

Scotland The Hydro Nation

3rd Annual Report

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Laid before the Scottish Parliament
By the Scottish Ministers
SG/2016/249

December 2016

 Scottish Government
Riaghaltas na h-Alba
gov.scot

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Further information on the issues raised in this report can be found at:

Scottish Government www.gov.scot

Scottish Water www.scottishwater.co.uk

Water Industry Commission for Scotland
www.watercommission.co.uk

Drinking Water Quality Regulator
www.dwqr.scot

Citizens Advice Scotland
www.cas.org.uk

Scottish Environment Protection Agency
www.sepa.org.uk

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Scotland The Hydro Nation – 3rd Annual Report

Our Water Economy Vision

Introduction by Roseanna Cunningham MSP, Cabinet Secretary for the Environment, Climate Change and Land Reform

I am very pleased to introduce this third annual report to the Scottish Parliament on progress in delivering against our innovative Hydro Nation agenda.



We can look back with a sense of achievement at the last year for Hydro Nation. Since the last report, the new Hydro Nation Water Innovation Service, a key plank in our domestic strategy to support the industry, has been steadily establishing its central role in Scotland's water ecosystem. Scottish Water continues to achieve the highest standards of service delivery and together with other key partners, including the Scottish Environment Protection Agency, is playing a key role in efforts to protect and enhance Scotland's remarkable water environment which is so important to our national health and wellbeing.

Underpinning this, we are growing our research and knowledge base still further, making an ever greater contribution to Scotland's and our global partners understanding of key water issues.

Further afield, we continue to develop our historic relationship with Malawi, working with our partners in the academic and third sectors, and the Government of Malawi, developing our plans to bring great improvements in access to clean and safe drinking water for many people there. In addition, we are working with our enterprise and development agency colleagues to promote opportunities for our water sector in key markets, and to help our businesses align with developing international water science-based initiatives.

As ever, the Hydro Nation Forum has provided helpful support and oversight of the Hydro Nation agenda, providing guidance and advice on priorities. Their contribution to the development of our water sector is greatly appreciated, and I thank them for their input.

This third report is the last required under statute and so it is right that we take the opportunity to reflect on the Hydro Nation journey to date. I believe these reports offers a very useful outline of activity being carried out by The Scottish Government and our partners under the Hydro Nation agenda. It is therefore my intention that we continue to report in a similar way in future to ensure greater awareness and engagement with Scotland: The Hydro Nation.

The Hydro Nation Journey

Scotland's journey to become a Hydro Nation is directly linked to the strategic vision set out in the Hydro Nation Prospectus document published by The Scottish Government in 2012 and subsequently underpinned by the duty placed on the Scottish Ministers in the Water Resources (Scotland) Act 2013. The duty on Ministers to "take such reasonable steps as they consider appropriate for the purpose of ensuring the development of the value of Scotland's water resources" is the touchstone of the overarching Hydro Nation agenda.

The Hydro Nation vision is one of maximising the economic and non-economic value of Scotland's water resources and seeks to draw together and develop the many different threads that make up Scotland's water sector. It ranges from one of the largest and most successful water utility companies in the UK, through an impressively innovative and diverse supply chain, to the academic specialists that support our industry and help develop policy and practical solutions, we have an industry to be proud of. Ours is a vision that seeks to build on the strengths of the sector identified together with our partners, to help deliver against our ambition for Scotland to be a world leader in the responsible management of water resources.

The road map for the Hydro Nation journey is the Hydro Nation Strategy, an evolving document which sets out the key areas of activity as agreed, and refined by the Hydro Nation Forum, and reviewed by them at its biannual meetings. To assist the Forum's discussion and facilitate focus on priorities the Strategy introduces a number of themes of activity:

- **National**
- **International**
- **Innovation**
- **Knowledge / Profile**

In this first phase of the Hydro Nation journey our focus has been on helping the sector to grow sustainably contributing to the domestic economy and increasing our water profile on the world's stage. We work closely with our enterprise agency partners to better define and understand the sector, providing increasingly sophisticated and better networked support that specifically recognises its needs, but we have not lost sight of the fact that the ultimate beneficiaries must be the people of Scotland. A strong focus on the performance of Scottish Water is central to that, but we also work with other partners to address domestic challenges such as the sustainable provision of rural water and wastewater services.

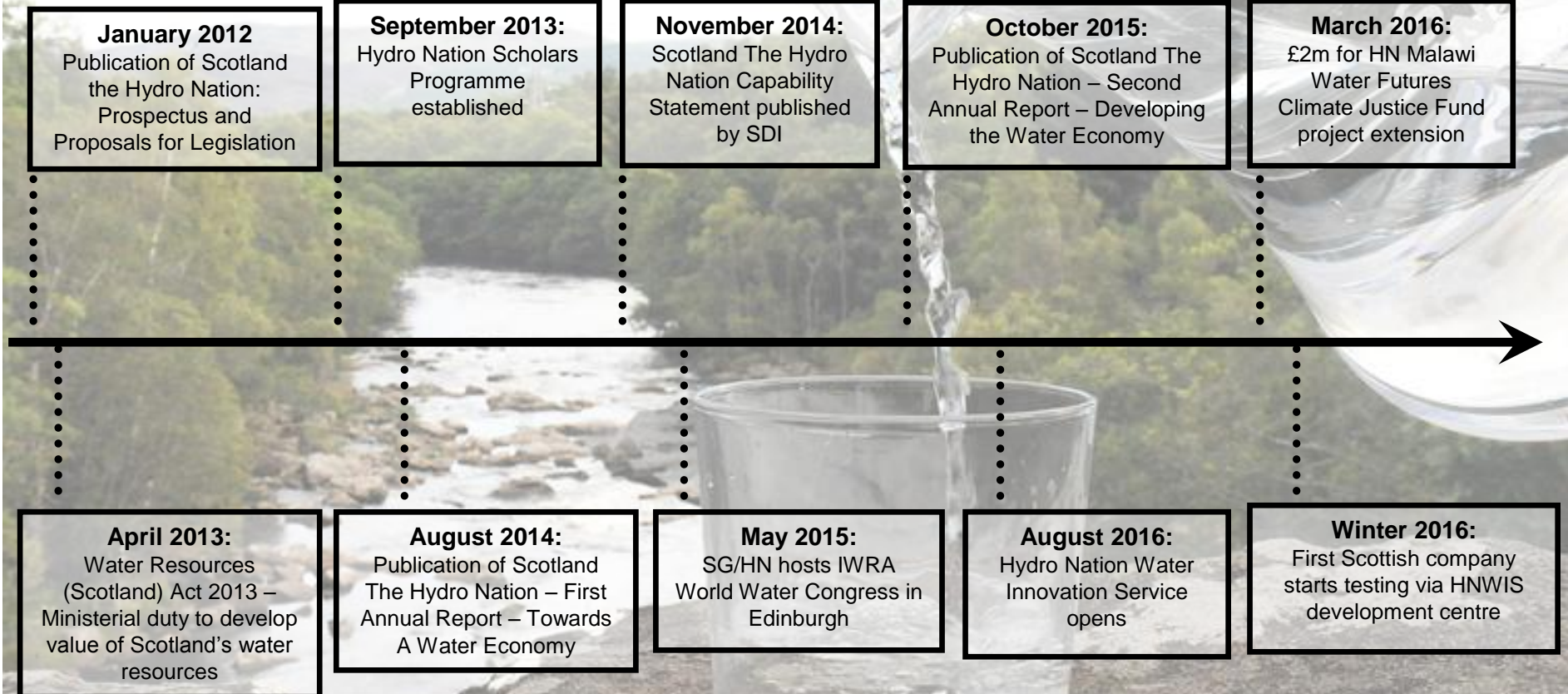
Hydro Nation recognises the critical importance of innovation in developing the sector. Undoubtedly, a major milestone in Hydro Nation's evolution has been in establishing the Hydro Nation Water Innovation Service (HNWIS). Demand for the service has been encouragingly high with good progress being made and the new Development Centres operated by Scottish Water Horizons at Bo'ness and Gorthleck hosted their first HNWIS client companies for testing and evaluation in winter 2016.

