WATEF Conference 2015:
6th August 2015

Meeting Longer Term Goals for Greenhouse Gas Reduction

David Rose
Energy and Carbon Manager, South West Water

SOUTH WEST WATER

Meeting longer term goals for greenhouse gas (GHG) reduction

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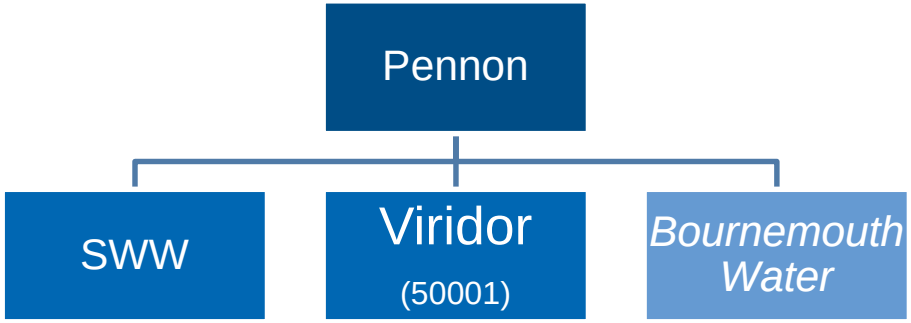
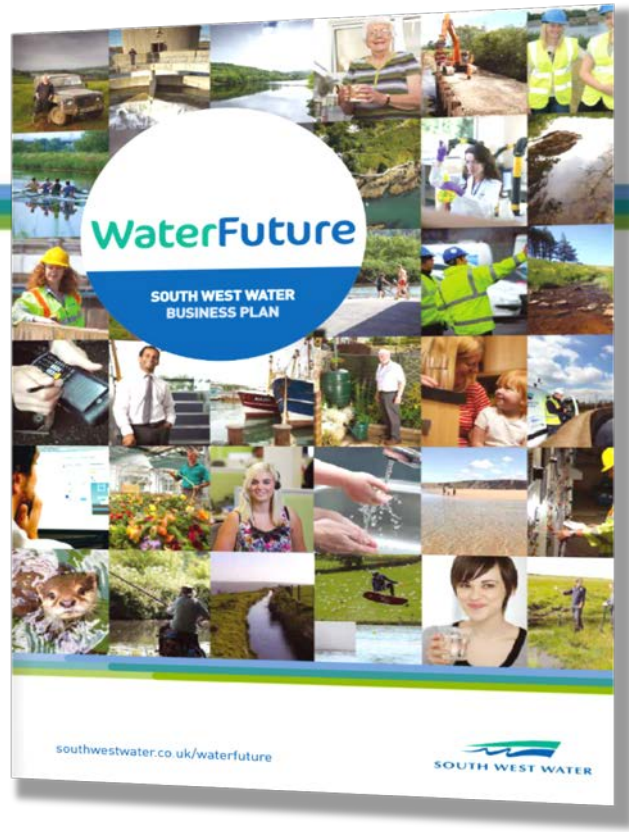
- Who is South West Water?
- Our business plan 2015-2020
- Climate change adaptation & mitigation (2015-20)
- Global progress towards GHG emissions control
- UK water industry commitment to GHG reduction
- SWW's longer term aspirations
- 'Pathways to 2050' (a SWW GHG emissions model)
- Conclusions

South West Water Ltd

- Water and sewerage services for Cornwall, Devon and parts of Somerset and Dorset
- Owned by the Pennon Group (SWW, Viridor Waste and *Bournemouth Water – pending CMA investigation*)
- Privatised in 1989, since spent £6 billion improving the region's water and sewerage service
- Just entered our 2015-2020 planning period with some extremely challenging targets on GHG reduction and renewable energy sourcing



What's in SWW's 2015-20 Business Plan?



WaterFuture –

- Submitted to Ofwat in December 2013
- Receives 'enhanced' status April 2014
- Good deal for customers, bills will be 7% lower in 2020 than in 2015 (in real terms)

Energy & Carbon Stats -

- ~1,800 sites
- Energy usage ~260GWh/yr
- Energy bill ~£24m/yr
- Renewable 50GWh/yr (by 2020)
- Emissions 150ktCO2e (by 2020)

Key challenges for our ‘WaterFuture’

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CLEAN, SAFE AND RELIABLE SUPPLY OF DRINKING WATER
Providing an uninterrupted supply of fresh clean water that not only meets the highest water quality standards but is also free from unwanted taste, colour or smell.

RELIABLE WASTEWATER SERVICE
Ensuring our customers can rely on us to remove and dispose of wastewater safely and efficiently, and that the likelihood of sewer flooding on customers' property is minimised.

AVAILABLE AND SUFFICIENT RESOURCES
Preventing restrictions on water use and managing and delivering the region's supplies as efficiently as possible.

RESILIENCE IN EXTREME CONDITIONS
Making sure water and wastewater services can withstand the potential impacts of extreme weather and security threats.

RESPONSIVE TO CUSTOMERS
Dealing with customer requests, problems and queries quickly and efficiently, and ensuring the service our customers receive represents value for money.

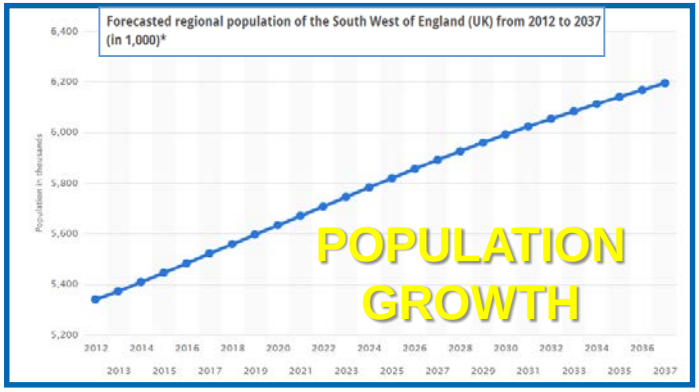
PROTECTING THE ENVIRONMENT
Minimising our impact on the world around us and taking steps to protect and enhance it where possible.

BENEFITING THE COMMUNITY
Having a positive long-term effect on people and quality of life in the region.

FAIR CHARGING
Being efficient in order to keep our costs as low as possible and offering support to those who struggle to pay.

Key Environmental Challenges

- Climate Change (Resilience)
- Population Growth
- New Legislation



Protecting our assets: Climate change adaptation

Case Study: Exeter Water Treatment Works

Building in resilience & protecting assets for the future

Pynes Water Treatment Works serving Exeter is a site that was built on the River Exe flood plain in1833, the site is at risk from flooding. Given the evidence of flood risk from future climate change events SWW have spent £2.2m on building a 600 metre long steel sheet piled wall to protect the site from a one in 100 year flood event. This work secures the site's future for years to come.

Customer Priorities

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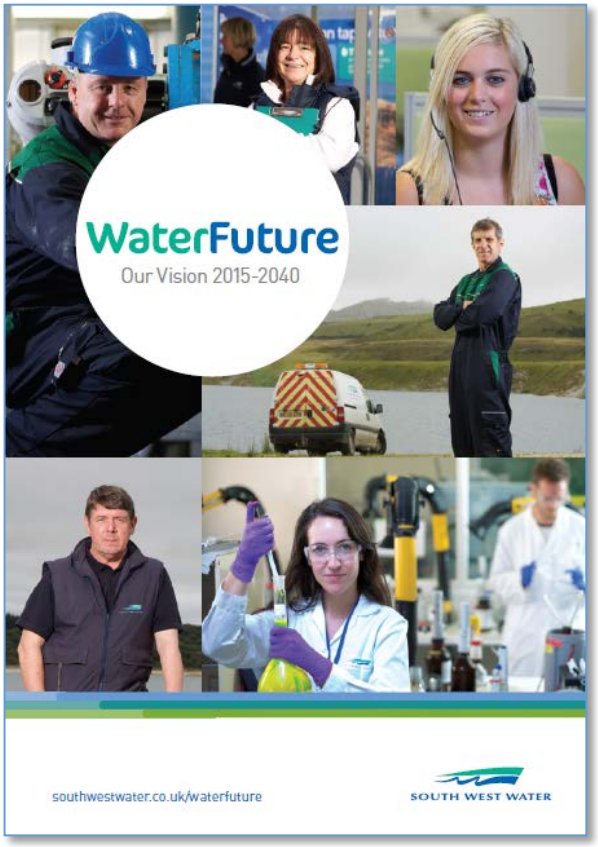
PRIORITIES	2012 RANK
SAFE WATER SUPPLY	1
LEAKAGE CONTROL	2
PREVENT POLLUTION	3
RESILIENCE IN EXTREME CONDITIONS	4
BATHING AND SHELLFISH WATERS	5
REDUCE SEWER FLOODING	6
AVOID SUPPLY INTERRUPTIONS	7
WATER RESOURCE RESTRICTIONS	8
RIVER WATER QUALITY	9
HABITATS	10
CUSTOMER CONTACT EXCELLENCE	11
CATCHMENT MANAGEMENT	12
WATER CONSERVATION	13
REDUCE HARMFUL ABSTRACTION	14
SMART/COMPULSORY METERING	15
PUMPING STATION ADOPTION	16
REDUCE ENERGY CONSUMPTION	17



