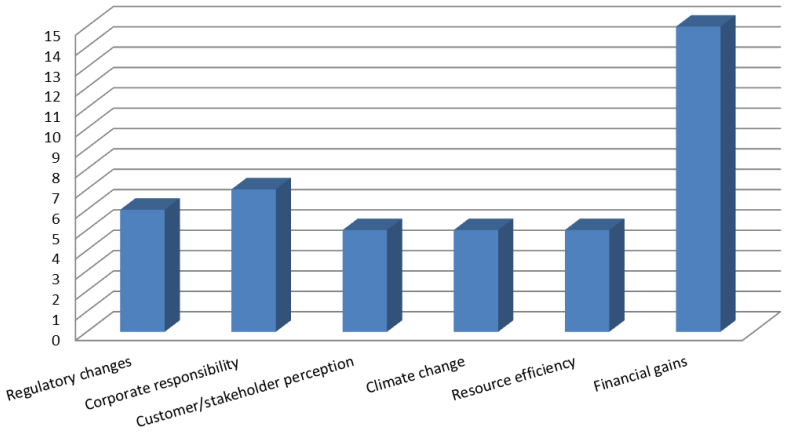
Figure 3.7 Measurement of current water efficiency status within the facility



Participants were asked about the main drivers of change within their industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies. Figure 3.8 presents the drivers of change presented to the participants and the number of marks each option received.

"Financial gains" through adoption of new innovative water / wastewater technologies were identified as the main driver of change. They were followed by corporate responsibility, regulatory changes, customer/stakeholder perception, resource efficiency and climate change.

Figure 3.8 Drivers of change relating to the adoption of new water / wastewater treatment technologies



During the survey it was asked if the participants previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption. 70% (14 out of 20) of the participants had not received support from any public sector bodies for activities related to water or wastewater technology adoption. Out of the 6

companies which previously received support from the public sector bodies, 3 were fully satisfied with the level of support they had received, 1 did not comment as they were in the middle of a project and 2 were dissatisfied. The key reason for expressing disappointment was that in their opinion they did not receive suitable solutions for their key issues.

Finally, participants were asked if their organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation. 79% of the participants expressed interest in participating in any future Scottish Enterprise work of this nature, 11% indicated that they may participate and the remainder were not interested (11%).

Based on the information captured from the survey and WRc's past experience, various findings and challenges are highlighted in this section.

Industry awareness on barriers for future development

According to the responses received from the survey, there is a high level of awareness of future water availability and restrictions on wastewater discharge for industrial users, particularly amongst heavy water users.

Appetite of industrial users for adoption of new technology solutions

There is a strong interest within medium and heavy water users for the adoption of new technology solutions. This is particularly observed where local constraints exist; either through expansion demands or environmental constraints identified by SEPA.

Amongst the industries surveyed there appeared to be a general trend for expansion of capacity, coupled with a need to maintain operations at a named location. At some locations this is resulting in potential constraints due to limitations in the availability of sufficiently high quality water resources. For industries such as breweries and distilleries which traditionally obtain part of their water supply via ground water abstraction from the neighbouring area, land-owners demand on-going access fees for water abstraction and this fee appears to be continuing to rise. Therefore, uncertainties in terms of costs associated with fresh water intake and importantly accessibility to fresh water (relying on others to provide water) have put additional strains on current operations and future development of this industry.

In addition, current stringent regulations on wastewater discharge both in terms of volume and quality have added more constraints on medium and heavy water users in terms of treatment and discharge costs. This was clearly identified by the survey where the participants indicated that "financial gains" was the highest driver of change and to the adoption of new treatment technologies. Employing new wastewater treatment technologies which are able to deliver high wastewater quality at high reliability is essential. Moreover, the opportunities for wastewater recycling and reuse have not been fully exploited by most of the medium and

heavy water users to both minimise the volume of the discharge and reduce the dependence on fresh water supply.

Challenges and risks associated with adoption of new technology solutions by the end-users

1- Financial risks / Return on Investment

In trialling innovative new technologies, financial risks and return on investment were the main two risks identified by the medium and heavy water users. The cost was also identified as the highest drivers of change relating to adoption of new water / wastewater treatment technologies. In order to minimise this risk, introduction of innovation funds could be essential. This could minimise the investment cost and financial risks for the medium and heavy water users. In addition, it could support innovation and the technology providers to improve their innovative technologies. A list of global innovation funding programmes are gathered and presented in Table 4.1.

2- Technology readiness and relevance (fit for purpose):

A number of participants in the survey indicated that they have reservations to adopt new technologies due to: 1) the lack of confidence in technology being fit for purpose; 2) not having past proven performance information; and 3) safety considerations particularly in the food and beverage industry. These could be addressed through having the requirement for testing and/or obtaining accreditation from a third party validating the performance of the technology against the claimed specifications. This would reduce the risk to the medium and heavy water users.

In addition, for innovative new technologies, it is important to ensure that the technology readiness level (TRL) is at 9 (commercialised level) and ready for up-scaling as the medium and heavy water users do not want to be the ones developing the technology for the first time. If the technology is not scaled up, it is important that the technology providers could demonstrate that there are plans in place for future up-scaling of the technology.

3- Regulatory and operation / production risks

In the case of failure during the trialling stage of a technology, it is important to understand if there are any penalties from the regulators for the medium and heavy water users. In addition, it is important to assess the operation / production risks associated with the failure of the technology such as loss of production due to low fresh water availability.

Comments on legal contract requirements between the medium and heavy users and technology provider

In order to promote innovation and adoption of new technology solutions, the following points should be considered.

1- *Expectations management -* in order to promote a successful and collaborative trial of a new technology, realistic performance commitments should be set based on the available test data and understanding of the site condition and not just the literature in isolation.

2- *Risk Sharing –* both financial and performance risks associated with employing new technologies discourage medium and heavy water users to trial innovative technologies. Sharing the risks between the technology provider and the end-user will reduce the risk for both parties.

3- *Level of involvement and support –* this should be clearly defined and agreed in the contract. Trialling new technologies at the medium and heavy water user's site could be challenging. The operators of the site typically are resistant to trialling new technologies. Therefore, in order to have a successful trial, it is important to involve the site manager and operators in the trial. Additionally, technology providers should be committed to provide operating and troubleshooting support if they are not running the trial. This should be defined at the contract stage.

4- *Collaboration –* as stated in point 3, collaboration is the key to success. In addition to providing adequate resources, it is important that the technology provider makes references and case studies of the innovation technologies available to inform and educate the team.

5- *Realistic liability set on technology provider –* The innovative technologies are not widely tested and will impose some risks to the medium and heavy water users. However, setting unrealistic liabilities on technology providers could discourage them in the promotion of trials and new innovative solutions.

6- *Intellectual Property (IP) protection –* technology providers would typically like to retain their IP for the technologies. They should be supported in protecting their IP.

3.3 Market intelligence from Trade Associations

In addition to the survey which was sent out to various industry sectors within Scotland, a list of questions were sent to the trade associations to gain trade body's industry wide, strategic, perspective on industrial water use. The questions were focused on:

- the importance of water to their members;

- issues relating to water affecting their members;
- the main drivers to adopt new water technologies; and
- any ideas on how to accelerate the adoption of best practice water technology

The detailed responses received are presented in Appendix A. Below is a summary of the received responses.

Dairy UK

Dairy industry is aware of the pressures on water resources and water efficiency is one of their priorities. The dairy industry has an initiative called “Dairy Road Map” which is an aspiration defined every 5 years. In this Road Map the fresh water efficiency targets of 20% improvement in 2008-2020 and 30% improvement in 2008-2025 are defined.

The dairy industry in the UK is currently at 23% improvement in water efficiency which is in line with their 2008-2020 targets for improvement of water efficiency. In addition, based on their assessment in 2008-2016 this industry has achieved 17.5% reduction in wastewater production.

The main drivers to adopt new water technologies in this industry sector is their commitments to be more water efficient and to hit the targets set by Dairy UK. In addition, regulation and legislations are other contributing factors.

In order to accelerate the adoption of best practice water technologies within their industry, they have been sharing the positive stories and publishing case studies within the sector. They also look at ways to support their sector both through Dairy UK and the government. They believe having the first successful example of adopting new technology is very important and could encourage other end-users to follow. They have been supporting co-funding programs such as Industrial Energy Efficiency Accelerator funding (IEEA) which is managed by Carbon Trust (Table 4.1) and found it highly successful within their sector.

The Confederation of Paper Industries (CPI)

Water is crucial to the papermaking process. Paper cannot be made without water. In simple terms, paper making fibres are carried in water. Whilst the paper sector has a high water use, water consumption is low. The majority (85% plus) is returned to the environment.

As the paper sector is regulated through environmental permitting (IED), Best Available techniques (BAT), is defined in the Pulp & Paper BREF document. All mills are required to work to BAT (by September 2018). There are BAT AEPLs (BAT Associated Emission Performance Levels) in the BREF for water use. These are different for different paper making

processes. Water usage when producing packaging paper, for example, is less than usage for tissue which is in turn less than usage for speciality grades.