Scottish Water continues to report on its own excellent progress meeting the highest standards of quality and service in supplying the people of Scotland, and doing this in ever more cost-effective, energy- and water-efficient ways to consistently deliver amongst the very lowest average charges across the UK. As Scotland's single publicly-owned utility it is right that Scottish Water sits at the heart of our eco system. But as Hydro Nation evolved so has there been increasing focus on the wider constituent parts of the eco system; early-stage businesses, entrepreneurs and new and established innovators, and we expect this aspect to develop further as we move forward.

We have also sought to evolve and develop an appropriate strategy to guide Hydro Nation's international activities to ensure they meet Scottish Government objectives in respect of international development and complement the efforts of Scottish Development International in providing support for the Scottish water sector through spotting opportunities at government level in key territories. For example, we have refined our support via the Climate Justice Fund in sub-Saharan Africa to focus almost entirely on Malawi, to help provide access to clean water and sanitation. In India, we are working with a range of official partners to help address some of India's most pressing water problems through the application of Scottish research and technology and we have established relationships with official bodies overseeing the massive River Ganga clean-up project which is expected to provide commercial opportunities for the Hydro Nation by demonstrating our capability while helping improve lives.

In summary, in a relatively short space of time, Hydro Nation has begun to establish a clear identity and constituency involving a wide range of partners across Scotland and beyond. The next stage in the journey must be to build on our networks to widen our community of engagement, ensure that we are doing everything we can to connect the sectors' members and supporting them to grow and deliver partnerships and innovation that can help consumers at home as well as others around the world.

Timeline of the Hydro Nation Journey



The Hydro Nation – 3rd Annual Report – Highlights

The **Hydro Nation Forum** continue to provide guidance and advice, and to track progress at its biannual meetings. With the Forum’s help we continually review our overarching strategy across the four key interlinking themes set out below to ensure the Hydro Nation programme is fit for purpose, and is working to support the sector’s needs. The last year has seen considerable activity against each of the themes including the following highlighted examples:

National



Cabinet Secretary with Lewis Bennett

Cabinet Secretary for the Environment, Climate Change & Land Reform, Roseanna Cunningham MSP officially launched the 180 metre Shieldhall Tunnelling Machine with Lewis Bennett (aged 9), who won a competition at the local primary school to name it “**Daisy the Driller**”. This crucial 3.1 mile-long waste water tunnel project is a key part of our plans to upgrade Glasgow’s sewerage networks. It will not only help to improve the River Clyde & enable economic growth but also provide much needed resolution to some chronic storm & sewer flooding. This project is part of the biggest upgrade of Glasgow’s waste water network in more than a century. Daisy’s route will

run from Queen’s Park and Craighton industrial estate via Pollok and Bellahouston parks.

Innovation

The First Minister officially opened Ross-Shire Engineering’s purpose built ‘**modular construction**’ workshop in September this year which increases the company’s ability to make products such as water treatment units in Muir of Ord, so they can be delivered to Scottish Water’s sites across the country. This marks an important milestone in the company’s recent expansion as they were successful in securing Capital & Operational Delivery projects from Scottish Water in the period up to 2021. These projects have already secured more than 100 new jobs including opportunities for apprenticeships and many other skilled posts, making a real difference to the local community in Muir of Ord and to the wider economy.



First Minister with Managing Director Allan Dallas.

International

On World Water day, 22 March 2016 the then Cabinet Secretary for Infrastructure, Investment and Cities, Keith Brown MSP, announced that we would be building on our successful Hydro Nation - Climate Justice Fund programme in Malawi which has

already delivered real benefits to thousands of people. Strengthening our existing strategic relationship with the University of Strathclyde and the Malawian authorities, we are now extending the reach of the '**Water Futures**' project to bring benefits to even more people in the Lower Shire Basin in rural Malawi to access groundwater resources protected from the impact of climate change.

Knowledge



The Hydro Nation Scholars Programme goes from strength to strength and we now have a cohort of 18 talented PhD scholars from Scotland and around the world studying a wide range of topics identified by a Steering Group drawn from Hydro Nation family including government, industry and the academic sector.

May 2016 saw the first HNSP Summer School in which Scholars visited a range of key water sites around Scotland helping the Scholars to

contextualise their work in relation to the challenges and opportunities presented by Scotland's water resources from a highland distillery to a lowland flood defence scheme. The scholars worked throughout the field programme to produce syntheses of their learning & engagement on water pressures; policies & futures; and approaches to water management in Scotland.

Hydro Nation - National

Our water sector, including Scottish Water, is worth an estimated £1.8bn to the Scottish Economy. That value can be increased through our actions to improve Scotland's capacity for innovative technological development; effective knowledge transfer across the industry; and ensuring focussed support for our water sector companies. We can also create value from our respected leadership in our unique governance of our water industry. We are also promoting the need for sustainable water efficiency measures.

Provision of high-quality rural services in remote or sparsely populated areas presents distinctive challenges in many parts of the world, including here at home. Scotland is developing innovative approaches to demonstrate our resilience to these challenges. Our work will capitalise on advances in technology; catchment management techniques; supporting Communities' participation; raising quality standards & protecting the environment by supporting businesses to deliver within our valued sustainable service.

Key to our National Strategy is to ensure that, as the sector grows, we support local communities, businesses, and entrepreneurs to develop their own, and share in our, sustainable approach. Below are some examples of how we are delivering in practice.

Supporting Scotland's Communities

Rural Service Provision for drinking & waste water

In partnership with the Water Industry Commission for Scotland (WICS), our Rural Provision Working Group are developing enduring solutions for rural communities with private water & wastewater supplies. As part of this work, WICS is developing a project which will focus on determining the costs associated with a range of technical solutions and service options for small to large private supply communities. To inform this project, WICS have been researching approaches taken to improve private supplies in other countries, particularly across Europe. The UNESCO Centre for Water Law, Policy and Science, University of Dundee has also published research reports on the issue of public supply, including most recently: Hendry, S and Akoumianaki, I. 2016 – 'Governance and management of small rural water supplies: a comparative study'.. Available online at: crew.ac.uk/publications – ref: CRW2015/05

Scottish Water: delivering for you

Scottish Water are supporting local businesses and communities by either sharing a contribution of the benefits of projects, purchasing the power generated by a community or local business through a 'private wire' or enabling development through access to land and/or water resources where it is compatible with our statutory duties.



Laurencekirk Wastewater Treatment Works - Scottish Water is providing a proportion of the annual financial benefit from a wind turbine to the community council in Laurencekirk which is a community benefit payment in line with the Scottish Government guidelines. The wind turbine was installed at the Wastewater Treatment Works to reduce cost of power imported from the grid.