2012 customer consultation ranks investment in renewables & carbon footprint 17th out of 17

Outcome Delivery Incentives: Targets for 2015-2020

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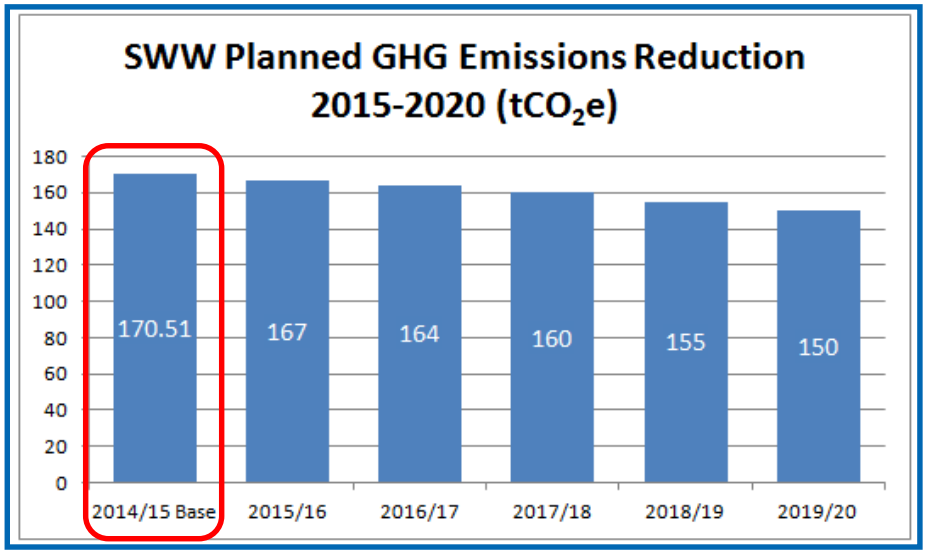
Reputational ODIs

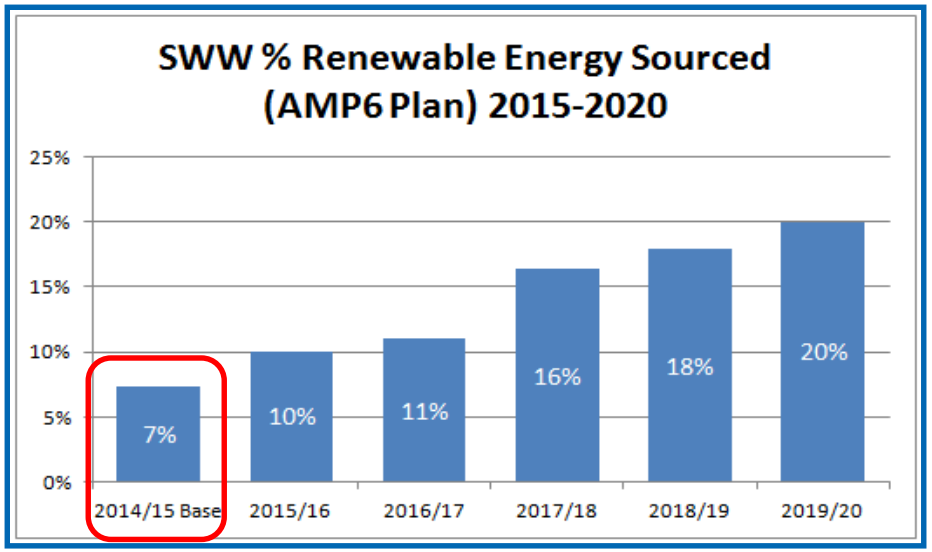
GHG Emissions 150ktCO2e by 2019/20

~12% reduction in emissions over 5 years



Renewable Energy 20%sourced by 2019/20

~64% increase in renewable energy usage over 5 years



Global context of GHG emissions control

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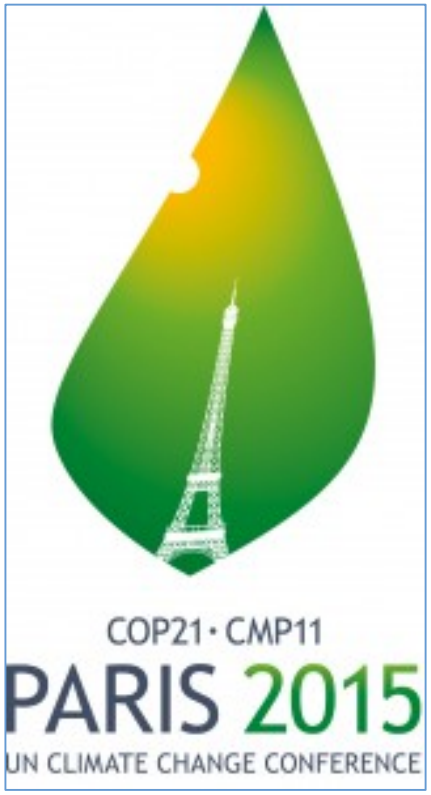
- UNFCCC COP 21 takes place in Paris December 2015
- 190 nations expected to produce global agreement for 2020–2030+
- EU - committed to 40% cut on 1990 levels
- USA - 26%-28% on 2005 levels (poss.32%?)
- China – emissions to peak by 2030
- **UK Response Climate Change Act 2008 - 80% reduction by 2050 from 1990 levels**