A clean, consistent water supply is essential for paper mills. Water is generally abstracted from boreholes or rivers with few mills using mains water supply. Generally water is recycled as much as possible in the process. Water is usually used initially for cooling purposes with the warm water being collected and used for sprays and process dilution. Treatment of paper mill effluents is well understood with emission levels defined in the BREF. Emission levels are different for different grades of paper produced. Treated effluent is reused in the process where appropriate typically for hose water and low grade sprays.

As above, a consistent supply of water is essential. Paper machine cannot stop and start short term to accommodate fluctuating water availability. Any threat to the availability of water would deter investment and limit growth.

In some cases the quality of water is not good enough for reuse in the process. New water technologies may improve this allowing for greater reuse. Greater energy efficiency could also be a driver.

CPI do not have any recent publications. We have previously collaborated with Envirowise (now part of WRAP) on the Guide BG348 *Reducing water costs in paper and board mills* (The Paper Federation of Great Britain, 2002) and the Environmental Technology Best Practice Programme Guide GG111 *Practical Water Management in Paper and Board Mills.*

4. Regional, national and international funding programmes

The following table presents a list of Regional, National and International funding programmes

Table 4.1 List of regional, national and international funding programmes

Funding Name	Programme Team	Country	Available fund	Max contribution to project cost	Time line	Summary
BEIS Industrial Energy Efficiency Accelerator (IEEA)	Co-Funded by: Department for Business, Energy & Industrial Strategy Led by: Carbon Trust Partners: JACOBS, amec foster wheeler	UK	£9.2 million	40-60%	2017-2021	Focused on novel technologies with an intention to reduce energy use and/carbon emissions. Open to private sector companies and universities. Through an open competition, with awards typically in the range of £150k - £750k for up to 20 projects (40-60% capital support of eligible costs).
SD Tech Fund	Funded by: Canadian Government Delivered by: Sustainable Development Technology Canada	Canada	$965 million	33%		The SD Tech Fund supports projects that are pre-commercial and have the potential to demonstrate significant and quantifiable environmental and economic benefits in one or more of the following areas: climate change, clean air, clean water and clean soil. Since 2001, the Government of Canada has allocated a total of $965 million for the fund. This fund is active and accepting applications through a continuous intake process.
Interreg 2 Seas	Co-Funded by: European Regional Development Fund	EU	€241million	60%	2014-2020	European Territorial Cooperation Programme covering England, France, the Netherlands and Belgium (Flanders). Projects can be part-financed for up to 60 % of their total project budget.
SBRI: point-of-use treatment for organic-rich surface water	Funded by: Scottish Water	UK	£450,000	100%	2018	Fund up to 5 feasibility studies to explore the development of a point-of-use (POU) water treatment system.
Makara Innovation Fund	Funded by: Joint venture between Intellectual Property Office of Singapore and Singapore private equity firm Makara Capital Partners	Singapore	US$718 million	100%	2018-2026	Intellectual Property Office of Singapore and local private equity firm Makara Capital will invest US$30 to US$150 million each in 10 to 15 companies with globally competitive technologies.
Industrial Strategy Challenge Fund	Funded by: UK Government Delivered by: UK Research and Innovation.	UK	Varies for different schemes		2017-2021	Part of UK Government's strategy for £4.7 billion increase in research and development over 4 years. It is designed to ensure that research and innovation takes centre stage in the government's Industrial Strategy.

HORIZON 2020	Funded by: EU Delivered by: European Commission	EU	€80 billion Euro		2014-2020	Horizon 2020 emphasis on excellent science, industrial leadership and tackling societal challenges. Horizon 2020 is the biggest EU Research and Innovation programme. In addition to the private investment that this money will attract. It promises more breakthroughs, discoveries, and 'world-firsts' by taking great ideas from the lab to the market.
The Newton Fund	Funded by: UK Government and partner countries. Delivered by: 15 partners http://www.newtonfund.ac.uk/about/about-delivery-partners/	UK , Brazil, Chile, China, Colombia, Egypt, India, Indonesia, Jordan, Kazakhstan, Kenya, Malaysia, Mexico, Peru, Phillipines, South Africa and wider Africa, Thailand, Turkey, Vietnam	total UK investment of £735 million with partner countries matching resources	Varies	2014-2021	The Newton Fund uses science and innovation partnerships to promote economic development and social welfare of partner countries. It does this through collaboration with partner countries and working with 15 UK delivery partners. The Newton Fund was launched in 2014 and now has a total UK investment of £735 million to 2021, with partner countries providing matched resources within the fund.
MassCEC (Massachusetts Clean Energy Centre)	Funded by: State of Massachusetts Delivered by: Massachusetts Renewable Energy Trust Fund	US	$500,000	100%		MassCEC encourages the development of the water technology industry by supporting the formation of a water technology industry cluster organization, helping the local industry access global partners and markets, and by providing early funding support for promising water technologies. By utilizing existing grant programs, MassCEC aims to accelerate the commercialization of new technologies in the water market.
DND/NSERC Research Partnership Grants	Funded by: Canadian Government Delivered by: NSERC	Canada	$500,000 / application	100%	Up to five years from start	The Collaborative Research and Development (CRD) Grants are intended to create mutually beneficial collaborations between Canadian universities and private and/or public sector partners that lead to advancements that will result in economic, social or environmental benefits.
Innovate UK	Funded by: UK Government Delivered by: Innovate UK	UK	£19 million	100%		UK businesses can apply for a share of £19 million for game-changing innovations with strong commercial potential that will significantly impact the UK economy. This competition covers a UK based business of any size – one or more micro, small or medium-sized enterprise (SME) must be involved.
Resource Efficiency And Productivity (REAP) Grants	Funded by: Government of South Australia Delivered by: Green Industries SA	Australia	$20,000 / applicant	50% (match funding)	2017-2018	REAP Grants are available as a subsidy towards the cost of resource efficiency and productivity assessments delivered by third parties for the benefit of South Australian businesses. Funds are also available to 'kick-start' implementation of improvements recommended through the assessment.

Below is some additional information on three of the funding programs which could potentially be adopted by Scottish Enterprise:

BEIS Industrial Energy Efficiency Accelerator (IEEA)

This program has recently been launched. This is a co-funding program where up to 40-60% of the capital cost is paid by the UK Department for Business, Energy & Industrial Strategy and the remaining is paid by an industry partner. Carbon Trust is assigned to promote and manage the program. JACOBS and foster wheeler are in the technical committee to evaluate the technologies and conduct the technical review.

This program is mainly focused on technologies at TRL values of 5-8 where they are ready for pilot scale validation but not commercialised yet. It funds technologies with capacity to reduce energy use and or carbon emissions.

This program aims to promote the use of innovative technologies within high and medium energy intensity industries. However, the model could be adopted for the high and medium water users within the industry sectors in Scotland.

SD Tech Fund

The SD Tech Fund is a co-funding program where up to 33% of the project costs are paid by the Canadian government. Average contribution is $2-4 million over the life of a project up to a five-year period. Private sector contribution must be at least 25% of the eligible project costs. At least 50% of eligible project costs must be incurred in Canada.

The fund supports projects that are pre-commercial and have the potential to demonstrate significant and quantifiable environmental and economic benefits in one or more of the following areas: climate change, clean air, clean water and clean soil.

This fund is to support Canadian small and medium size enterprises by providing non-repayable contributions. This program is funded by the Canadian government and delivered by Sustainable Development Technology Canada. This funding is designed to fund projects at earlier stages of development (TRL 3 to 7) in comparison with the IEEA.

Interreg 2 Seas

Interreg 2 Seas 2014-2020 is a European Territorial Cooperation Programme covering England, France, the Netherlands and Belgium (Flanders). The Programme is part-financed by the European Regional Development Fund and has a total of €241m European Regional Development Fund

The overall objective of this program is to develop an innovative, knowledge and research based, sustainable and inclusive 2 Seas area, where natural resources are protected and the green economy is promoted.

This is a large program covering various objectives including technical innovation. The programme seeks to contribute to increase the delivery of technological innovation applications throughout the innovation chain by:

- enhancing technology transfer and uptake, in particular by SMEs,
- testing and developing pilot actions;
- promoting a closer, more effective and operational cooperation among the key stakeholders of innovation.

Unlike IEEA this program is designed to fund projects at earlier stages of development (TRL 3 to 7).

5. Conclusions and Recommendations

5.1 Conclusions

Since in Scotland water metering is not compulsory, there is some level of uncertainly in the reported abstraction data.

A survey was conducted targeting various industry sectors including the heavy (>100,000 m^3 per year) and medium (35,000-100,000 m^3 per year) water users. 85% of the participants were from medium and heavy water using industry sectors. For those companies who reported water being a barrier to the development of their product capacity, capability and capacity of wastewater treatment systems and the need for more water efficient technologies were identified as their main reasons. Lack of access to fresh water and recycled water were of less concern. This shows the appetite of the medium and heavy water users for adoption of new technology solutions to improve wastewater treatment and increase water efficiency.