Lochgoil Community Development Trust - Community investment in Donich Water Hydro project - Scottish Water worked with the Lochgoil Community Development Trust and Forestry Commission Scotland to enable development of a hydro scheme near the intake to our Water Treatment Works.



Donich Water Hydro project

Scottish Environment Protection Agency (SEPA): delivering for you

Septic tanks pollution project - Given the remote nature in parts of Scotland it's not always possible to simply build a small sewage treatment works, and in these circumstances communities rely on septic tanks. SEPA in partnership with the University of the Highlands and Islands, who are leading, have submitted a bid to the Northern Peripheries and Arctic Programme. This bid is looking at dealing with issues of pollution from septic tanks in remote rural areas; specifically around problems with pharmaceutical products. It is likely that the solutions developed would be implemented and managed by the local communities, on a local scale through the application and implementation of green, sustainable technology and social engagement solutions. The project will provide long-term, cost-effective and transferable methods for reducing emerging micro-pollutants in the environments of remote regions.



Northern Periphery and
Arctic Programme
2014-2020



EUROPEAN UNION
Investing in your future
European Regional Development Fund

Scotland's Enterprise Agencies: Supporting Scottish Business

Clearwater Controls Ltd is a Scottish early stage technology company based in Grangemouth, which has successfully developed and patented a revolutionary new intelligent anti-ragging device, the 'Deragger II', which significantly reduces operator callouts to tackle blockages in waste water pumps. The problem of operator call outs to tackle blockages was initially identified by Scottish Water and ID Systems UK Ltd (the sister company to Clearwater Controls). Clearwater Controls has received support from Scottish Enterprise since its initial spin out from ID Systems with mentoring and most importantly support and advice on how to expand into international marketplaces. After international trials, orders for Deragger II have been secured in the US; Canadian; and Australian markets, with potential to expand across numerous other international territories.

The Deragger II can detect when as much as a single wet-wipe is clogging the blades of a sewage pump by analysing the power consumption of a pump. At the point clogging is identified the system will intelligently reverse the pump, dislodge the wet-wipe and put it back into forward motion in order to pass the wipe through the system. If the wipe does not pass through immediately, it will repeat the process until cleared (subject to any manufacturer guidelines on the number of times a pump may be reversed).

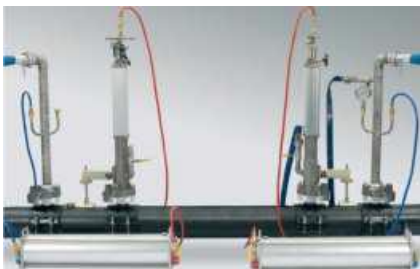
Trials and live implementations of the Deragger II are delivering very impressive results by dramatically if not totally eradicating blockages. Pumps operate at close to maximum capacity, potentially extending their life-span; and significant energy savings have been recorded of up 48%.

Further information can be found at <http://clearwatercontrols.co.uk/>

Sarco Stopper, based in Broxburn, is the UK's leading manufacturer of specialist standard & bespoke under pressure bagging-off systems. Their patented Aquastop system is used by water utility companies worldwide to:

- repair pipes in situ without interrupting supplies to nearby customers;
- save water as the affected pipe will no longer have to be emptied; and
- do work during business hours in commercial and industrial areas which in the past would have been done overnight.

Loss of supply can not only be disruptive to water utility sector customers but the UK utility regulators can fine the utilities companies if water flow to customers is disrupted. In deploying one Aquastop for one day, Thames Water avoided shutting supplies to 50 Streets; 1,452 Properties; 11 Special Needs Customers; 42 Businesses; 2 Schools and 1 Hospital.



Other Sarco Stopper systems are used by gas utility companies; off and on-shore oil & gas process companies and other industries such as food processing.

Sarco Stopper has received support from Scottish Enterprise for a number of years.

Most recently Scottish Enterprise has supported them to attend trade shows in Europe, and

Singapore International Water Week to promote their equipment on a world stage. Their innovative technology is currently being introduced into Australia.

Further information can be found at www.sarcostopper.com

Supporting Entrepreneurs

Our pilot programme supporting entrepreneurs links our strategies on national, innovation, and international projects with our partners the Power of Youth. We have established a programme with the aim of encouraging the development of solutions

to key water sector issues; joint collaborative ventures; and to identify opportunities for Scottish businesses in India (and *vice versa*).



Hydro Nation Scholars participated in the Young Water Leaders' Summit at Singapore's International Water Week

The Power of Youth initiative brings together key experts from the public & private sector, innovative technologies, and future leaders in the water sector over 2 summits. The first took place in Scotland in September 2016, with the second planned for India in January 2017.

Hydro Nation – Innovation

Our Innovation strategy is designed to support Scottish businesses to bring new products to market through the **Hydro Nation Water Innovation Service (HNWIS)**, including provision of advice, research, and testing facilities to trial new products, as well certification and accreditation.

This strategy links HNWIS into the support from SEPA in association with the James Hutton Institute in the development of water innovation through their work to support the European Commission **Environmental Technology Verification Standard (ETV)** and **International Organization for Standardization (ISO)** activities on ETV.



ETV is an important tool used to evaluate the claims of environmental technologies and enables technology providers and innovators to independently demonstrate the value of their products. In May 2015, Fergus Ewing MSP, then Minister for Business, Energy and Tourism launched a competition run by the accredited European Marine Energy Centre offering

free ETV to a successful technology developer. Scottish-based Dryden Aqua specialising in sustainable water treatment technologies were subsequently announced as the competition winner and are progressing through the full ETV process to verify the environmental benefits of their innovative water treatment product.

Working in partnership with a range of organisations, we recognise and highlight the significant steps businesses across Scotland are already taking to improve or reduce their impact on the environment through the **VIBES** (Vision in Business for the Environment of Scotland) Awards. In addition, we also recognise the significant innovative steps that **Scottish Water** are already taking to reduce impact on the environment, and in the process making significant financial savings.

Hydro Nation Water Innovation Service (HNWIS) – supporting innovation



Photograph: Strathkelvin Instruments Ltd product 'ASP-Con' system being tested.

Strathkelvin Instruments Ltd is a Scottish SME based in North Lanarkshire, and is one of the first companies to engage with and receive support from HNWIS since late 2015. Strathkelvin Instruments have been active in the wastewater market for almost 20 years, and have been at the forefront of innovation in the industry for much of that time.

Their latest product is the 'ASP-Con' (Activated Sludge Plant Controller). This product is self-cleaning; self-calibrating; an online respirometer instrument, which can control the biological wastewater treatment process. Ultimately this will also reduce energy consumption in the wastewater plant, whilst assuring discharge to the receiving waters remains in compliance.

Strathkelvin instruments claims their technology offers the potential to deliver up to 40% reduction in wastewater aeration energy treatment costs, which is one of the largest single areas of energy use within water utilities' treatment facilities. (Scottish Water's annual electricity consumption is in the order of 445GWh p.a.).

HNWIS are supporting Strathkelvin instruments with –

- **Trials of their product** within Scottish Water's operational sites over the next few months
- **Independent Review of existing & test trial data** through the HNWIS network of technical experts
- **Introductions within the water industry** to open up the market for their product
- **Raising the companies profile** HNWIS worked with Strathkelvin instruments to gain them entry into the Water Research Council Innovation Day Awards 2016, where Strathkelvin came a very credible second.