The Government's Carbon Plan: Progress to date

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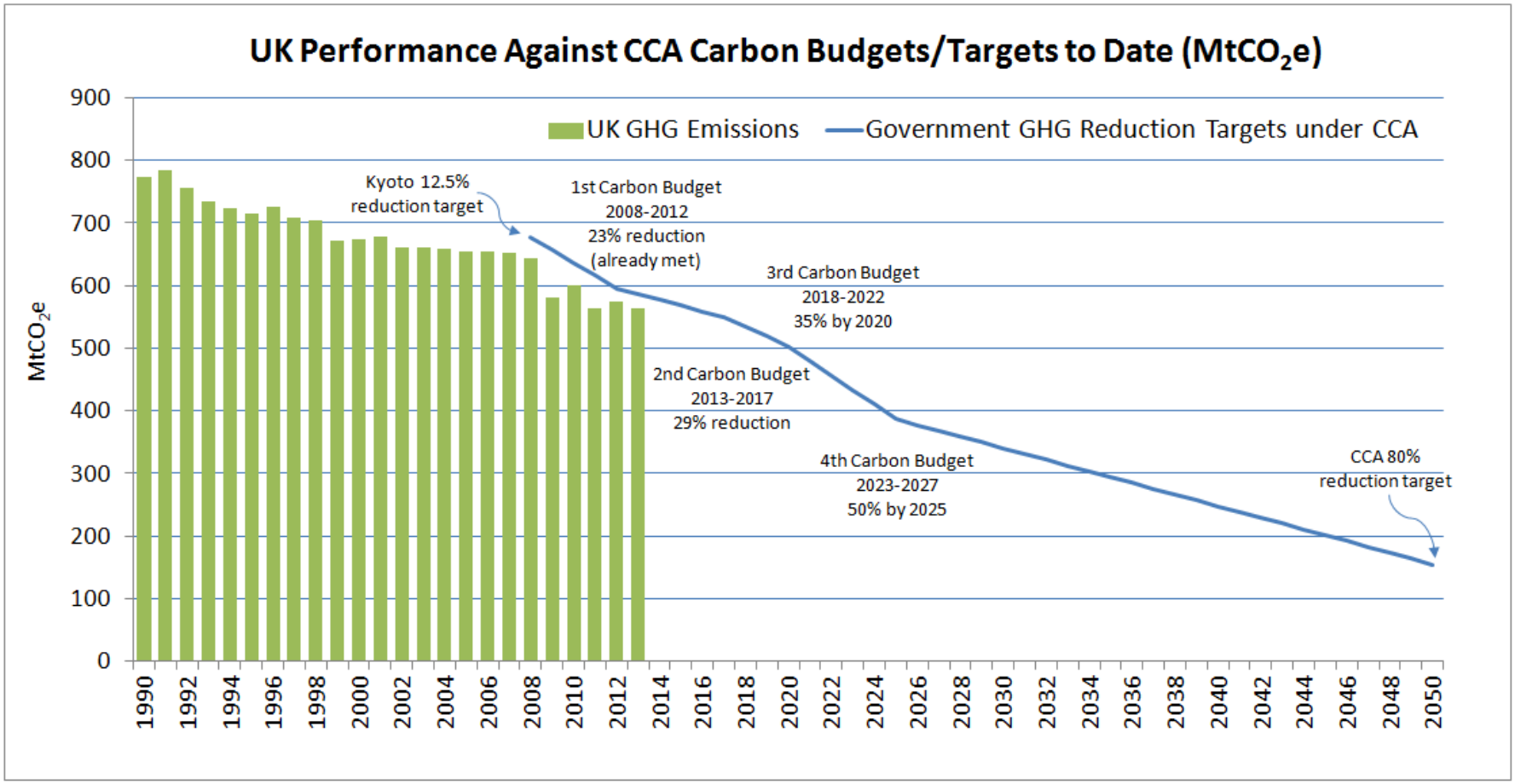
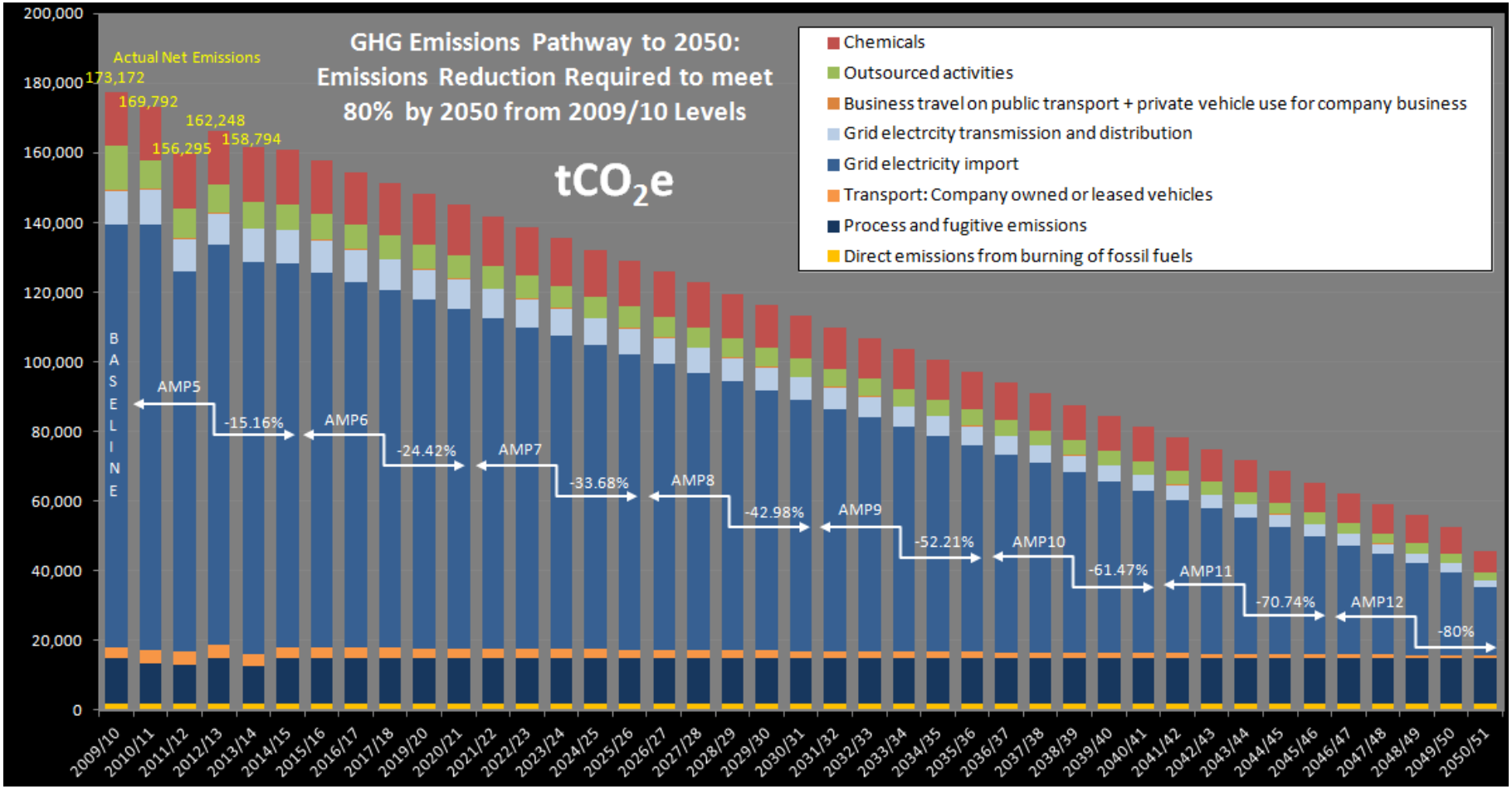
The Government's Climate Change Act 2008 requires a 80% reduction in emissions by 2050, a series of five-year carbon budgets provides incremental reduction targets



SWW road map to 80% reduction in GHG by 2050



SWW keen to play its part

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SWW Strategic Direction - "***Water Future: Our Vision 2015-2040***"
published in December 2012

OVER THE NEXT 25 YEARS WE WILL CONTINUE TO INVEST IN ORDER TO ACHIEVE THE FOLLOWING: page 51

- ✔ 50% of the energy we use will be generated on-site by 2040
- ✔ carbon emissions will be reduced in line with the national framework (an 80% reduction due by 2050 based on ~~2006~~ baseline).

Baseline changed to 2009/10, since this represents a better set of data and more mature GHG reporting

But what are the drivers for action?

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SWW only 3% of UK WI emissions, which itself is only 1% of all UK emissions – So why are we bothering?

- **Customer view** - Engagement for PR14 BP reveals customers generally supportive with a *"greater concern for the environment than in 2009"*
- **Government view** – Defra's challenge to UK WI to contribute to targets
- **Ofwat view** – GHG Outcome Delivery Incentive (ODI) for AMP6 + key indicator for annual reporting
- **City view** – Strong performance in indices such as the Carbon Disclosure Project attracts ethical investors
- **CRC** – annual energy bill ~£24m, annual CRC bill >£2m and rising
- **Mandatory GHG Reporting** – legal requirement to report on GHG emissions
- **Indentifies money saving investments** – renewable energy & efficiency
- **Voluntary Targets** – Commitments from WaterUK, individual company targets and competition, progress towards carbon neutrality?

What commitments are other UK Water Companies making?