There was expressed interest from medium and heavy water users to adopt new technology solutions particularly where local constraints exist either through expansion demands or environmental constraints identified by SEPA. However, the following barriers and risks were identified in adopting new water / wastewater treatment technologies:

- Financial risks / Return on Investment
- Technology being fit for purpose ;
- Lack of proven examples;
- Safety consideration particularly in re-use applications for food and beverage industry; and
- In addition, WRc highlighted the need for further understanding of the regulatory risks and operation / production risks.

“Financial gains” through adoption of new innovative water / wastewater technologies was identified as the main driver of change. This was followed by regulatory changes, corporate responsibility, customer / stakeholder perception, climate change and resource efficiency.

70% of the participants had not received any support from public sector bodies for activities related to water or wastewater technology adoption. 79% of the participants expressed interest in participating in Scottish Enterprise work which might lead to field trials and evaluations of new water / wastewater treatment technologies.

For a successful collaboration between the technology provider and the industrial water user the legal contract requirements need to be managed and considerations should be given to:

- Expectations management;
- Level of risk sharing;
- Level of involvement and support by each party;
- Level of collaboration;
- Realistic liability set on technology provider; and
- IP protection.

5.2 Recommendations

In order to promote new technology adoption by heavy water users, Scottish Enterprise should consider the following:

Funding arrangements should be organised. This could be either fully paid by the Scottish Government or co-funded with the medium and heavy water users to minimise the financial risks. A list of similar funding programmes is provided in the report.

Scottish Enterprise could adopt funding models such as BEIS Industrial Energy Efficiency Accelerator (IEEA) for any future support.

To minimise the barriers and risks of adopting new innovative technologies, a structured assessment procedure should be introduced to:

1 Assess the innovative technology in terms of its Technology Readiness Level (TRL) and to ensure that it is either at TRL 9 (commercialised) or ready to be commercialised shortly after the successful trial; and

2 Ensure the technology has been tested and / or obtained an accreditation from a third party validating the performance of the technology against the claimed specifications.

Provide incentives to the medium and heavy water users by adopting and trialling new technologies.

The funding should be awarded in stages. At the end of each stage, Scottish Enterprise or its trusted third party should intervene and review the progress of the project against the defined

targets. This will allow Scottish Enterprise and the industry partner to ensure targets are achieved or will be achieved by the end of the project.

In order to accelerate the adoption of new innovative water / wastewater treatment technologies within the industry, sharing the positive stories and publishing case studies could be effective.

6. Reference

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Appendix A Response from Trade Associations

Henry Clifford
Environment Manager
Dairy UK

How significant is water to your members?

We constantly look at water efficiency, its link to cost saving and being profitable. Moving forward as the pressure is on water resources we look at how dairy industry could be more water efficient .

Are you aware of any targets, aspirations, best practice, performance measurements within your industry in terms of water efficiency?

Dairy industry has initiative called Dairy Road Map which is an aspiration defined every 5 years. We have fresh water efficiency targets of 20% improvement in 2008-2020 and 30% improvement in 2008-2025.

Data shows 17.5% volume reduction of effluent discharge in 2008-2016.

The diary industry is currently at 23% water efficiency and they have almost hit the target already.

What issues relating to water affect your members (focused on water supply, water use (efficiency) and water treatment)?

Both water and wastewater are important. We look at water efficiency, water reuse, how dairy industry could reuse water and how that impact the food hygiene.

In terms of wastewater treatment capacity and quality of discharge, we have seen improvement within our industry.

Any barriers that reduce turnover or growth of companies relating to water?
Not in particular

What are the main drivers to adopt new water technologies?
Industries commitment to be more efficient and the targets we set for the dairy industry help to drive the change. Regulations and legislations are also contributing. Technologies and business cases that could provide cost saving and process improvement and help the businesses to be beneficial.

What opportunities exist for your members to reduce the impact of water?
A few years ago there was a lack of opportunity and there was need for improvement of treatment technology. Treatment technologies didn't keep up with the requirements. The targets initially were too ambitious and technologies couldn't keep up with the requirement. However, at present, new treatment technologies are delivering what is expected and are assisting the sector to hit the set target.

Any ideas on how to accelerate the adoption of best practice water technology?
Share the positive stories. Publish the case studies. Show where and how are the best practices. We look at supports that could be given to the industry by Dairy UK and the government.

Having the first example of a successful application of a new technology within the industry is very important. This could be

We work with carbon trust to ensure our industry gain benefit from Industrial Energy Efficiency Accelerator funding (IEEA). It has been very highly successful within our industry.

We found the IEEA is very easy to make it cross sectorial and could be used within sectors. And united different sectors and share the findings.

Do you have access to any publications/ case studies /research on water published by your organisation that we could have access to?

Dairy road map document

Debbie Stringer
Environment Manager
The Confederation of Paper Industries (CPI)

How significant is water to your members?

Water is crucial to the papermaking process. We cannot make paper without water. In simple terms, paper making fibres are carried in water, ejected through a narrow nip onto a moving wire. Fibres are formed into the paper sheet on the wire as the water drains through the wire and is collected and recirculated back through the process. That said, whilst the paper sector has a high water use, **water consumption in low**. The majority (85% plus) is returned to the environment.

Are you aware of any targets, aspirations, best practice, performance measurements within your industry in terms of water efficiency?

As the paper sector is regulated through environmental permitting (IED), Best Available techniques (BAT) is defined in the Pulp & Paper BREF document. All mills are required to work to BAT (by September 2018). There are BAT AEPLs (BAT Associated Emission Performance Levels) in the BREF for water use. These are different for different paper making processes. Water usage when producing packaging paper, for example, is less than usage for tissue which is in turn less than usage for speciality grades.

What issues relating to water affect your members (focused on water supply, water use (efficiency) and water treatment)?

A clean, **consistent** water supply is essential for paper mills. Water is generally abstracted from boreholes or rivers with few mills using mains water supply. Generally water is recycled as much as possible in the process. Water is usually used initially for cooling purposes with the warm water being collected and used for sprays and process dilution. The grade of paper manufactured dictates the amount of water that can be recycled round the system and, hence usage levels as above. Treatment of papermill effluents is well understood with emission levels defined in the BREF. Again emission levels are different for different grades of paper produced. Treated effluent is reused in the process where appropriate typically for hose water and low grade sprays.

Any barriers that reduce turnover or growth of companies relating to water?

As above, a consistent supply of water is essential. Paper machine cannot stop and start short term to accommodate fluctuating water availability. Any threat to the availability of water would deter investment and limit growth.

For the following questions the paper mills themselves are better placed to answer. I understand you have had responses from at least two of the four mills in Scotland. I would refer you to these responses.

What are the main drivers to adopt new water technologies?

In some cases the quality of water is not good enough for reuse in the process. New water technologies may improve this allowing for greater reuse. Greater energy efficiency could also be a driver

What opportunities exist for your members to reduce the impact of water?

Any ideas on how to accelerate the adoption of best practice water technology?

Do you have access to any publications/ case studies /research on water published by your organisation that we could have access to?

As mentioned water efficiency is a mature concept in the paper sector. We do not have any recent publications. We have previously collaborated with Envirowise (now part of WRAP) on the Guide BG348 *Reducing water costs in paper and board mills*: http://www.wrap.org.uk/sites/files/wrap/BG348.pdf and the Environmental Technology Best Practice Programme Guide GG111 *Practical Water Management in Paper and Board Mills.* Unfortunately I do not have a link/digital version of the latter guide.

Appendix B Completed surveys

Water Efficiency Technologies Research

Scottish Enterprise has commissioned WRc to carry out a survey of industrial water users in Scotland. The survey is designed to determine the level of industry support for the introduction of new technology solutions for water treatment, wastewater treatment and water re-use and recycling.

On behalf of Scottish Enterprise, please find below a short survey that will allow you to comment on whether there is a substantive demand for the introduction of innovative and novel wastewater treatment technologies within industry which might support business growth within Scotland. Please can you take a few minutes to familiarise yourself with the survey questions. **We will call you in a few days to help you to complete the survey over the phone and to answer any questions that you may have.**

Scottish Enterprise helps to identify and exploit opportunities for economic growth by supporting ambitious companies based in Scotland to compete within the global marketplace. Scottish Enterprise also works with a range of partners in the public and private sectors to attract new investment to Scotland and to help create a world-class business environment. This survey forms part of that ambition and follows the Scottish Government's Hydro Nations Strategy encouraging new technology companies to locate to Scotland and develop solutions from Scotland.

The following questions are designed to help Scottish Enterprise qualify the industrial sector's approach to the adoption of new technologies, and whether there is a demand such new technology.

We do not expect the survey to take more than 15 minutes of your time, and your responses will be kept confidential on request.

Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Ronald Daalmans, Environmental Manager, Chivas Brothers Ltd

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

- **Distiller/brewer**
- Manufacturing
- Pharmaceutical
- Textiles
- Paper
- Mining, quarrying and construction
- Oil & gas
- Food and Drink
- Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

a) Heavy use >100,000 m^3 per year

b) Medium use 35 – 100,000 m^3 per year

c) Light use <35,000 m^3 per year

3. Would you consider any of the following issues to be a barrier to your production capacity development?

- **Waste water treatment capability and capacity;**
- **Lack of access to sufficient water restricting your plans for business growth;**
- **Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;**
- **Need for greater water efficiency technologies and techniques.**

4. What do you consider to be the main barriers to the adoption of the following:

- Access to increased volumes of water for production use;
    - **Most distillery supplies are privately owned, long-established and of high quality with access generally agreed through simple wayleaves. For malt distilleries, in particular, water supplies have traditionally played an important part in marketing / telling the story of the whisky brand. Where local constraints exist (either through expansion demands or environmental constraints identified by SEPA) it is generally possible to identify additional potential supplies. However, current land-owners are generally looking for ongoing access payments to abstract water from their land or move it across their estate, with wayleave charges compared to the value of commercial mineral water supplies or mains water costs.**
- Water efficiency technologies;
    - **Water supplies are generally private and cost free, making justification of business case difficult unless driven by local environmental constraints or expansion limitations**
- Water re-use and recycling technologies;
    - **Water supplies are generally private and cost free, making justification of business case difficult unless driven by local environmental constraints or expansion limitations**
- Waste water treatment solutions.
    - **Developers / providers with a fixed technology mindset / expertise, rather than problem characterisation, reduction & treatment option assessment approach**
    - **Limits to in-house knowledge or access to external independent advice to help assess & compare the relative merits of different treatment technologies**

- **Lack of proven examples of comparable effluents / sectors.**
- **Problem & treatment mindset of developers, vs raw material & resource recovery approach**

5. Do you measure your current water efficiency status, for example in terms of water use: product ratio?

Yes, we measure:
- total abstraction (process & cooling)
- volume returned (cooling)
- efficiency per tonne input / litre output (process)

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption? **Yes**

If so, which? **Zero Waste Scotland and Hydro Nation Water Innovation Service**

Would you consider your experience to have been beneficial, and how might that experience have been improved? **Generally positive, but has been used to date as a means of checking and auditing our operations for water efficiency opportunities. The industry has a water efficiency target wished to establish if any good practice measures had not been adopted in both traditional and modern distilling operations. No gaps were found during the audits. We have also sought to identify novel technologies worthy of further consideration / pilot trials through the HNWIS, however, we are awaiting the publication of its database.**

If there was support from the public sector for adopting new technologies, would you consider this? **Yes, this would be welcomed but has generally only be available to SMEs. We have been able to use relatively small amounts of money within the R&D arena to leverage additional funds from UK and EU research bodies in collaboration with academic institutions in order to address common research needs / technology gaps. However, this has not been possible (in order to help share the risk / learnings) for larger organisations interested in piloting or adopting novel solutions to water or wastewater treatment issues.**

Is there anything that might prevent you from seeking further support from public sector bodies?

If support wasn't restricted to SMEs we would seek out further assistance. As an industry we have actively engaged with ZWS on water efficiency matters through the SWA (Scotch Whisky Association). We have sometimes had issues around anonymity of data collected as part of sector studies, which is important to avoid any potential perceptions of un-competitive practice.

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies.

There are a mixture of drivers depending on location:

- **The industry has made a general commitment to improve its water efficiency by 10% in order to demonstrate its contribution to responsible production and one planet prosperity. For many distillery locations these improvements are not driven by a lack of water availability or local competition for water resources.**

- **there is a general trend for expansion of capacity, coupled with a need to maintain operations at a named location. At some locations this is resulting in potential constraints due to limitations in the availability of sufficiently high quality water resources, as distilleries do not generally pre-treat any of their process water supplies. The same is also true for wastewater where local watercourses are small or several distillery operators exist in close proximity.**

- **Although effluent treatment technologies are now able to deliver much higher effluent quality and reliability, the opportunities for efficient capture and reuse of water and effluent has not been fully exploited by the sector. Reuse process technologies have the greatest potential to help with our sector commitments and expansion plans where local constraints exist.**

- **The sector has also made commitments to reduce its carbon emissions and improve its energy efficiency. Where local water constraints are not present, the additional energy and chemical requirements of effluent treatment and reuse technologies (e.g. Reverse Osmosis) currently make these unattractive where a plentiful supply of high quality process water exists nearby.**

- **The majority of malt distilleries use a private water supply for process water, which does not require water treatment. An alternative high quality water source would generally be sough before consideration is given to using water treatment or making use of a mains supply.**

- **Bottling operations now generally use a mains water supply, which is demineralised before use. Risk reduction strategies, regarding the storage of hazardous treatment chemicals on site, have generally resulted in a move from ion-exchange technologies to Reverse Osmosis.**

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation?

Yes, this would be encouraged, especially where risk and learnings can be shared. We would be particularly interested in technologies in the area of:

- resource recovery from or utilisation of effluents and liquid byproducts for the production of added-value feedstocks, products or energy

- technologies to improve the potential for accurate management of water and wastewater treatment plant in order to improve efficiencies, consistency, reliability and reduce associated energy / chemical consumption

- low energy water reuse technologies to allow a cascade of uses of water by different processes on site

- opportunities for alternative uses of low temperature hot water in remote locations

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.

Water Efficiency Technologies Research

Scottish Enterprise has commissioned WRc to carry out a survey of industrial water users in Scotland. The survey is designed to determine the level of industry support for the introduction of new technology solutions for water treatment, wastewater treatment and water re-use and recycling.

On behalf of Scottish Enterprise, please find below a short survey that will allow you to comment on whether there is a substantive demand for the introduction of innovative and novel wastewater treatment technologies within industry which might support business growth within Scotland. Please can you take a few minutes to familiarise yourself with the survey questions. **We will call you in a few days to help you to complete the survey over the phone and to answer any questions that you may have.**

Scottish Enterprise helps to identify and exploit opportunities for economic growth by supporting ambitious companies based in Scotland to compete within the global marketplace. Scottish Enterprise also works with a range of partners in the public and private sectors to attract new investment to Scotland and to help create a world-class business environment. This survey forms part of that ambition and follows the Scottish Government's Hydro Nations Strategy encouraging new technology companies to locate to Scotland and develop solutions from Scotland.

The following questions are designed to help Scottish Enterprise qualify the industrial sector's approach to the adoption of new technologies, and whether there is a demand such new technology.

We do not expect the survey to take more than 15 minutes of your time, and your responses will be kept confidential on request.

Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Alistair Longwell

Senior Manager – Distillation & Maturation Operations

Beam Suntory UK Ltd

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

☒ Distiller/brewer

☐ Manufacturing

☐ Pharmaceutical

☐ Textiles

☐ Paper

☐ Mining, quarrying and construction

☐ Oil & gas

☐ Food and Drink

☐ Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

☒ Heavy use >100,000 m^3 per year

☐ Medium use 35 – 100,000 m^3 per year

☐ Light use <35,000 m^3 per year

☐ Other _____

3. Would you consider any of the following issues to be a barrier to your production capacity development?

☐ Waste water treatment capability and capacity;

☐ Lack of access to sufficient water restricting your plans for business growth;

☐ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

☒ Need for greater water efficiency technologies and techniques.

4. What do you consider to be the main barriers to the adoption of the following:

☐ Access to increased volumes of water for production use;

☐ Water efficiency technologies;

☐ Water re-use and recycling technologies;

☐ Waste water treatment solutions.

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio?

Yes

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption?

No

If so, which?

Would you consider your experience to have been beneficial, and how might that experience have been improved?

If there was support from the public sector for adopting new technologies, would you consider this?

Yes

Is there anything that might prevent you from seeking further support from public sector bodies?

No

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies.

Internal company targets, SWA Environmental strategy targets, water resource availability / climate change, continuous improvement (ISO14001:2015) opportunities, efficiency opportunities, and corporate social responsibility requirements

.

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation?

Yes

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.

Water Efficiency Technologies Research

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Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Arjowiggins

Kathleen Hoy

Environmental Manager at arjowiggins

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

- Distiller/brewer
- Manufacturing
- Pharmaceutical
- Textiles
- Paper
- Mining, quarrying and construction
- Oil & gas
- Food and Drink
- Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

a) Heavy use >100,000 m^3 per year

b) Medium use 35 – 100,000 m^3 per year

c) Light use <35,000 m^3 per year

3. Would you consider any of the following issues to be a barrier to your production capacity development?

- Waste water treatment capability and capacity;
- Lack of access to sufficient water restricting your plans for business growth;
- Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;
- Need for greater water efficiency technologies and techniques.