Further information can be found at www.strathkelvin.com/asp-con

Scottish Water's approach to Innovation -

In December 2015 Fergus Ewing MSP, then Minister for Business, Energy and Tourism officially launched the UK's first heat recovery from sewage system at the Borders College campus in Galashiels. The launch of this system was the result of a successfully 18 months collaboration between:



Photograph: Ross Burton – SHARC Energy (left), & Fergus Ewing MSP (right) at Galashiels facilities.

- SHARC Energy demonstrating their technology is a practical solution for customers;
- Scottish Water Horizons facilitated the installation of the system as it intercepts waste water from a sewer close to the local treatment works operated by Scottish Water; and
- Borders College as the system now provides around 95% of the heat needed by the campus.

With 32,000 miles of sewer pipes throughout Scotland, Scottish Water Horizons are exploring the roll out of this innovative technology at numerous locations across the Scottish mainland and Islands, to offer further environmental benefits. Particularly, as the Galashiels project will deliver 1.8 Gwh/annum and will result in 150 tonnes per annum of carbon savings by displacing the use of mains gas.

• Energy Efficiency & Energy from Water

Scottish Water is a large user of electricity, requiring around 445 Gigawatt hours (GWh) per year. In December 2015 Scottish Water won the 'Renewing Scotland' Award at the annual Scottish Green Energy Awards for their work to reduce their energy bill and increase renewable energy.

Scottish Water's approach to energy management and development is focused on:



Photograph: Scottish Water's Gorthleck facilities.

- Reducing consumption by improving the capability of assets and operations; with an aim of reducing base consumption by 11GWh by 2021
- Increasing self-generation; with 28 hydro turbines, 18 small scale wind turbines, 23 solar schemes and 2 CHP plants, helping to offset the amount of electricity Scottish Water needs from the grid.
- Hosting private renewables investment on land where compatible with service and quality; Scottish Water currently hosts 350GWh of third party wind turbines on its estate.

Through a combination of Scottish Water's investment and private investment they expect to be hosting renewable energy amounting to over twice their annual consumption by 2018. Their energy programme is a key part of their strategy to reduce the costs of delivering water and waste water services to keep customer charges stable and affordable.

- **Climate Change & Sustainability**

Scottish Water have reduced their operational carbon emissions by 15% since 2006/07. Their carbon footprint for 2014/15, the most recently reported year, showed an underlying decrease of 1.4% since 2013/14. This was masked by an increase in the emissions factor for grid electricity, which caused a 7% rise in the reportable carbon footprint to 404,000 tonnes carbon dioxide equivalent. This was due to more coal (which is highly carbon-intensive) being burnt in UK thermal power stations. A fall in 2015/16 is expected due to a reduction in the grid emissions factor. Its water service continues to have the lowest carbon intensity in the UK, largely due to the opportunity to use gravity to supply many of our customers rather than pumping.



Photograph: Scottish Water's new PV scheme at Black Esk facilities.

During the financial year 2015/16, Scottish Water Horizons invested £2.9M in 10 new renewable energy generation projects on Scottish Water assets. These had a combined power output of 1.8 GWh/annum. Over 6,500 solar panels were installed at seven of their sites (Kirkcaldy, Falkirk, Dundee, Armadale, Brechin, Lockerbie

and Crawford) totalling over 1.7MW of generation capacity. Three wind generation projects were successfully delivered (Thurso, Laurencekirk and Tobermory) with combined generation capacity of 0.2 MW.

Scottish Water Horizons delivered Scottish Water's first retrofit of a renewable heat project on a SW asset. A 100 Kw biomass boiler was successfully installed at the Penwhirn water treatment works near Stranraer. As well as delivering cost benefits this renewable scheme displaced the use of an oil fired boiler (Photo attached).



Photograph: Scottish Water's biomass boiler at Penwhirn facilities.

Hydro Nation – International

Our International theme is designed to reach out to the world to share our academic excellence; professional governance; and management expertise in order to grow our networks and develop opportunities. Strengthening our water economy & trading relationships will encourage our Scottish partners to export expertise, and deliver projects in collaboration with partners in response to international opportunities. Focusing on key territories will allow us to support our objectives of **building our networks, trade, and targeted development support**.

Below are some examples of how we are delivering in practice.

Building our networks –

Water Industry Commission for Scotland (WICS) is a founding member of the European Water Regulators network (WAREG). They have been working hard over the past year to build capacity within the network, share experience in economic regulation and learn from other regulators. They have recently signed two experience sharing agreements with Romanian and Albanian WAREG members.

WICS is also exploring further opportunities to use its expertise in economic regulation in specific capacity building projects. This year, they embarked upon a project with the National Regulator for Public Services for Romania and participated in a two-week mission to understand the current regulatory framework in Romania and identify how it may be developed in the future. Alongside the Romanian regulator, WICS presented their findings at a European Bank for Reconstruction and Development (EBRD) seminar in September.

There has been a growing international interest in the Scottish water industry's regulatory framework. Particularly in the approach taken in the 2015-21 Strategic Review to agree charges. WICS has shared their experience by hosting delegations from Albania, Italy and two separate delegations from Australia. In addition, WICS has also developed close working relationships with international organisations, the OECD will undertake a review of the 2021-27 price review process under the auspices of the Network of Economic Regulators (NER). WICS is also developing links with the Triveni Water Institute in India and WICS' Director of Hydro-Nation, Retail and Innovation participated in their annual conference in Delhi.

Scottish Government and the **UNESCO Centre for Water Law, Policy and Science, University of Dundee** have also been involved in directly supporting the OECD Water Governance Initiative in a number of ways, including helping develop a water governance framework and measurement criteria. The framework has now been published, but Scotland will continue to work towards meeting the full criteria and share our experience with others to assist them in their compliance journey

Aqua Publica Europa (APE) - Scottish Government participates in the European-wide network of public water operators, sharing knowledge and contributing to APE's recent report on Water Affordability.

Alliance for Water Stewardship (AWS) – supporting the first Global Water Stewardship Conference hosted by AWS in Edinburgh on 1st and 2nd November 2016.

Trade – Scotland Development International support for Hydro Nation

Aquatech Amsterdam November 2015

Aquatech is one of the world's leading trade exhibitions for process, drinking and waste water and is part of the biennial Amsterdam International Water Week. In 2015, Scottish Development International took a pavilion for the first time at the event aimed at promoting Scotland's Hydro Nation agenda and assisting Scottish companies to access trade opportunities. In 2015 the event attracted a visitor attendance of 18,411 from 140 countries, 856 exhibitors, 4,479 exhibitor staff and 1,100 AIWW conference delegates.

Aquatech provided an ideal opportunity to showcase Scotland's ambition, the newly created Hydro Nation Water Innovation Service (HNWIS) and Scottish companies' capabilities at an event which is recognised as one of the biggest global platforms for the sector. Eight Scottish companies and key staff from the Innovation Service participated on the Scottish pavilion. SDI worked with a range of key partners to engage with the international delegations, especially those from the identified priority markets for Scottish companies such as India and South East Asia.

Heat and Water 2016: Glasgow

Along with a range of partners, including the Scottish Government and Scottish Water, Scottish Enterprise hosted an International Low Carbon Heat & Water Conference and Showcase in February 2016 in Glasgow. The Conference theme was forging connections for customers and suppliers with the event raising further Scotland's profile as a Hydro Nation. It successfully demonstrated the Scottish Water industry's strengths and how Scotland is open for business in the sector. Representatives attended from Scotland, UK, Europe and further afield to forge new connections in low carbon heat and water.