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GHG Emissions reduction pledges -

- **Anglian water -** 50% reduction by 2035
  (2010 baseline)
- **Dwr Cymru -** At least 50% reduction by 2035
- **Northumbrian Water -** 35% reduction by 2020
  (2008 baseline)
- **Severn Trent -** 80% reduction by 2040, carbon neutral and energy self-sufficient aim
- **Thames Water -** 20% reduction by 2020
  (1990 baseline)
- **United Utilities -** 50% reduction by 2035
  (2005/06 baseline)
- **Wessex Water -** 80% reduction by 2050
  + aim to be carbon neutral (no timeframe)
- **South West Water** - 80% reduction by 2050
  (2009/10 baseline)

Previous studies/publications

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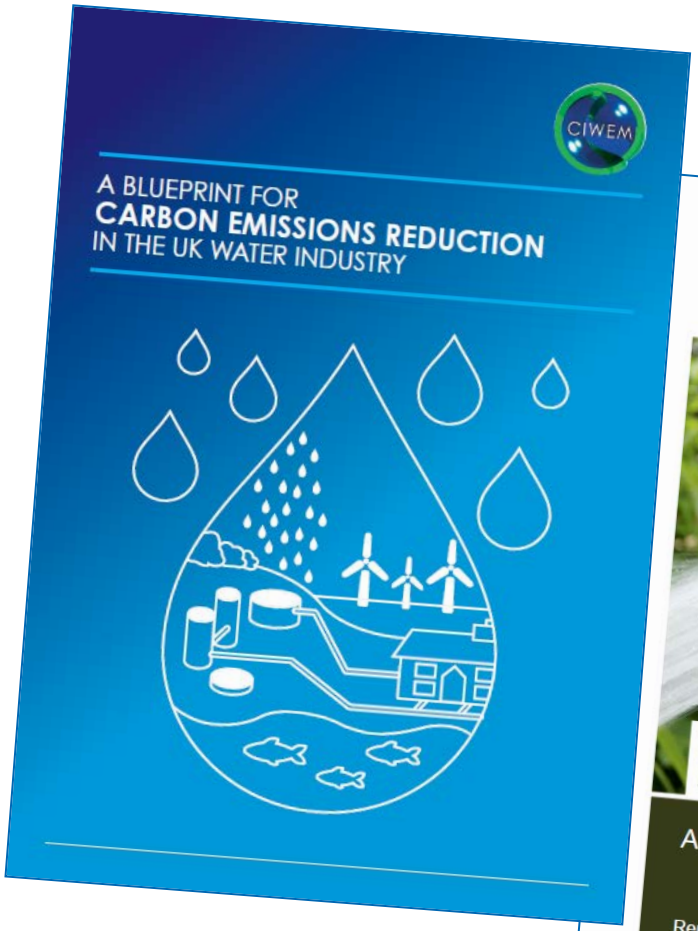

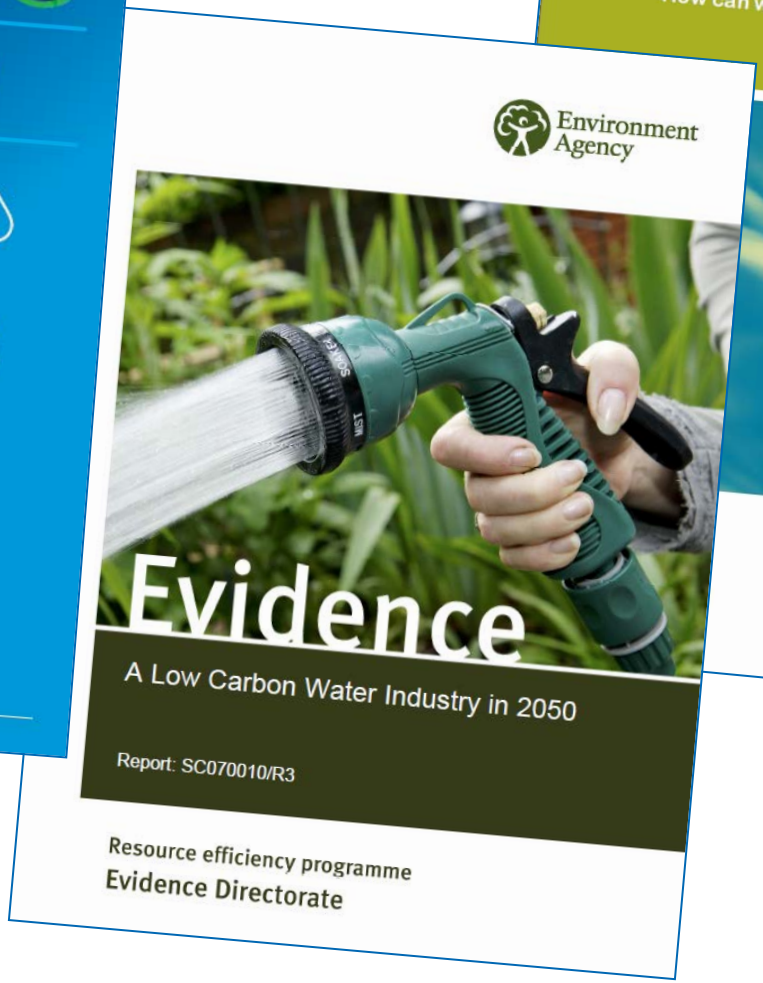

Assessing the options for GHG reduction: What's in the tool kit?

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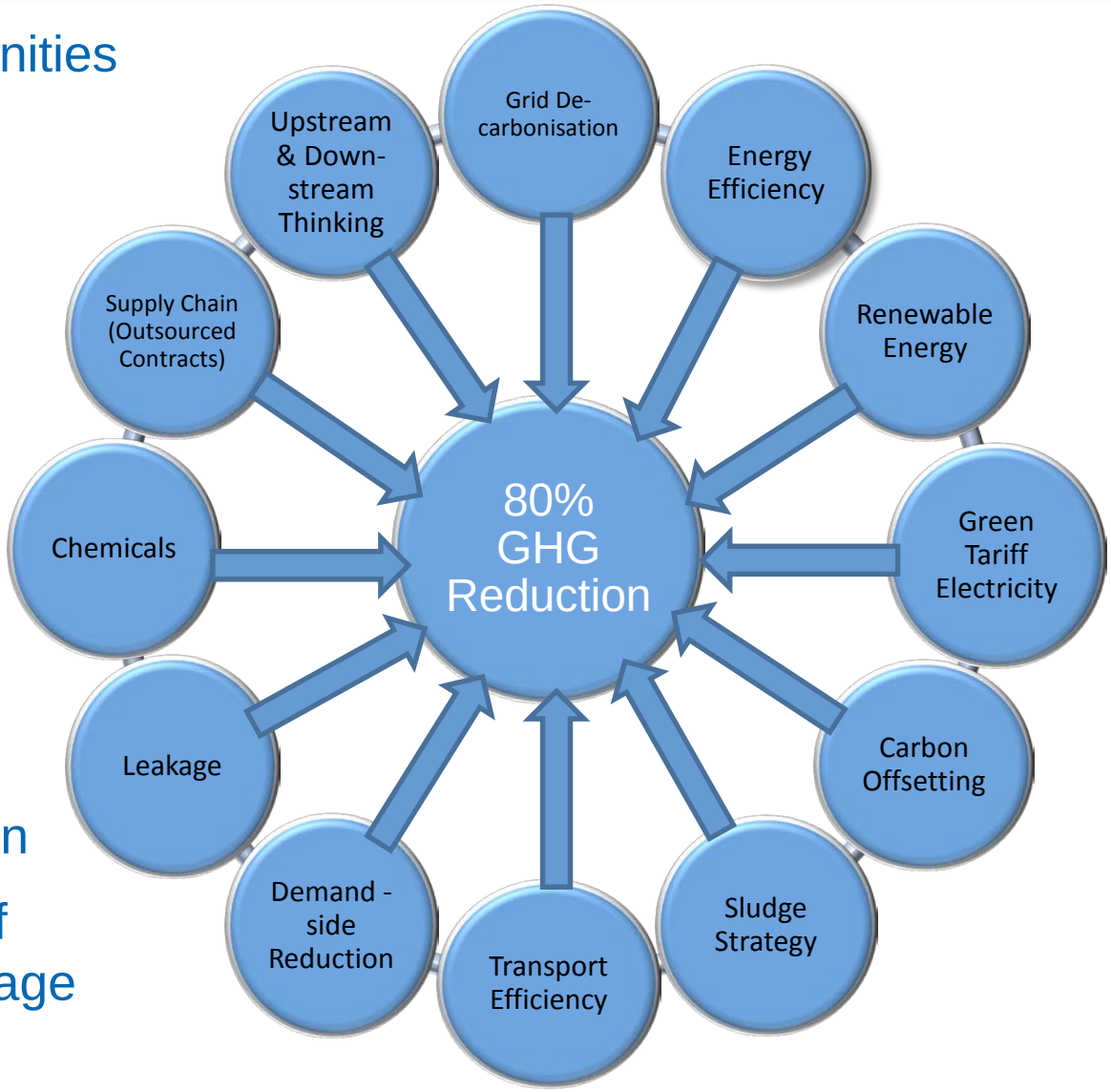
Identify Obvious Opportunities