4. What do you consider to be the main barriers to the adoption of the following:

- Access to increased volumes of water for production use; permit
- Water efficiency technologies; investment
- Water re-use and recycling technologies; investment
- Waste water treatment solutions. investment

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio? Yes – reportable to parent company and regulatory body

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption?

If so, which? Yes – Business Stream for water treatment

Would you consider your experience to have been beneficial, and how might that experience have been improved? Yes

If there was support from the public sector for adopting new technologies, would you consider this? Yes

Is there anything that might prevent you from seeking further support from public sector bodies? No

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies. Legislation/permits/investment

.

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation? Yes

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.

Water Efficiency Technologies Research

Scottish Enterprise has commissioned WRc to carry out a survey of industrial water users in Scotland. The survey is designed to determine the level of industry support for the introduction of new technology solutions for water treatment, wastewater treatment and water re-use and recycling.

On behalf of Scottish Enterprise, please find below a short survey that will allow you to comment on whether there is a substantive demand for the introduction of innovative and novel wastewater treatment technologies within industry which might support business growth within Scotland. Please can you take a few minutes to familiarise yourself with the survey questions. **We will call you in a few days to help you to complete the survey over the phone and to answer any questions that you may have.**

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The following questions are designed to help Scottish Enterprise qualify the industrial sector's approach to the adoption of new technologies, and whether there is a demand such new technology.

We do not expect the survey to take more than 15 minutes of your time, and your responses will be kept confidential on request.

Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Gary Smith, Project Manager, Bioanalysis, Cyclacel Ltd.,

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

☐ Distiller/brewer

☐ Manufacturing

☐ Pharmaceutical

☐ Textiles

☐ Paper

☐ Mining, quarrying and construction

☐ Oil & gas

☐ Food and Drink

☒ Other – (Please Specify) Small Biotech

2. Would you consider your organisation's water use fits in to one of the following categories;

☐ Heavy use >100,000 m^3 per year

☐ Medium use 35 – 100,000 m^3 per year

☒ Light use <35,000 m^3 per year

☐ Other _____

3. Would you consider any of the following issues to be a barrier to your production capacity development?

☐ Waste water treatment capability and capacity;

☐ Lack of access to sufficient water restricting your plans for business growth;

☐ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

☐ Need for greater water efficiency technologies and techniques.

4. What do you consider to be the main barriers to the adoption of the following:

☐ Access to increased volumes of water for production use;

☐ Water efficiency technologies;

☐ Water re-use and recycling technologies;

☐ Waste water treatment solutions.

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio?

We do not manufacture. We have no products.

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption? No

If so, which?

Would you consider your experience to have been beneficial, and how might that experience have been improved?

If there was support from the public sector for adopting new technologies, would you consider this?

Is there anything that might prevent you from seeking further support from public sector bodies?

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies. N/A

.

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation? No.

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know. Confidential please.

Water Efficiency Technologies Research

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Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

John Sanderson

Head of Environment, UK & Ireland at UPM

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

- Distiller/brewer
- Manufacturing
- Pharmaceutical
- Textiles
- Paper
- Mining, quarrying and construction
- Oil & gas
- Food and Drink
- Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

a) Heavy use >100,000 m^3 per year

b) Medium use 35 – 100,000 m^3 per year

c) Light use <35,000 m^3 per year

3. Would you consider any of the following issues to be a barrier to your production capacity development?

- Waste water treatment capability and capacity;
- Lack of access to sufficient water restricting your plans for business growth;
- Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;
- Need for greater water efficiency technologies and techniques.
- None of the above

4. What do you consider to be the main barriers to the adoption of the following:

- Access to increased volumes of water for production use;
- Water efficiency technologies;
- Water re-use and recycling technologies;
- Waste water treatment solutions.
- Potentially Investment funding for investigation / Installation

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio? Yes m3/tonne of product

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption? Not specifcally

If so, which?

Would you consider your experience to have been beneficial, and how might that experience have been improved?

If there was support from the public sector for adopting new technologies, would you consider this?

Is there anything that might prevent you from seeking further support from public sector bodies?

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies. Increasing costs both in terms of fresh water usage and Effluent treatment / changes in legislation/

.

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation? Most probably

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Water Efficiency Technologies Research

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We do not expect the survey to take more than 15 minutes of your time, and your responses will be kept confidential on request.

Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Gerry Stephens, Finance Director, Mackie's Ltd, Westertown, Rothienorman, Aberdeenshire AB51 8US

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

- Distiller/brewer
- Manufacturing
- Pharmaceutical
- Textiles
- Paper
- Mining, quarrying and construction
- Oil & gas
- Food and Drink
- Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

a) Heavy use >100,000 m^3 per year

b) Medium use 35 – 100,000 m^3 per year

c) Light use <35,000 m^3 per year

3. Would you consider any of the following issues to be a barrier to your production capacity development?

- Waste water treatment capability and capacity;
- Lack of access to sufficient water restricting your plans for business growth;
- Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;
- Need for greater water efficiency technologies and techniques.

4. What do you consider to be the main barriers to the adoption of the following:

- Access to increased volumes of water for production use; cost
- Water efficiency technologies; availability
- Water re-use and recycling technologies; suitability and cost
- Waste water treatment solutions. cost

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio? No

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption? We have spoken to several companies to look at waste water treatment and water usage. Non have provided a suitable solution.

If so, which?

Would you consider your experience to have been beneficial, and how might that experience have been improved? No – they could have proposed something that would work at a low cost.

If there was support from the public sector for adopting new technologies, would you consider this? Yes

Is there anything that might prevent you from seeking further support from public sector bodies? No apart from scepticism.

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies. Our customers, the major retailers, are looking for water efficiencies. We are looking for efficient and low cost water use and reuse.

.

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation? Yes

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.

Water Efficiency Technologies Research

Scottish Enterprise has commissioned WRc to carry out a survey of industrial water users in Scotland. The survey is designed to determine the level of industry support for the introduction of new technology solutions for water treatment, wastewater treatment and water re-use and recycling.

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Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Jim Caithness

Regional QSE Manager

SAICA Pack UK Ltd (Edinburgh)

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

☐ Manufacturing

2. Would you consider your organisation's water use fits in to one of the following categories;

☒ Light use <35,000 m^3 per year

3. Would you consider any of the following issues to be a barrier to your production capacity development?

☒ Waste water treatment capability and capacity;

☐ Lack of access to sufficient water restricting your plans for business growth;

☐ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

☐ Need for greater water efficiency technologies and techniques.

4. What are the potential barriers to adopt water efficient technologies such as water re-use and recycling or other technologies?

Water is mainly used in ink. Any colour taint is detrimental. Some use of recycled water to wash out ink containers

Would consider rainwater harvesting. Set up cost and limited knowledge is a barrier

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio?

Yes – water per 1000 m^2 of product

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption?

If so, which? None

Would you consider your experience to have been beneficial, and how might that experience have been improved? N/A

If there was support from the public sector for adopting new technologies, would you consider this? Yes

Is there anything that might prevent you from seeking further support from public sector bodies? No – not top priority at present

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies.

Cost, compliance, policy of continual enviro improvement. No real push from customers at the moment

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation?

I would be interested but would not have the final say.

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Water Efficiency Technologies Research

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On behalf of Scottish Enterprise, please find below a short survey that will allow you to comment on whether there is a substantive demand for the introduction of innovative and novel wastewater treatment technologies within industry which might support business growth within Scotland. Please can you take a few minutes to familiarise yourself with the survey questions. **We will call you in a few days to help you to complete the survey over the phone and to answer any questions that you may have.**

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Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Mr R Hodge -Energy Manager (including sustainability) -DSM Nutritional Products (UK) Limited

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

☐ Distiller/brewer

☒ Manufacturing

☐ Pharmaceutical

☐ Textiles

☐ Paper

☐ Mining, quarrying and construction

☐ Oil & gas

☐ Food and Drink

☐ Other – (Please Specify) Human and animal nutrition

2. Would you consider your organisation's water use fits in to one of the following categories;

☒ Heavy use >100,000 m^3 per year

☐ Medium use 35 – 100,000 m^3 per year

☐ Light use <35,000 m^3 per year

☐ Other _____

3. Would you consider any of the following issues to be a barrier to your production capacity development?

☒ Waste water treatment capability and capacity;

☐ Lack of access to sufficient water restricting your plans for business growth;

☐ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

☒ Need for greater water efficiency technologies and techniques.

4. What are the potential barriers to adopt water efficient technologies such as water re-use and recycling or other technologies?

Currently we are looking at water reduction areas but are constrained by effluent concentration(sulphates) levels to Scottish Water network.

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio?

Water is metered to the site and reported monthly to the production areas and measured against production output. DSM has a site KPI target for m3 water/T production and this is reported monthly and action plans required to account for deviations.

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption?

If so, which? Previous contact with Scottish Water Business Stream looking at methods for ammonia reduction from the waste water treatment plant.

Would you consider your experience to have been beneficial, and how might that experience have been improved?

We have found that most retailers could not provide great technical support when required and support tends to come from internal DSM expertise.