Some striking statistics from the day include:

- 450 delegates from 22 countries around the world attended the conference
- 293 Matchmaking participants
- 504 individual Matchmaking meetings
- 67 Exhibitors

Over 40 speakers whet the appetite for investment in Scotland through a series of themed breakout sessions, including Glenmorangie Distillery outlining their work with Business Retail United Utilities in building a new Anaerobic Digestion effluent treatment plant and Caledonia Water Alliance's use of Scottish businesses in the

wider supply chain, to ensure that a forward looking £360 million water supply is in place for the country.

Delegates heard how the Hydro Nation and Scotland's technology expertise is accelerating growth; with many good practice case studies and examples of how innovation support is being promoted to Scottish businesses.

Additional site visits on the 2nd day of the Conference offered opportunities for businesses from a wide range of sectors to see how solutions can be delivered into the Water Utility market. This included site visits to Scottish Water's Wastewater Development and Testing Centre at Bo'ness, Scottish Water's Deerdykes Anaerobic Digestion Plant and the Veolia managed Seafield Wastewater Treatment plant serving Edinburgh and a population of 850,000. Delegates were shown around its thermal hydrolysis plant commissioned to produce a more eco-friendly sludge product.

Singapore International Water Week – July 2016

This event is organised by Singapore International Water Week Pte Ltd, a company set up by Singapore's Ministry of the Environment & Water Resources and PUB, Singapore's national water agency. SIWW is a platform for partners from the global water industry to share and co-create innovative water solutions and is globally acknowledged as one of the key events on the international water and waste water stage attended by delegates from government, international organisations, as well as industry and the academic sector. Twelve Scottish companies (a mix of water and environmental services companies) and one university attended the event and all participants provided very positive feedback following the event. The delegation received very strong support from the local SDI office as well as the Department of International Trade.

India

We are committed to strengthening links between Scotland and India, building on the business and cultural links between the two countries. Our India Plan recognises the need for closely targeted activity to maximise economic opportunities and focuses on four key areas - tourism, education and science, trade and investment, and cultural links.



Our support at a UK level is helping to establish a UK/India Virtual Centre on Water Security, including a specific focus on Water Security for the Ganga to ensure Scottish interests & opportunities are appropriately taken forward. In addition, our support for the Science &

Technology bridge partnership with India will develop a Scottish-focussed programme to deliver opportunities for Scottish water-sector businesses and research.

James Hutton Institute – Scotland & Interdisciplinary Centre for Water Research, Indian Institute of Science – Bangalore jointly organised the Indo-UK Workshop on Water Quality – Source Protection. This workshop provided stakeholders with an interest in water security issues in India explore the real-world opportunities for world class collaborations on policy led science & engineering that addresses the international challenges of the Sustainable Development Goals.

Pune Municipal Corporation Commissioner, Senior Engineers from their Water & Transport divisions comprised a delegation which visited UK to develop their understanding on UK's solutions & technologies that could help Pune achieve its Smart City objectives. Pune City is the 9th most populous city in India with over 2.5 million citizens. They are ranked 2nd in the Indian Smart Cities Challenge, a competition organized by the Indian Government. Pune's biggest challenges in transforming to smart infrastructure is their water & waste management and with Hydro Nation support SDI facilitated their visit to Glasgow and hosted 1-2-1 meetings with Scottish water companies to explore how they could help address the challenges Pune City faces. Encouraging contact was made and is being followed up by officials and the businesses themselves.

Trade - Scottish Water International

Scottish Water International undertakes a diverse range of consultancy assignments around the world to help transform utilities. SWI uses an innovative model drawing expertise from the core business creating value for the economy and developmental opportunities for staff. Examples of recent successes are set out below;



- **Qatar** - helping oversee the management of a 5-year Drainage Asset Management Programme, as sub-consultants to MWH, to transform drainage and waste water services.



- **Ireland** – continuing to provide advice and support for the creation of Irish Water, Ireland’s new water utility, to help develop its operations and maintenance functions and also supporting a major project to develop the Water Industry Operating Framework in Ireland.



- **Canada** – helping them to improve the efficiency and effectiveness of water services for The City of Calgary’s Water Services business unit. The value of the efficiency benefits from these opportunities has been valued in the range C\$2.4m – \$5.0m per annum (5%-10% of the overall operating budget). Currently working on a second assignment for the City of Calgary Water Resources Unit. The review will evaluate three areas: service levels for wastewater, capital delivery, efficiency and effectiveness and data management/analytics.



- **Australia** – supporting SA Water, the utility serving the water and waste water needs of the state of South Australia, as sub-consultants to KBR, to build asset management capability with a focus on customer service. Also worked with the appointed lead consultant to define the transformation of Water Corporation’s asset management capability. Water Corporation is the principal supplier of water, wastewater and drainage services in Western Australia.



- **England** – assisting the Market Operator Services Ltd (MOSL) in the planning for drafting of Codes associated with opening of the Retail Market in England.

Scottish Water International has also raised the profile of the Scottish water industry this year by hosting many visits from Sweden, Norway, New Zealand, Canada, Ireland and Aqua Publica Europe (the European Network of Public utilities). They also hosted internships for two Qataris for a month and representatives from Mulonga Water Company (Zambia) for a week to share knowledge, expertise and build capabilities.

International Development Support – Malawi

Water Futures – Long Term Ground Water Resources Management in Malawi is a transformational step supporting the Malawi Ministry of Agriculture, Irrigation and Water Development to evaluate rural water supplies in 7 districts in the Lower Shire Malawi (25% of Malawi). This will include rural water supply functionality (including risks, economics, sanitation, and social interactions) to underpin implementation of Sustainable Development Goal 6 by 2030.

Water Futures project includes the first wide-scale capacity building in groundwater science for staff at all levels in the Ministry focusing on two key issues. First, engagement on groundwater resource management research. Secondly, and importantly a pilot scale apprenticeship scheme to train area mechanics & water monitoring assistants in the skills required to transform from reactive (act with a water point becomes non-functional) to proactive (preventative maintenance of rural water supplies). This work will see positive actions to integrated water resource management & water availability in these districts for Everyone for Ever.



Photograph: Stakeholders Progress Review Meeting 24 May 2016 for Project Implementation.

Hydro Nation – Knowledge

Scotland is internationally recognised for our networks of water industry leaders and academic experts, including. CREW; Interface and the UNESCO Centre for Water Law, Policy and Science at Dundee University. Our work to support the scale and profile of the sector’s research includes that of the research undertaken by the Hydro Nation Scholars.



Scholars Programme

The Hydro Nation Scholars Programme & Graduate School, managed by CREW on our behalf, funds postgraduate research projects aligned to our strategic priorities. Scholars benefit from specialised programmes to deliver objective & robust research; and expert opinion to support the development & implementation of water policy in Scotland.

The Scholarships are recognised as a prestigious award for research excellence, and the Scholars and their work is deployed to benefit the sector by:

- developing understanding of how & where best to develop the value of Scotland’s water resources;
- focusing on enhancing Scottish capacity in areas of existing research excellence to tackle domestic & global water and sanitation issues; and
- providing new research & insights where there are gaps related to managing water resources in Scotland or globally.