- Grid decarbonisation
- Energy efficiencies
- Improved design
- Operational improvements
- Wider use of renewable energy
- Adoption of new technologies
- Demand side reduction
- Better management of catchments and drainage systems



SWW Carbon Footprint

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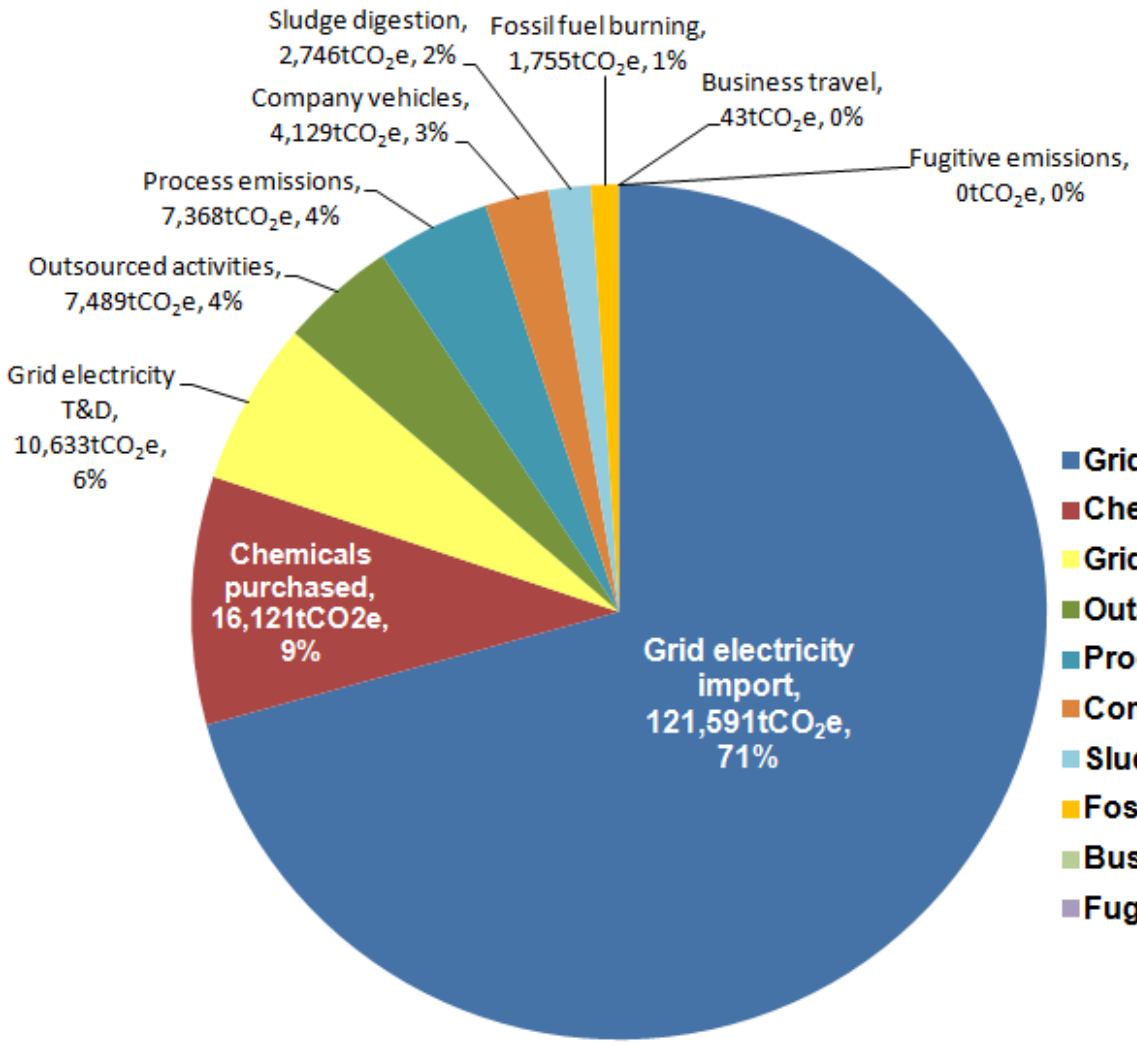
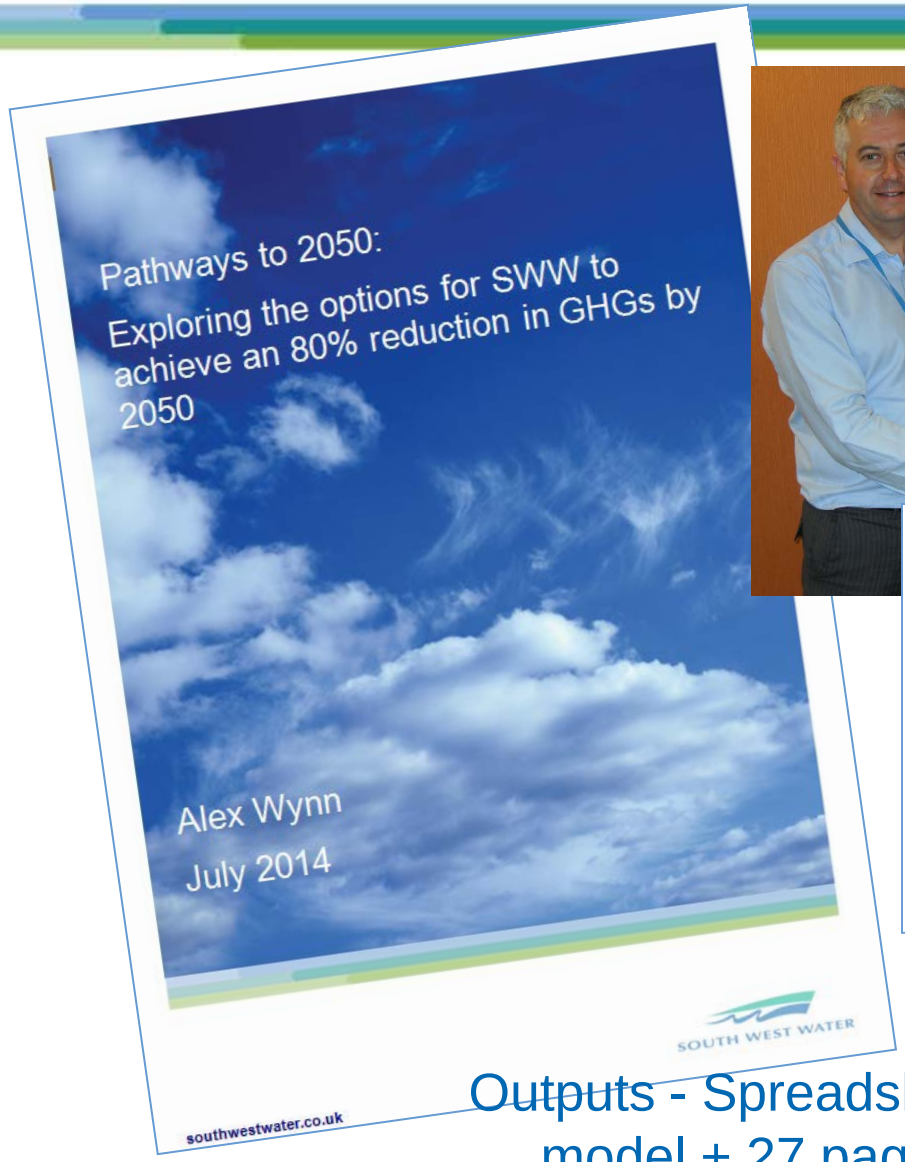
Emissions in Order of Magnitude - Largest First		
GHG Scope	Source of Emissions	tCO_2e
Scope 2	Grid electricity import	121,591
Scope 3	Chemicals purchased	16,121
Scope 3	Grid electricity T&D	10,633
Scope 3	Outsourced activities	7,489
Scope 1	Process emissions	7,368
Scope 1	Company vehicles	4,129
Scope 1	Sludge digestion	2,746
Scope 1	Fossil fuel burning	1,755
Scope 3	Business travel	43
Scope 1	Fugitive emissions	0
	Gross Emissions	**171,875**
Less	Renewable Export	-4,486
Less	Green Tariff	-1,018
	Net Emissions	**166,370**



SWW OPERATIONAL CARBON FOOTPRINT 2014/15

‘Pathways to 2050’ analysis



- Energy Intern (undergraduate from UEA)
- 6 weeks to undertake detailed analysis!