If there was support from the public sector for adopting new technologies, would you consider this?

Yes

Is there anything that might prevent you from seeking further support from public sector bodies?

No.

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies.

We are seeking more sustainable solutions to support capacity increase and cost reduction.

.

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation?

Yes

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.

Water Efficiency Technologies Research

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Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

John McMullen, QSE Manager, AG Barr plc

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

☐ Distiller/brewer

☐ Manufacturing

☐ Pharmaceutical

☐ Textiles

☐ Paper

☐ Mining, quarrying and construction

☐ Oil & gas

☒ Food and Drink

☐ Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

☒ Heavy use >100,000 m^3 per year

☐ Medium use 35 – 100,000 m^3 per year

☐ Light use <35,000 m^3 per year

☐ Other _____

3. Would you consider any of the following issues to be a barrier to your production capacity development?

☒ Waste water treatment capability and capacity;

☐ Lack of access to sufficient water restricting your plans for business growth;

☐ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

☐ Need for greater water efficiency technologies and techniques.

4. What are the potential barriers to adopt water efficient technologies such as water re-use and recycling or other technologies?

Currently being able to demonstrate the correct solution and associated capital investment as well as the ROI on this investment.

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio?

Yes.

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption?

Yes

If so, which?

Scottish Enterprise – we are currently working on an initiative looking at wastewater and future solutions

Would you consider your experience to have been beneficial, and how might that experience have been improved?

Still ongoing at present, and we haven't received the output – too early to comment.

If there was support from the public sector for adopting new technologies, would you consider this?

Absolutely particularly around research and funding.

Is there anything that might prevent you from seeking further support from public sector bodies?

Not specifically.

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies.

The cost of disposing water, and associated energy charges. In addition the need to show that we are using water effectively from a customer/consumer point of view..

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation?

I would think so, provided we could see a future benefit.

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.

Water Efficiency Technologies Research

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Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Jay Christie

Environment Coordinator at Diageo

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

☒ Distiller/brewer

☐ Manufacturing

☐ Pharmaceutical

☐ Textiles

☐ Paper

☐ Mining, quarrying and construction

☐ Oil & gas

☐ Food and Drink

☐ Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

☒ Heavy use >100,000 m^3 per year

☐ Medium use 35 – 100,000 m^3 per year

☐ Light use <35,000 m^3 per year

☐ Other _____

3. Would you consider any of the following issues to be a barrier to your production capacity development?

☒ Waste water treatment capability and capacity;

☒ Lack of access to sufficient water restricting your plans for business growth;

☐ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

☐ Need for greater water efficiency technologies and techniques.

4. What are the potential barriers to adopt water efficient technologies such as water re-use and recycling or other technologies? No barriers but we process our water on site before putting it into product to ensure there is no taint.

5. Do you measure your current water efficiency status, for example in terms of water use: product ratio? Yes, we currently measure water used per litre/litre packaged

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption?

If so, which? No

Would you consider your experience to have been beneficial, and how might that experience have been improved? NA

If there was support from the public sector for adopting new technologies, would you consider this? NA

Is there anything that might prevent you from seeking further support from public sector bodies?

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies. Water quality and efficiency, if we can reduce the amount of water used for process then we gain an financial savings as well as a time saving

.

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation? Yes

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.

Water Efficiency Technologies Research

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Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Jim Spence at key-tech

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

☐ Distiller/brewer

☒ Manufacturing

☐ Pharmaceutical

☐ Textiles

☐ Paper

☐ Mining, quarrying and construction

☐ Oil & gas

☐ Food and Drink

☐ Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

☐ Heavy use >100,000 m^3 per year

☒ Medium use 35 – 100,000 m^3 per year

☐ Light use <35,000 m^3 per year

☐ Other _____

3. Would you consider any of the following issues to be a barrier to your production capacity development?

☐ Waste water treatment capability and capacity;

☐ Lack of access to sufficient water restricting your plans for business growth;

☐ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

☒ Need for greater water efficiency technologies and techniques.

4. What are the potential barriers to adopt water efficient technologies such as water re-use and recycling or other technologies? None

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio? No

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption? None

If so, which?

Would you consider your experience to have been beneficial, and how might that experience have been improved?

If there was support from the public sector for adopting new technologies, would you consider this?

Is there anything that might prevent you from seeking further support from public sector bodies?

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies. ???

.

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation? Possibly

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.

Water Efficiency Technologies Research

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Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Gerard Kennedy, Site Manager, Highland Meats Blaklely Rd, Saltcoats Ayrshire KA215JQ

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

☐ Distiller/brewer

☐ Manufacturing

☐ Pharmaceutical

☐ Textiles

☐ Paper

☐ Mining, quarrying and construction

☐ Oil & gas

☒ Food and Drink

☐ Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

☐ Heavy use >100,000 m^3 per year

☒ Medium use 35 – 100,000 m^3 per year

☐ Light use <35,000 m^3 per year

☐ Other _____

3. Would you consider any of the following issues to be a barrier to your production capacity development?

☒ Waste water treatment capability and capacity;

☒ Lack of access to sufficient water restricting your plans for business growth;

☒ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

☒ Need for greater water efficiency technologies and techniques.

4. What are the potential barriers to adopt water efficient technologies such as water re-use and recycling or other technologies?

We would not be able to re-use water in the majority of our processing as it is food contact or cleaning of food contact areas. However there are some areas on site where we would have the option

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio?

Yes we have KPI's and take daily water meter readings

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption?

No

If so, which? N/A

Would you consider your experience to have been beneficial, and how might that experience have been improved?

N/A

If there was support from the public sector for adopting new technologies, would you consider this?

Yes

Is there anything that might prevent you from seeking further support from public sector bodies?

Not currently

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies.

Our drive to meet our energy and water saving targets by 2020. The financial and environmental benefit plus maintaining our ISO14001 status through continuous improvement.

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation?

Yes

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.

Water Efficiency Technologies Research

Dear first name,

Scottish Enterprise has commissioned WRc to carry out a survey of industrial water users in Scotland. The survey is designed to determine the level of industry support for the introduction of new technology solutions for water treatment, wastewater treatment and water re-use and recycling.

On behalf of Scottish Enterprise, please find below a short survey that will allow you to comment on whether there is a substantive demand for the introduction of innovative and novel wastewater treatment technologies within industry which might support business growth within Scotland. Please can you take a few minutes to familiarise yourself with the survey questions. **We will call you in a few days to help you to complete the survey over the phone and to answer any questions that you may have.**

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The following questions are designed to help Scottish Enterprise qualify the industrial sector's approach to the adoption of new technologies, and whether there is a demand for such new technology

We do not expect the survey to take more than 15 minutes of your time, and your responses will be kept confidential on request.

Water Efficiency Technologies Research Survey Questions

Please provide your name, position and the organisation you represent.

Kenneth Driscoll

Health and Safety Manager at Strathmore foods

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:,

- Distiller/brewer
- Manufacturing
- Pharmaceutical
- Textiles
- Paper
- Mining, quarrying and construction
- Oil & gas
- Food and Drink
- Other – (Please Specify)

They have the bore hole. The abstract licence is 88 m3/ day. They take 44m3/day. They use that for cleaning. Then they take water from ScW for food.

The effluents are combined and collected in an effluent tank . They break the solid with Sodium hydroxide. They adjust pH . and use a coagulant to precipitate the solids. Then pumped to effluent tank. Then Scotloo company comes to take off the solid from that tank. They discharge the wastewater to ScW drain. They are currently trialling a new coagulant.

2. Would you consider your organisation's water use fits in to one of the following categories;

a) Heavy use **>**100,000 m3 per year

b) Medium use 35-100,000 m3 per year

c) Light use - <35,000 m3 per year

3 Would you consider any of the following issues to be a barrier to your production capacity development?

Waste water treatment capability and capacity?

Lack of access to sufficient water restricting your plans for business growth?

Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist?

Need for greater water efficiency technologies and techniques

Explore here the following:

- *Do you have an on-site effluent treatment works? YES*
- *Quality criteria*
    - *Do you have effluent quality criteria which affect treatment processes? YES*
    - *Do your treatment processes produce solid wastes that are difficult to handle (why?) YES food waste. Discharge of the solid waste is issue. Scotloo comes to collect the sludge and wastewater is discharged to the ScW drain line. It comes with a cost for them.*

      They get charged on the wastewater. They get charged. They get charged. Collect in the tank once they collect that in the tank. ScW charge them based on the quality. Discharge. They charge them . they

      Feed

    - *Are you subject to restrictive licence conditions? 61% compliant. Not great.*
    - *Do you discharge to river or coast? None –Scw drain line*

- *Have you investigated and/or installed any innovative treatment solutions on your site? Yes*

- *Quantity criteria*
  - *Are there any quantity restrictions on your downstream discharge? Yes*
  - *Are there any daily/seasonal variations in your discharge which might affect the efficiency of your treatment process? Yes*

- *Odour*
  - *Do you consider you treatment processes as odorous activities? Yes*
  - *Have you ever received any complaints from nearby receptors? (This question applies also to noise) No*

- *Process issues*
  - *Do you consider your treatment process to be reliable? Not at the moment*
  - *Have you had any discharge licence issues with SEPA or other regulatory bodies*? No licence issue.