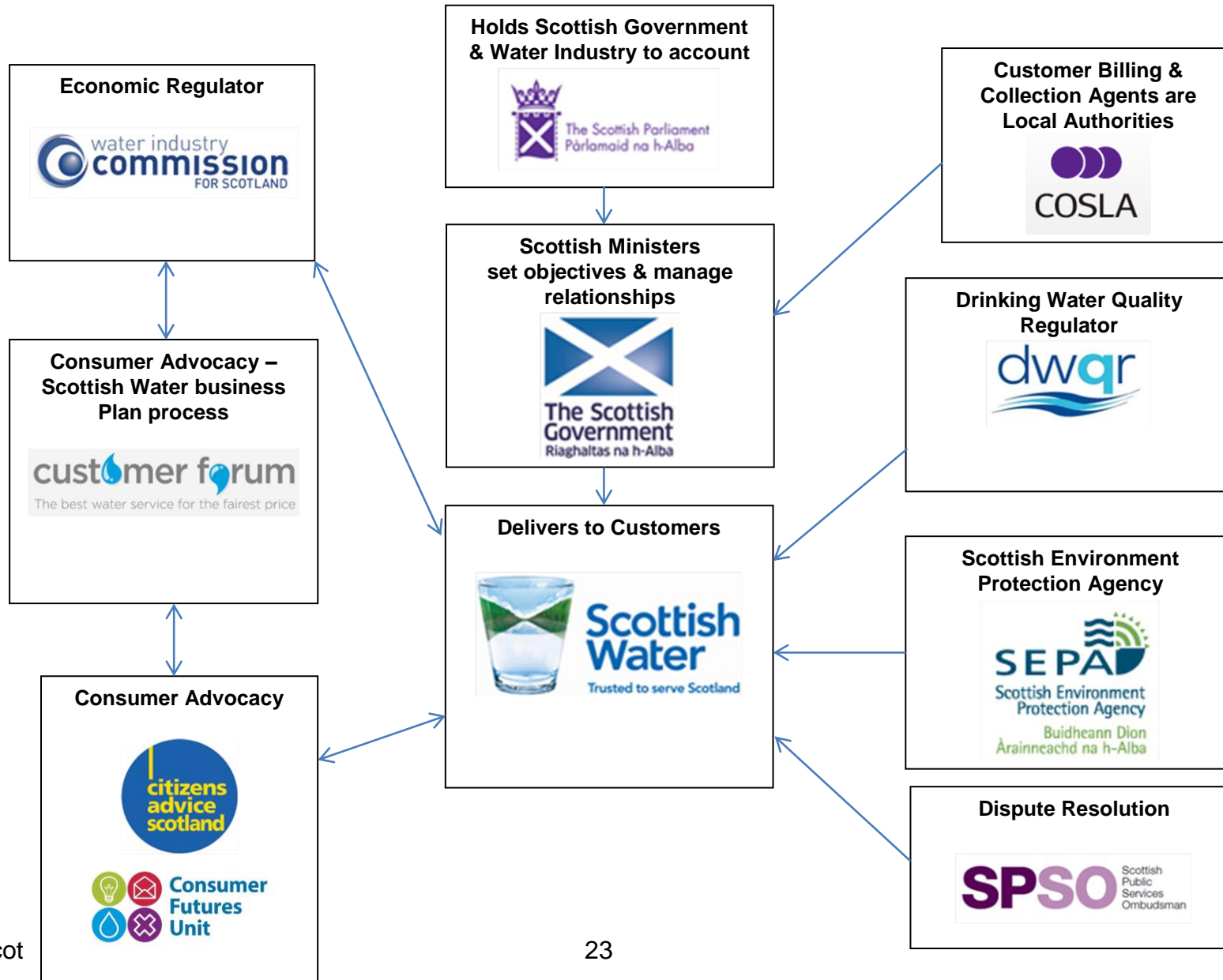
The Programme allows for periods of research with central Government and our water-related institutions, such as Scottish Water, SEPA, or our private industry partners. At the start of the 2016/17 academic year we now have a total of eighteen Scholars, with the first programme cohort of four Scholars appointed in 2013.

Forward look: Towards a Water Economy

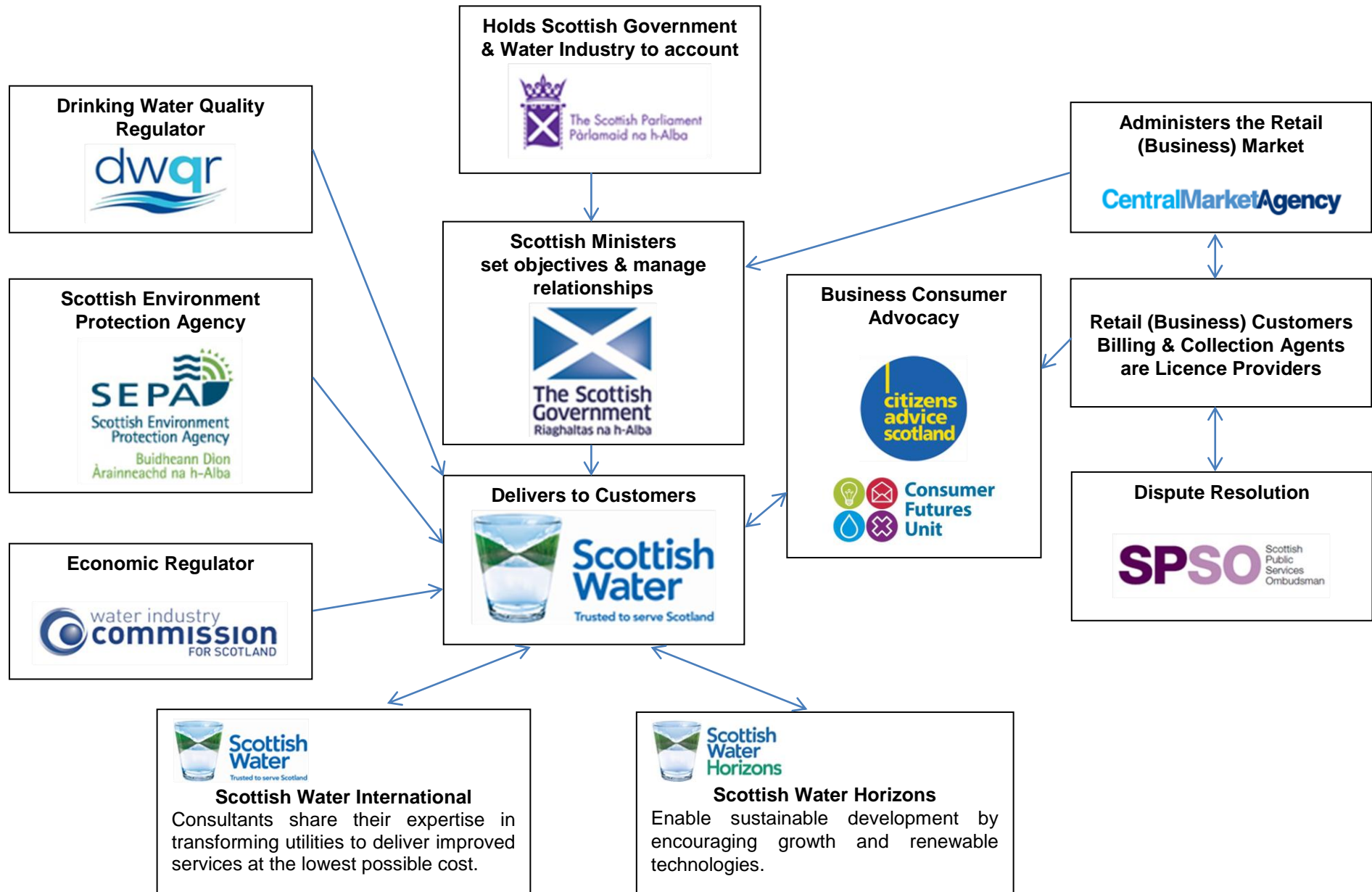
Good progress has been made in the first three years of our journey as a Hydro Nation. We will continue to develop the programme to build on the success achieved to date, supporting communities, and taking the global context for our international agenda from the Sustainable Development Goals. Knowledge sharing will remain central to our approach as will a strong focus on developing innovation and seeking out international trade opportunities for the sector. The overarching aim remains firmly fixed on maximising the value of our water resources in a responsible and sustainable way to make an ever-stronger contribution to the development of a vibrant water economy in Scotland, by continuing to address the following areas:

- **Value creation** - growing the profitability of existing and new water sector businesses through enhanced innovation support and developing export potential with key international partners and markets;
- **Growing Scotland's international reputation and profile in water** - we will continue to identify networks and opportunities for international collaboration and communication, supporting Climate Justice and knowledge sharing with the Malawi Government in particular, and as an active contributor to other global forums in water technology, skills and governance, as set out elsewhere in this report;
- **Education including research excellence** - building the scale and reputation of the Hydro Nation Scholars Programme and Graduate School, including the work of its first International Fellow
- **Delivering for customers** - with a particular focus on rural communities, we will continue to develop a comprehensive workplan to deliver sustainable provision options for the Scottish Ministers - we will support the Water Industry Commission for Scotland (WICS), in the process to develop their methodology for the 2021-27 Price Review, looking to introduce a more community-focused approach to customer involvement, potentially building on the Customer Forum model to ensure that individual communities can provide more input into the price-setting process. This approach could help to identify community priorities and ensure they are better represented in the price setting process.
- **Sustainable development in the water sector** - we will continue to promote and support the development of more efficient resource use, and low-carbon service delivery across the sector, building on the impressive efforts made by Scottish Water, thereby developing and growing the value of our water resources. The Consumer Futures Unit is working with key water industry stakeholders to conduct independent research on issues relating to consumers and water, which will inform the development of policy, and the regulatory framework in areas such as the principles of charging set out under Ministerial objectives.
- **Reporting on Progress** – while this third report is the last report required by statute we will continue to report in a similar way in future.

Annex A: Structures of Governance - Domestic Market



Annex A: Structures of Governance - Retail (Business) Market



Annex A: Structures of Governance – Who does what?

Central Market Agency (CMA) – on 1 April 2008 competition was introduced into the water industry in Scotland for retail (business) customers. The CMA is the organisation that administers the retail market for water and wastewater services in Scotland. They are a company limited by guarantee and owned by its members.

The Consumer Futures Unit (CFU) of Citizens Advice Scotland (CAS) – represents water consumers, and are a key partner in many areas of policy development. They are responsible for:

- Advocacy - to provide advice and information, make proposals and represent the views of consumers to Ministers, regulators, European Institutions and other relevant bodies.
- Evidence – conducting research to obtain information about consumer matters and consumers' views on those matters.
- Empowerment – facilitating the dissemination of advice and information to consumers

Convention of Scottish Local Authorities (COSLA) – are the representative voice of Scottish local government. Local Authorities provide the collection and billing for water and sewerage services on behalf of Scottish Water for all domestic (and non-metered) customers.

Customer Forum – was established to participate in the price setting process for 2015-2021 in order to provide customers with a stronger voice and to secure the most appropriate outcome for customers.

Drinking Water Quality Regulator (DWQR) – are responsible for monitoring and confirming that the drinking water supplied by Scottish Water through the public water mains system meets the requirements of the drinking water quality regulations and is safe to drink. DWQR also advises Ministers on the delivery of and the need for future investment in drinking water quality.

Licence Providers (LPs) – Retail (Business) customers are able to choose who supplies their water and sewerage services. All water and sewerage service providers are licensed and are therefore known as Licensed Providers.

Scottish Environment Protection Agency (SEPA) – are responsible for ensuring that Scottish Water meets strict environmental requirements. SEPA also advises Ministers on the delivery of and the need for future investment in environmental improvements.

Scottish Government – Scottish Ministers and their officials manage the relationship with Scottish Water and its regulators within the statutory framework established under the Water Industry (Scotland) Act 2002. Scottish Ministers set the objectives for the industry (as set out in the Ministerial Directions available at <http://www.gov.scot/Resource/0045/00459867.pdf>) and the principles that should underpin charges (as set out in the Principles of Charging Statement available at <http://www.gov.scot/Resource/0045/00459866.pdf>). More information about our role can be found on our website.

Scottish Parliament – scrutinise the work of the Scottish Government and their public bodies, and hold it to account. Both the Scottish Government and the Scottish Parliament are accountable to the people of Scotland.

Scottish Public Services Ombudsman (SPSO) – is the final stage for complaints about Local Authorities, most water providers, the Scottish Government and its agencies and departments. If customers have complaints they should in the first instance try and resolve that with the organisation they have a complaint about. However, if they remain dissatisfied they may be able to raise their issue with the SPSO.

Scottish Water – are a public corporation accountable to Scottish Ministers and through them to the Scottish Parliament. Scottish Water provides clean safe drinking water to 2.49 million households and 152,000 business premises across Scotland. Every day it supplies 1.37 billion litres of treated drinking water and takes away nearly one billion litres of wastewater from customers' properties and treats it carefully before returning it safely to the environment.

With more than 60,000 miles of pipes and 2,000 treatment works, Scottish Water supports communities the length and breadth of Scotland every day. In providing these essential services to customers, we recognise these activities and operations can be visible in the communities we serve. That's why they work very hard to ensure they are responsive and sensitive to the needs of our customers in the community in every corner of Scotland and aim to put communities at the heart of the business.

Scottish Water Horizons – are a commercially sustainable, stand-alone business, who use innovative ideas, knowledge and assets to encourage growth and renewable technologies. From generating renewable energy from wind, waste and water to facilitating the installation of high-speed broadband within our sewer networks, Horizons is all about improving connections, communications and enabling sustainable development.

Scottish Water International – are a wholly-owned subsidiary of Scottish Water, delivering reputational-enhancing projects. Drawing on their experience of the remarkable transformation in the water industry in Scotland they offer services to utilities, governments and other clients from around the world, including the Middle East, Canada, Ireland and Australia. Their team of high calibre in-house consultants offer services to support utilities transform their efficiency and service, with specific focus on:

- Operations and maintenance advice and support, including training and strategic advice;
- Asset management and capital investment governance;
- Regulatory and financial restructuring for public utilities; and
- Customer satisfaction and customer engagement strategic advice

Water Industry Commission for Scotland (WICS) – have the statutory task to determine price limits for Scottish Water based on the lowest overall reasonable cost of achieving Ministers' Objectives for the water industry. There is a competitive market for the provision of retail services (billing, collection, customer management etc) to business customers in Scotland. All retailers must be licensed by WICS and a list of licensed providers is available from their website. For further information on retail competition for non-domestic customers, please see the Scotland on Tap website (available at <http://www.scotlandontap.gov.uk>).