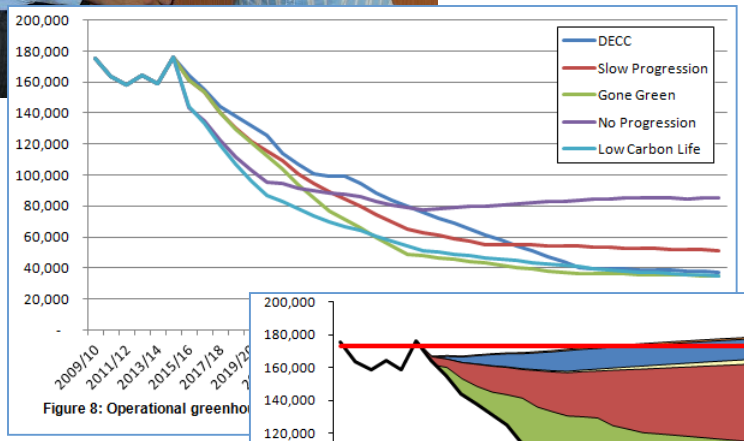


Figure 8: Operational greenho

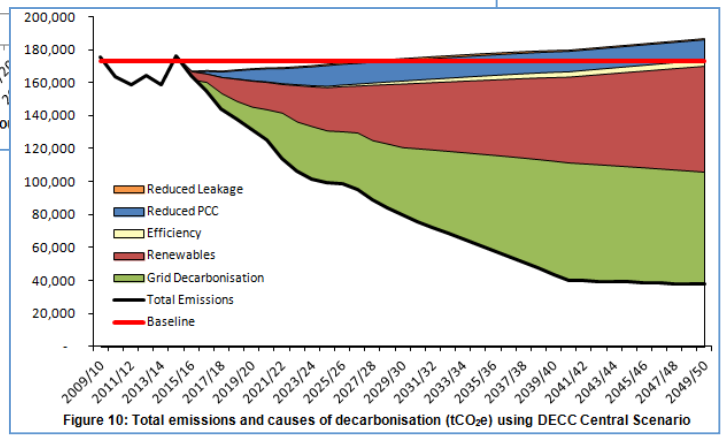


Figure 10: Total emissions and causes of decarbonisation (tCO_2e) using DECC Central Scenario

Outputs - Spreadsheet model + 27 page report

Modelling future SWW GHG emissions:the key brief

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- Based on current knowledge & current GHG accounting methodology
- Looking at emissions reduction feasibility only – no costs modelled!!
- Baseline year 2009/10 (same as base year for AMP5)
- Use publicly available grid decarbonisation scenarios as the basis for the analysis (1 x DECC and 4 x National Grid)
- Include all significant carbon reduction options currently available
- Estimate and include the impact of drivers for increasing carbon emissions, such as population growth, higher treatment standards
- It’s okay to make assumptions, as long as we record what we’ve done and why we’ve done it

Grid decarbonisation scenarios

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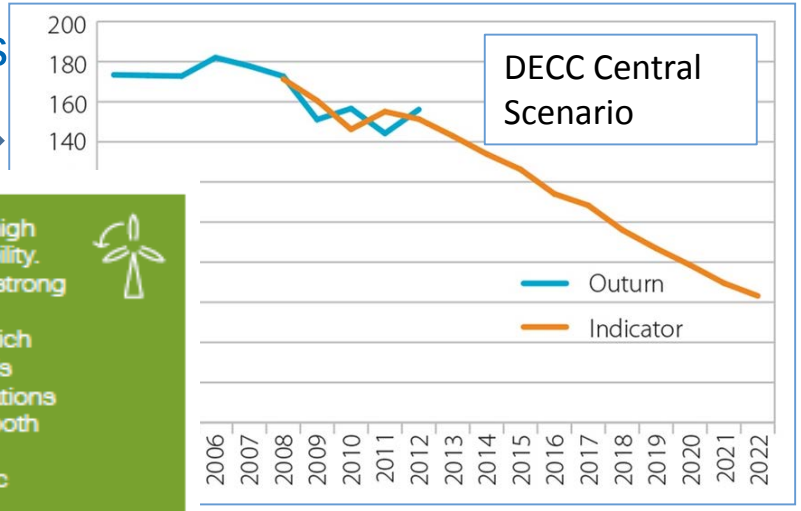
Publicly available decarbonisation Scenarios

1. DECC Central Scenario



Low Carbon Life is a world of high affordability and low sustainability. More money is available due to higher economic growth and society has more disposable income. There is short term volatility regarding energy policy and no additional targets are introduced. Government policy is focused on the long term with consensus around decarbonisation, which is delivered through purchasing-power and macro policy.

Gone Green is a world of high affordability and high sustainability. The economy is growing, with strong policy and regulation and new environmental targets, all of which are met on time. Sustainability is not restrained by financial limitations as more money is available at both an investment level for energy infrastructure and at a domestic level via disposable income.

No Progression is a world of low affordability and low sustainability. There is slow economic recovery in this scenario, meaning less money is available at both a government and consumer level. There is less emphasis on policy and regulation which remain the same as today, and no new targets are introduced. Financial pressures result in political volatility, and government policy that is focused on short-term affordability measures.

Slow Progression is a world of low affordability and high sustainability. Less money is available compared to Gone Green, but with similar strong focus on policy and regulation and new targets. Economic recovery is slower, resulting in some uncertainty, and financial constraints lead to difficult political decisions. Although there is political will and market intervention, slower economic recovery delays delivery against environmental targets.

Affordability
More money available

Affordability
Less money available

Sustainability
Less emphasis

Sustainability
More emphasis

National Grid Scenarios (2014)*

2. 'No Progression'

3. 'Slow Progression'

4. 'Low Carbon Life'

5. 'Gone Green'

*note: for 2015 'Low Carbon Life' has now been replaced by 'Consumer Power'

The role of energy efficiency

Investment in energy efficiency saving ~5GWh/yr (saving 2,650tCO_2e/yr)

POWERDOWN

- Lighting, heating, IT equip, employee engagement & behaviours
- More permanent energy reductions

PUMP EFFICIENCY

- 85,000 assets (most of which rotate), so 80% of energy efficiency investment directed at optimising pumping & aeration
- But, most interventions return equipment to some prior condition, so tagged as 'energy recovery'

Advanced Energy Efficiency Scenario

- Additional 'blue sky thinking' scenario that assumes permanent energy efficiencies are boosted by as yet unknown innovations

Energy Efficiency: Optimising Assets

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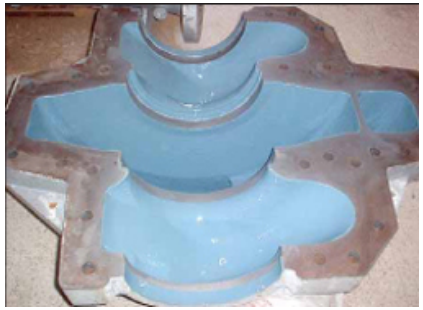
PUMP EFFICIENCY

- 80% of electricity consumption
- Programme of testing, refurbishing & rescheduling pumps & compressors
- Fixed permanent efficiency monitoring/metering