4. What are the potential barriers to adopting water efficient technologies such as water re-use and recycling or other water efficiency technologies? Depends on the technology and the cost

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio? Yes

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption? NO (3.5 years at least)

   If so, which?

   Would you consider your experience to have been beneficial, and how might that experience have been improved?

Is there anything that might prevent you from seeking further support from public sector bodies?

If there was support from the public sector for adopting new technologies, would you consider this?

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies.

Use the following potential issues as a framework for the conversation:

- *Regulatory changes*
- *Corporate responsibility and/or reporting*
- *Customer/stakeholder perception and influence*
- *Climate change*
- *Resource efficiency*
- *Economics*

Make plant as efficient as possible. They are interested in recycling reuse. They have responsibility. to the site and the local community.

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation?

YES

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential please let us know.

Water Efficiency Technologies Research

Dear first name,

Scottish Enterprise has commissioned WRc to carry out a survey of industrial water users in Scotland. The survey is designed to determine the level of industry support for the introduction of new technology solutions for water treatment, wastewater treatment and water re-use and recycling.

On behalf of Scottish Enterprise, please find below a short survey that will allow you to comment on whether there is a substantive demand for the introduction of innovative and novel wastewater treatment technologies within industry which might support business growth within Scotland. Please can you take a few minutes to familiarise yourself with the survey questions. **We will call you in a few days to help you to complete the survey over the phone and to answer any questions that you may have.**

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We do not expect the survey to take more than 15 minutes of your time, and your responses will be kept confidential on request.

Water Efficiency Technologies Research Survey Questions

Please provide your name, position and the organisation you represent.

Peter Calvert, Station Chemist, Operations at Torness Power Station,

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:,

- Distiller/brewer
- Manufacturing
- Pharmaceutical
- Textiles
- Paper
- Mining, quarrying and construction
- Oil & gas
- Food and Drink
- Other – (Please Specify)

Industrial electricity production

2. Would you consider your organisation's water use fits in to one of the following categories;

a) Heavy use >100,000 m3 per year

b) Medium use 35-100,000 m3 per year

c) Light use - <35,000 m3 per year

Qua

3 Would you consider any of the following issues to be a barrier to your production capacity development?

☐ Waste water treatment capability and capacity;

☐ Lack of access to sufficient water restricting your plans for business growth;

☐ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

☐ Need for greater water efficiency technologies and techniques

NONE

A lot of water has safety implication. They use rain water harvesting as another source of water for cleaning . If they come up with a new technology they would ask for internal investment from the business. If there is a technology that could resolve their issues, they are happy to consider.

Other consideration is the legionella risk. They have had issues. They are instructed to run taps to drain for an extended period of time to minimise the legionella risk. They need to control legionella for staff and control the water within the system.

They have big demineralisation plant. Treated water goes to the demineralised water tank. They are good positioned already. They have on site environmental sustainability representative.

Legionella control is their main issue. They have two major concers one is legionella control for the water in contact with staff and water quality used for their cooling systems.

They have concern on ScW meters as they are not as accurate. They have a lot of water tank with floating and if they have a reliable meter they could minimise the waste. Technologies water monitoring and metering 10-8 inch line. That is another issue.

They haven't done detailed monitoring on the water consumption and wasting of the water due to metering issues.

Technology on metering could help them to monitor the water and minimise waste.

Explore here the following:

- *Do you have an on-site effluent treatment works? Yes. Bio-disks (septic tanks) 4 of them.*
- *Quality criteria*
    - *Do you have effluent quality criteria which affect treatment processes? Yes*
    - *Do your treatment processes produce solid wastes that are difficult to handle (why?) Yes, de-sludge with Scottish water*
    - *Are you subject to restrictive licence conditions? Yes*
    - *Do you discharge to river or coast? Coast*

  Have you investigated and/or installed any innovative treatment solutions on your site? Reed bed cleaning the bio-disk effluent. 2 bio-disk – active filter and the reed bed. .

- *Quantity criteria*
    - *Are there any quantity restrictions on your downstream discharge? Yes*
    - *Are there any daily/seasonal variations in your discharge which might affect the efficiency of your treatment process?in flood event it is different*
- *Odour*
    - *Do you consider you treatment processes as odorous activities? NO.*
    - *Have you ever received any complaints from nearby receptors? (This question applies also to noise)*
- *Process issues*
    - *Do you consider your treatment process to be reliable? Yes they monitor every day they measure suspended solid. They do active management.*
    - *Have you had any discharge licence issues with SEPA or other regulatory bodies?* No

4. What are the potential barriers to adopting water efficient technologies such as water re-use and recycling or other water efficiency technologies?

Nuclear safety and l legionella

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio? No, it is difficult to separate admin and industrial area usages are combined in one meter.

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption? No

   If so, which?

   Would you consider your experience to have been beneficial, and how might that experience have been improved?

   Is there anything that might prevent you from seeking further support from public sector bodies?

   If there was support from the public sector for adopting new technologies, would you consider this?

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies. Money

   Use the following potential issues as a framework for the conversation:

   - *Regulatory changes*
   - *Corporate responsibility and/or reporting and money*
   - *Customer/stakeholder perception and influence*
   - *Climate change*
   - *Resource efficiency*
   - *Economics*

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation? YES

   Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential please let us know.

Water Efficiency Technologies Research

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On behalf of Scottish Enterprise, please find below a short survey that will allow you to comment on whether there is a substantive demand for the introduction of innovative and novel wastewater treatment technologies within industry which might support business growth within Scotland. Please can you take a few minutes to familiarise yourself with the survey questions. **We will call you in a few days to help you to complete the survey over the phone and to answer any questions that you may have.**

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We do not expect the survey to take more than 15 minutes of your time, and your responses will be kept confidential on request.

Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

John MacDonald

SHE Manager

Burton's Biscuits

Edinburgh

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

☐ Distiller/brewer

☒ Manufacturing

☐ Pharmaceutical

☐ Textiles

☐ Paper

☐ Mining, quarrying and construction

☐ Oil & gas

☐ Food and Drink

☐ Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

☐ Heavy use >100,000 m^3 per year

☒ Medium use 35 – 100,000 m^3 per year

☐ Light use <35,000 m^3 per year

☐ Other _____

3. Would you consider any of the following issues to be a barrier to your production capacity development?

☐ Waste water treatment capability and capacity;

☐ Lack of access to sufficient water restricting your plans for business growth;

☐ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

☐ Need for greater water efficiency technologies and techniques.

None of the above

4. What are the potential barriers to adopt water efficient technologies such as water re-use and recycling or other technologies?

None

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio?

Yes

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption?

Yes

If so, which?

Scottish Water Business Enterprise

Would you consider your experience to have been beneficial, and how might that experience have been improved?

If there was support from the public sector for adopting new technologies, would you consider this?

Yes

Is there anything that might prevent you from seeking further support from public sector bodies?

No

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies.

None

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation?

Yes

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.

Water Efficiency Technologies Research

Scottish Enterprise has commissioned WRc to carry out a survey of industrial water users in Scotland. The survey is designed to determine the level of industry support for the introduction of new technology solutions for water treatment, wastewater treatment and water re-use and recycling.

On behalf of Scottish Enterprise, please find below a short survey that will allow you to comment on whether there is a substantive demand for the introduction of innovative and novel wastewater treatment technologies within industry which might support business growth within Scotland. Please can you take a few minutes to familiarise yourself with the survey questions. **We will call you in a few days to help you to complete the survey over the phone and to answer any questions that you may have.**

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Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Owain Williams, Environmental Specialist, Chemring Energetics UK Ltd.

1. Please confirm which industrial sector your organisation is part of. Consider the following categories as part of the discussion:

☐ Distiller/brewer

☒ Manufacturing

☐ Pharmaceutical

☐ Textiles

☐ Paper

☐ Mining, quarrying and construction

☐ Oil & gas

☐ Food and Drink

☐ Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

☐ Heavy use >100,000 m^3 per year

☒ Medium use 35 – 100,000 m^3 per year

☐ Light use <35,000 m^3 per year

☐ Other _____

3. Would you consider any of the following issues to be a barrier to your production capacity development?

☐ Waste water treatment capability and capacity;

☐ Lack of access to sufficient water restricting your plans for business growth;

☐ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

☐ Need for greater water efficiency technologies and techniques.

4. What are the potential barriers to adopt water efficient technologies such as water re-use and recycling or other technologies?

Due to the nature of company operations, the site is sporadic with many buildings located across a sparse area. These have statutory distances between them for risk mitigation and any technologies as highlighted above are likely to be prohibitively expensive to install across such a large and diverse site. In addition, much of the water mains system is over 100 years old. With several kilometres of aged pipework, again replacement would be prohibitively costly.