Hydro Nation Forum Members

- Chair: Roseanna Cunningham MSP, Cabinet Secretary for Environment, Climate Change and Land Reform.
- Professor Robert Ferrier, Director of Research Impact, James Hutton Institute.
- Dr Douglas Henderson, *Senior Lecturer and School Director of Student Enterprise at Edinburgh Napier University (stood down July 2015)*.
- Chrysoula Pantsi, Edinburgh Napier University School of Engineering and Built Environment.
- Councillor Stephen Hagan, Spokesperson for the Environment and Regeneration Team at COSLA.
- Dr Michael Gormley, School of the Built Environment at Heriot-Watt University.
- Dr Howard Dryden, Founder of Dryden Aqua.
- Dr Alan MacDonald, Principal Hydrogeologist at the British Geological Survey.
- Terry A'Hearn, Chief Executive Scottish Environment Protection Agency.
- Professor Robert Kalin, Professor of Environmental Engineering for Sustainability at Strathclyde University.
- Steve Dunlop, Chief Executive of Scottish Canals.
- Professor George Fleming, Founder and Chairman of EnviroCentre.
- May East, Chief Executive at CIFAL Scotland.
- Galen Fulford, Managing Partner of Biomatrix Water Technology.
- Professor Simon Parsons, Director of Strategic Customer Service Planning, Scottish Water.
- Dr David Johnstone, Senior Visiting Research Associate at the School of Geography and the Environment, University of Oxford.
- Lisa Webb, Convener of Freshwater Taskforce at Scottish Environment Link.
- Alan Simpson, Chairman of the Institute of Civil Engineers.
- Professor Chris Spray, Chair of Water Science & Policy, UNESCO Centre for Water Law, Policy and Science, University of Dundee
- Professor Gordon Hughes, Chairman at the Water Industry Commission for Scotland.
- Nick Lyth, Director, Green Angel Syndicate.
- Jan Reid, Senior Manager, Low Carbon Technologies at Scottish Enterprise.
- Diane Duncan, Head of Low Carbon and Environmental Clean Technologies at Highlands and Islands Enterprise.

Hydro Nation Scholars - Who are they & what are they doing?

Scholar	Cohort	Project	University
Juan Carlos Sanchez	2013-17	Trans-boundary Waters & Ecosystems: Opportunities for Improved Cooperative Governance. Community Impact: Improved governance frameworks will enhance the quality of communities' lives by ensuring the more equitable delivery of water services between jurisdictions	University of Dundee
Ruby Mahana Moynihan	2013-17	Contribution of the UNECE Water Regime to Multi-Level Co-operation & Cross-Sectoral Coherence in International Water Law. Community Impact: More coherence and institutional coordination will enhance the quality of communities' lives by contributing to better balanced decisions impacting on water services and biodiversity	University of Edinburgh
Christopher Schulz	2013-17	A Multi-Stakeholder Perspective on the Value of Water in the Brazilian Cuiaba River Basin & in the Pantanal to Inform Water Governance Across Brazil and Scotland. Community Impact: Improved understanding of the economic and cultural value of water will contribute to better governance and reduce risk for communities	University of Edinburgh
Nazli Koseoglu	2013-17	Optimising Water Use in Scotland: Valuation, Tradability & Portfolio Theory. Community Impact: Improved understanding of competing uses and economic and cultural value of water will contribute to better policy making on governance and resource allocation	University of Edinburgh
Bas Buddendorf	2014-18	Multi-scale modelling to assess impacts on flows & ecology in regulated rivers. Community Impact: communities benefit through improved understanding and management of complex ecological systems to optimise usage and minimise environmental impact	University of Aberdeen
Nandan Mukherjee	2014-18	Integrated river basin management framework under the lens of loss and damage. Community Impact: more sophisticated assessment of the impact of climate change on water resources will lead to improved management and planning, improving understanding of appropriate adaption/mitigation action for fragile communities	University of Dundee

Scholar	Cohort	Project	University
Yuan Li	2014-18	Can low-cost bio-sorbent technology be used to efficiently remove steroid hormones & pharmaceutical residues from wastewater effluents? Community Impact: the efficient removal of pharmaceuticals reduces treatment costs and support improved environmental and public health	University of the Highlands and Islands
Kathleen Stosch	2015-19	Building Resilience to Respond to Future Environmental Change Across Scottish Catchments. Community Impact: Better understanding of the complex interactions in catchment management will contribute to strategies to improve resilience and reduce harmful outcomes impacting on those living in catchments	University of Stirling
Carolin Vorstius	2015-19	Safeguarding and Improving Raw Water Quality by Increasing Catchment Resilience. Community Impact: Better integrated catchment resilience enhances environmental protection and reduces treatment costs resulting from compromised catchments	University of Dundee & James Hutton Institute
Fortune Gomo	2015-19	Supporting Better Decisions Across the Nexus of Water-Energy-Food Challenges. Community Impact: Improved understanding of interactions benefits and trade-offs will improve quality of decision making enhancing the sustainability of rural communities	University of Dundee & James Hutton Institute
Aaron Neill	2015-19	Linking Small-Scale Hydrological Flow Paths, Connectivity & Microbiological Transport to Protect Remote Private Water Supplies. Community Impact: Better understanding the complex movement of pathogens to reduce impacts on Private Water Supplies will positively impact public health in remote rural communities	University of Aberdeen
Maricela Blair	2015-19	Micro & Nanoplastics in Wastewater Treatment Systems & Receiving Waters. Community Impact: better understanding the movement of these plastics is essential in designing policy to tackle environmental harm and reduce treatment costs thereby enhancing the lives of coastal and other communities	University of Glasgow

Scholar	Cohort	Project	University
Robert Trogrlic	2015-19	Community-based Non-Structural Flood Risk Management for Malawi. Community Impact: this project will directly benefit communities adversely affected by flood by engaging them in activity to minimise impacts through low-cost strategies	Heriot Watt University
Valerio Cappadonna	2016-20	Can Wastewater Treatment Plants Cope with Future Nanoparticle Loading Scenarios? Community Impact: Improved understanding contributes to strategies to more efficient and effective treatment understanding the impact of nano-particles on treatment will help optimise plant efficiency, reduce costs and protect receiving waters thereby enhancing the natural environment for communities with receiving waters	University of Strathclyde
Lydia Niemi	2016-20	Assessment of the Degradation Pathway, Persistence & Eco-Toxicological Impacts of Human Pharmaceuticals to the Aquatic Environment. Community Impact: efficient removal of pharmaceuticals reduces treatment cost to support improved environmental & public health & reduced impact on receiving waters	University of the Highlands and Islands
Kirsty Holstead	2016-20	Governing Water One Drop at a Time: Responses to, and Implications of, Community Water Management in Scotland & Beyond. Community Impact: will help optimise community engagement to protect and maintain raw water quality, improving quality of supply and reduce treatment in remote rural communities	University of St Andrews
Jonathan Fletcher	2016-20	Optimising Multi-Pollutant Phytoremediation Strategies to Sustainably Improve Raw Water Quality. Community Impact: Contribution to increased raw water security will develop more sustainable and innovative treatment options, reducing environmental impact and costs	University of Stirling
Bhawana Gupta	2016-20	Tackling the challenge of the water, food, energy nexus in India & Scotland'. Community Impact: through improved understanding project will contribute to better cross-sectoral approaches to improve the livelihood of rural communities	University of Dundee & James Hutton Institute



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This publication is available at www.gov.scot

Any enquiries regarding this publication should be sent to us at
The Scottish Government
St Andrew's House
Edinburgh
EH1 3DG

ISBN: 978-1-78652-681-6 (web only)

Published by The Scottish Government, December 2016

Produced for The Scottish Government by APS Group Scotland, 21 Tennant Street, Edinburgh EH6 5NA
PPDAS81870 (12/16)

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