- Condition Based Monitoring

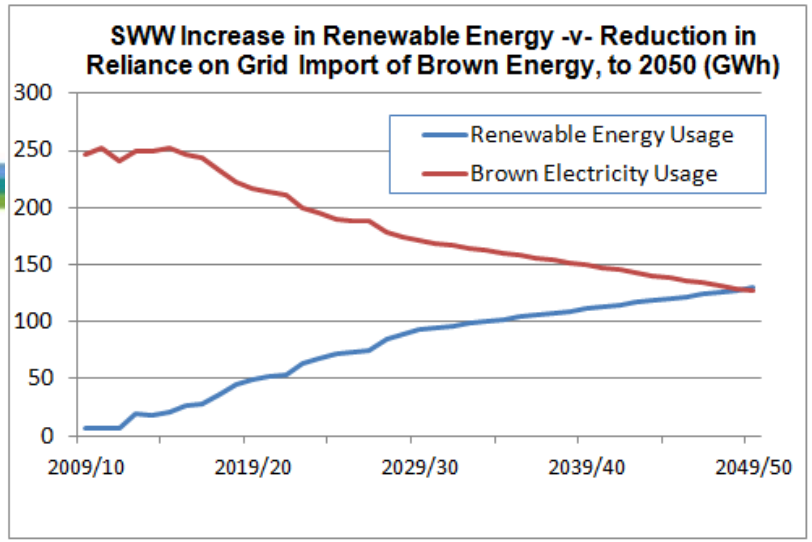
- Replacement with high efficiency motors
- VSDs & PLC controllers



POWERDOWN

- 20 % of electricity consumption
- Lighting - LED Lighting Replacement
- Heating & Cooling
- Voltage Optimisation
- UV treatment
- IT Equipment/Servers
- Staff Engagement
- Behavioural Change Programme
- Training and Energy Advice

The role of renewable energy



Key assumptions made with renewables –

Current (2015)	Future (2050)
20GWh (8%)	129GWh (>50%)

Renewable Energy Self-supply (there are limits to renewables growth!)

- Hydro - all (or almost all) 'larger' schemes already delivered
- Sewage Gas CHP - AAD could replace conventional AD at 3 largest WWTW
- Wind - most cost effective option, but location, planning & subsidy challenge
- Solar PV - longer paybacks (typ:7 to10 years), but quicker & easier to install

Renewable Energy Import

- 'Sleeved' volume - Re-imported export from SWW embedded renewables
- Private wire from 3rd party owed and operated adjacent RE schemes
- Grid imported via green tariff from energy supplier (not part of modelling)

Baseline of current SWW renewable energy assets

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Headline Stats:

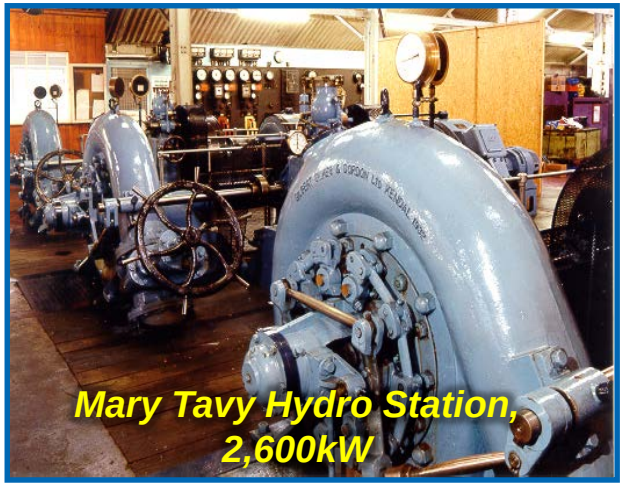
54 renewable energy sites

10MW installed capacity

Typ.25GWh generation PA

4 different technologies

- **Anaerobic Digestion with CHP – 1.7MW**
- **Hydro Power – 6MW**
- **Solar PV – 2MW**
- **Wind – 100kW**



A renewable energy strategy for 2015-2020 and beyond

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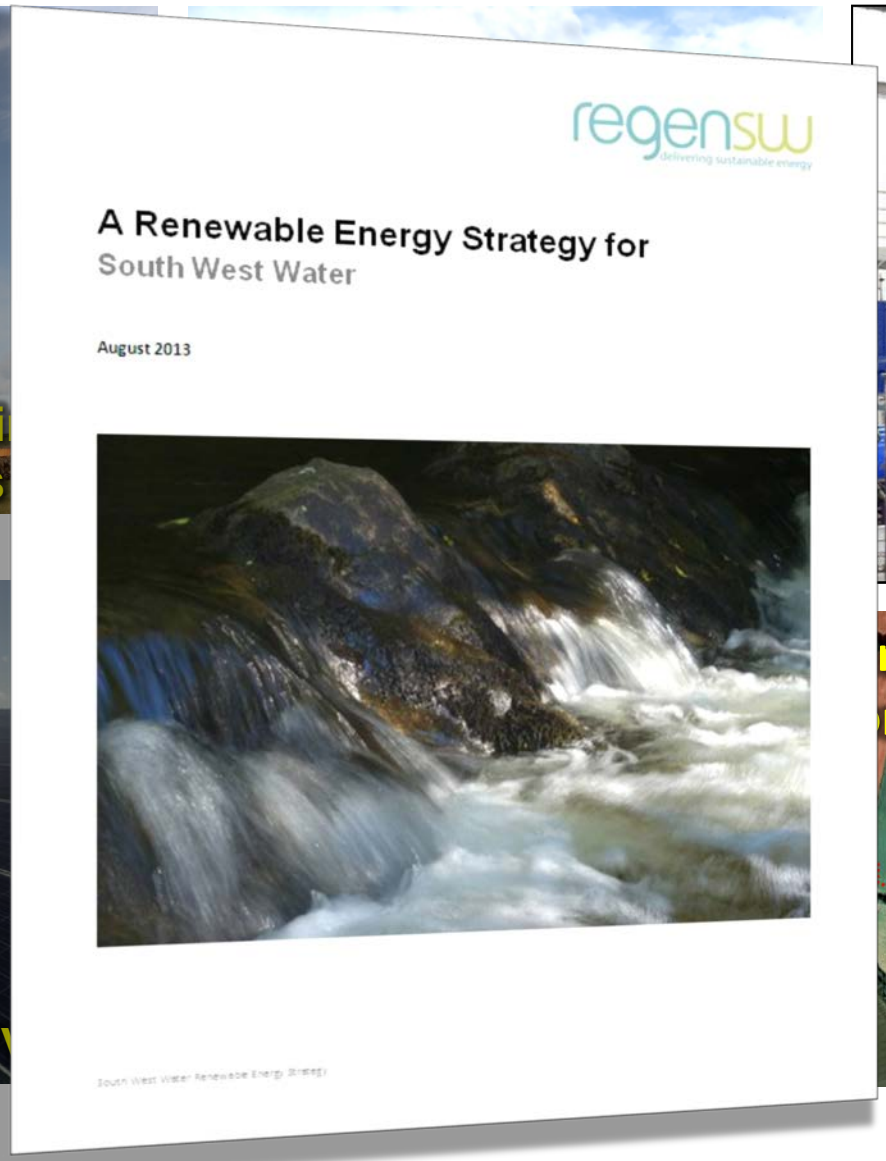

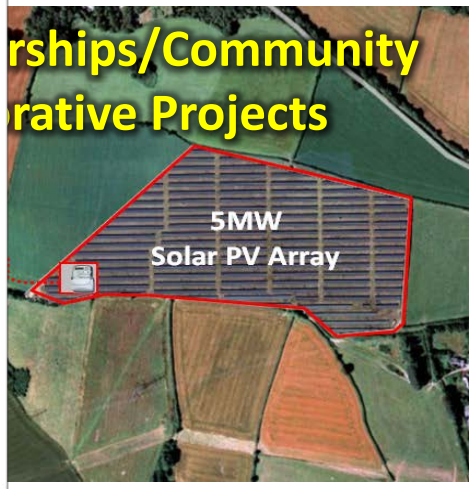

Engaging with local communities and community groups

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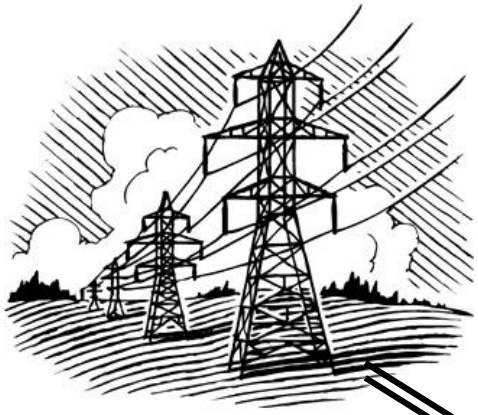