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio?

Water use is monitored monthly with reduction targets set on an annual basis. Results are compared against various factors including supply issues recorded (e.g. system leaks), weather conditions (the site utilises water in steam generation for heating) and production activity.

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption? No

If so, which? N/A

Would you consider your experience to have been beneficial, and how might that experience have been improved? N/A

If there was support from the public sector for adopting new technologies, would you consider this? N/A

Is there anything that might prevent you from seeking further support from public sector bodies?

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies.

. Cost and statutory requirements tend to be the primary drivers for change

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation?

Potentially, dependent upon project

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.

Water Efficiency Technologies Research

Scottish Enterprise has commissioned WRc to carry out a survey of industrial water users in Scotland. The survey is designed to determine the level of industry support for the introduction of new technology solutions for water treatment, wastewater treatment and water re-use and recycling.

On behalf of Scottish Enterprise, please find below a short survey that will allow you to comment on whether there is a substantive demand for the introduction of innovative and novel wastewater treatment technologies within industry which might support business growth within Scotland. Please can you take a few minutes to familiarise yourself with the survey questions. **We will call you in a few days to help you to complete the survey over the phone and to answer any questions that you may have.**

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Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Gary Milligan, Compliance Co-ordinator, Angus Dundee Distillers PLC

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

☐ Distiller/brewer

☐ Manufacturing

☐ Pharmaceutical

☐ Textiles

☐ Paper

☐ Mining, quarrying and construction

☐ Oil & gas

☒ Food and Drink

☐ Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

☐ Heavy use >100,000 m^3 per year

☐ Medium use 35 – 100,000 m^3 per year

☒ Light use <35,000 m^3 per year *(c. 4,000 m^3)*

☐ Other _____

3. Would you consider any of the following issues to be a barrier to your production capacity development?

☐ Waste water treatment capability and capacity; *(No)*

☐ Lack of access to sufficient water restricting your plans for business growth; *(Not at this moment)*

☐ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist; *(No)*

☐ Need for greater water efficiency technologies and techniques. *(Not at this moment)*

I struggle to see how any of these listed would severely impact on increasing our production capacity at this point in time

4. What are the potential barriers to adopt water efficient technologies such as water re-use and recycling or other technologies?

Cost and the practicalities of adoption/install

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio?

No

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption? *No*

If so, which? *None*

Would you consider your experience to have been beneficial, and how might that experience have been improved? *N/A*

If there was support from the public sector for adopting new technologies, would you consider this? *Yes*

Is there anything that might prevent you from seeking further support from public sector bodies?
No

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies.

Cost Savings

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation?

Would we? Don't see why not if it doesn't impact on process/production?

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.

Water Efficiency Technologies Research

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On behalf of Scottish Enterprise, please find below a short survey that will allow you to comment on whether there is a substantive demand for the introduction of innovative and novel wastewater treatment technologies within industry which might support business growth within Scotland. Please can you take a few minutes to familiarise yourself with the survey questions. **We will call you in a few days to help you to complete the survey over the phone and to answer any questions that you may have.**

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Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Ian Mackie Production Director Whyte and Mackay

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

☒ Distiller/brewer

☐ Manufacturing

☐ Pharmaceutical

☐ Textiles

☐ Paper

☐ Mining, quarrying and construction

☐ Oil & gas

☐ Food and Drink

☐ Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

☒ Heavy use >100,000 m^3 per year

☐ Medium use 35 – 100,000 m^3 per year

☐ Light use <35,000 m^3 per year

☐ Other _____

3. Would you consider any of the following issues to be a barrier to your production capacity development?

☒ Waste water treatment capability and capacity;

☒ Lack of access to sufficient water restricting your plans for business growth;

☐ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

☒ Need for greater water efficiency technologies and techniques.

4. What are the potential barriers to adopt water efficient technologies such as water re-use and recycling or other technologies?

Cost

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio? Yes

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption? No

If so, which?

Would you consider your experience to have been beneficial, and how might that experience have been improved?

If there was support from the public sector for adopting new technologies, would you consider this? Yes if substantial.

Is there anything that might prevent you from seeking further support from public sector bodies? No

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies. Reduce water and energy costs. Reduce carbon foot print.

.

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation? Yes

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.

Water Efficiency Technologies Research

Scottish Enterprise has commissioned WRc to carry out a survey of industrial water users in Scotland. The survey is designed to determine the level of industry support for the introduction of new technology solutions for water treatment, wastewater treatment and water re-use and recycling.

On behalf of Scottish Enterprise, please find below a short survey that will allow you to comment on whether there is a substantive demand for the introduction of innovative and novel wastewater treatment technologies within industry which might support business growth within Scotland. Please can you take a few minutes to familiarise yourself with the survey questions. **We will call you in a few days to help you to complete the survey over the phone and to answer any questions that you may have.**

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Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

Fraser Gourlay. Utilities Supply Manager, CalaChem Ltd

1. Please confirm which industrial sector your organisation is part of.

   Consider the following categories as part of the discussion:

   ☐ Distiller/brewer

   ☒ Manufacturing (Chemicals)

   ☐ Pharmaceutical

   ☐ Textiles

   ☐ Paper

   ☐ Mining, quarrying and construction

   ☐ Oil & gas

   ☐ Food and Drink

   ☐ Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

   ☒ Heavy use >100,000 m^3 per year

   ☐ Medium use 35 – 100,000 m^3 per year

   ☐ Light use <35,000 m^3 per year

   ☐ Other _____

3. Would you consider any of the following issues to be a barrier to your production capacity development?

   ☒ Waste water treatment capability and capacity;

   ☐ Lack of access to sufficient water restricting your plans for business growth;

   ☒ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

   ☒ Need for greater water efficiency technologies and techniques.

4. What are the potential barriers to adopt water efficient technologies such as water re-use and recycling or other technologies?

Business case: ROI for water efficient technologies does not generally meet the company criteria and these projects have to compete on their own merits with business cases that return a much better ROI. Cost of newly developed and largely untested technology with limited evidence to support long term high performance.

5. Do you measure your current water efficiency status, for example in terms of water use: product ratio?

Yes, annual reports are submitted to SEPA as part of PPC permit conditions. Water efficiency is included and is measured per tonne of product

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption? Not that I am aware of however SE supports and has supported CalaChem with growth

   If so, which?

   Would you consider your experience to have been beneficial, and how might that experience have been improved? No comments added to this section

   If there was support from the public sector for adopting new technologies, would you consider this? Yes, particularly relating to the environmental services business that CalaChem operates although manufacturing and service areas would be considered as well.

   Is there anything that might prevent you from seeking further support from public sector bodies?

   No

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies.

Not in any particular order - Cost of disposal is increasing and this is likely to continue, pollution impact of waste water, circular economy, corporate responsibility, more stringent regulatory requirements to maintain and improve a healthy water environment, societal pressures

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation?

Yes

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know. Please treat the responses to the above survey as confidential – Fraser Gourlay

Scottish Enterprise

Water Efficiency Technologies Research - Survey Questions

Please confirm your name, position and the organisation you represent.

1. Please confirm which industrial sector your organisation is part of.

Consider the following categories as part of the discussion:

☐ Distiller/brewer

☑ Manufacturing

☐ Pharmaceutical

☐ Textiles

☐ Paper

☐ Mining, quarrying and construction

☐ Oil & gas

☐ Food and Drink

☐ Other – (Please Specify)

2. Would you consider your organisation's water use fits in to one of the following categories;

☑ Heavy use >100,000 m^3 per year

☐ Medium use 35 – 100,000 m^3 per year

☐ Light use <35,000 m^3 per year

☐ Other _____

3. Would you consider any of the following issues to be a barrier to your production capacity development? N/o

☐ Waste water treatment capability and capacity;

☐ Lack of access to sufficient water restricting your plans for business growth;

☐ Lack of access to water re-use or recycling to help overcome any business growth constraints which might exist;

☐ Need for greater water efficiency technologies and techniques.

Scottish Enterprise

4. What are the potential barriers to adopt water efficient technologies such as water re-use and recycling or other technologies?

Food safety or cost

5. Do you measure your current water efficiency status , for example in terms of water use: product ratio?

Yes

6. Have you previously engaged with or sought support from any public sector bodies for activities related to water or wastewater technology adoption?

If so, which? No

Would you consider your experience to have been beneficial, and how might that experience have been improved?

If there was support from the public sector for adopting new technologies, would you consider this? Yes

Is there anything that might prevent you from seeking further support from public sector bodies?

No

7. What do you consider to be drivers of change within your industry relating to the adoption of new water treatment, water effluent treatment and water reuse process technologies.

cost

8. Would your organisation be prepared to be involved in any future Scottish Enterprise work on this subject which might lead to field trials and evaluation?

Unlikely

Thank you for your time. Please feel free to contact us should you have any questions relating to the survey, I will confirm our details by email. Should you wish your responses to the above survey to be treated as confidential, please let us know.