Grid Connection

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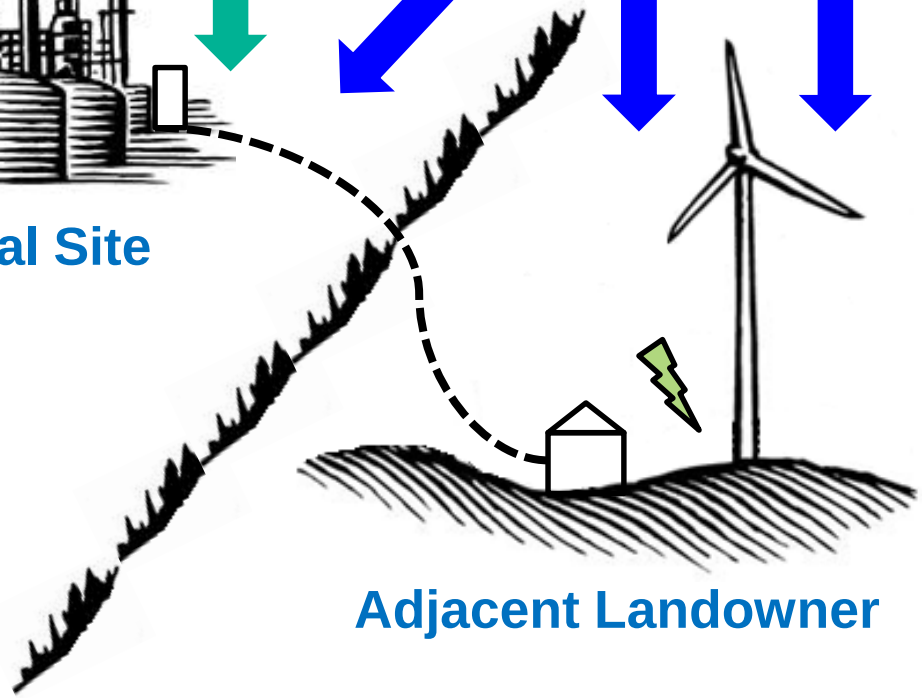
Community Group & Landowner

SWW Operational Site



Adjacent Landowner

1) Scaled project developed and owned by community group & landowner

2) All subsidy payments and sale of electricity (to SWW), goes to the project

3) SWW benefits from cheaper electricity and contribution to RE targets

Other emissions reducing options

Some key assumptions –

- **Transport** – Gradual switch to electric cars beginning from 2020

- **Process & Fugitive Emissions (CH_4 & N_2O)** – Step reductions as AAD plants come online over next 15 years, process & fugitive emissions actually increase but net emissions reduce because of additional renewable energy output

- **Chemicals** – AAD significantly reduces lime usage. Chemicals benefit from grid decarbonisation in manufacture

- **Supply Chain/Outsourced Contracts** – Assume our suppliers also begin switching to electric vehicles after 2020

- **Leakage -** Current 84Ml/d reduced to 64Ml/d by 2040, but gains offset by population growth & future higher treatment standards

Innovation and Whole Life Carbon

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Embodied Carbon in Design and Procurement -

Investment planning software calculates embodied carbon + operational carbon over life of asset to provide 'whole life' carbon value

IE3 pumps with >50% recycled content

Restormel (Cornwall) WTW GAC plant

2015-2020

New north Plymouth WTW to replace Crownhill WTW

Suspended ion exchange and ceramic microfiltration process set to reduce energy and chemical intensive processes. Built by 2020.

SWW 'Pathways to 2050': the outputs

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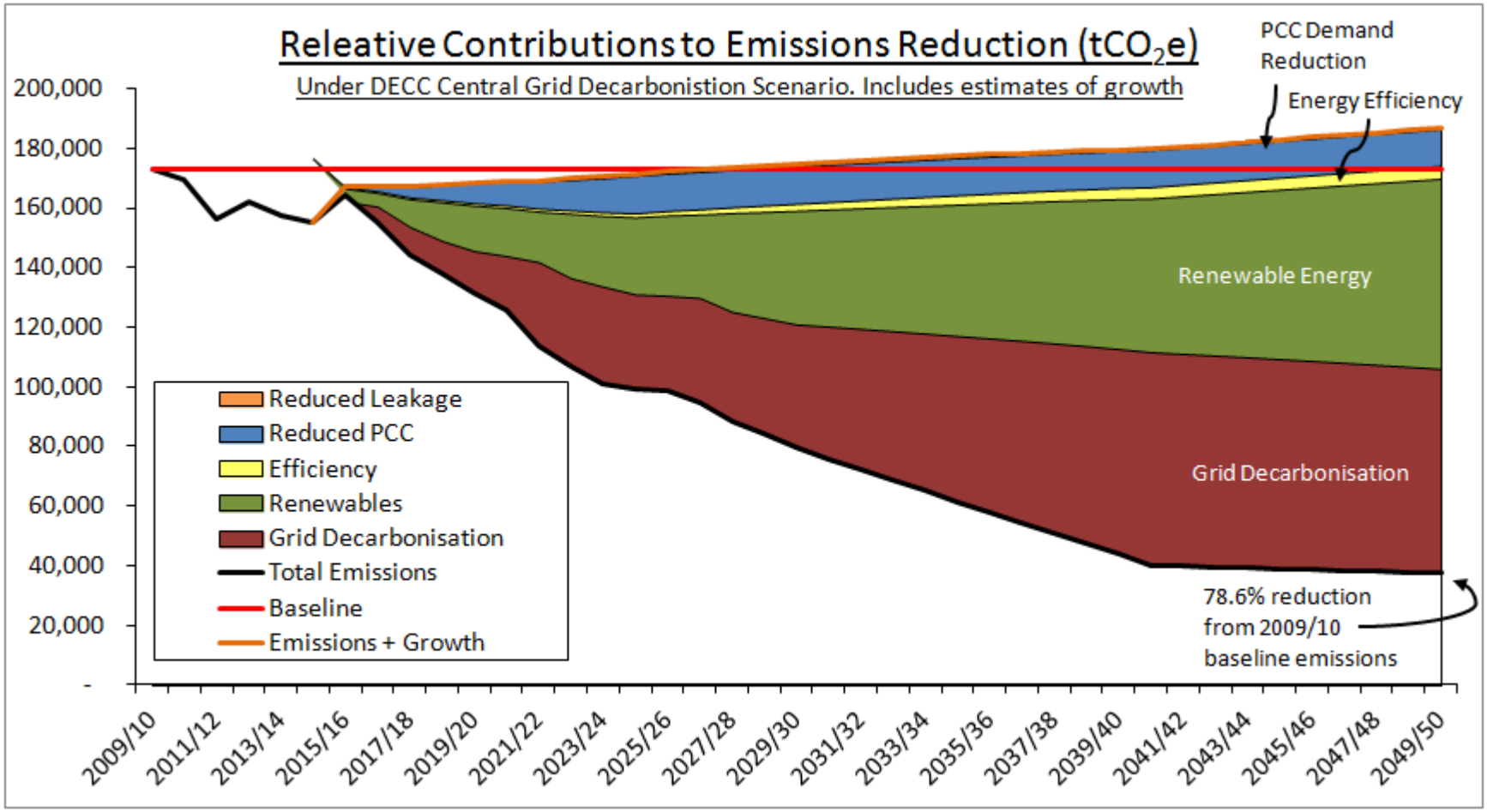

SWW 'Pathways to 2050': the outputs

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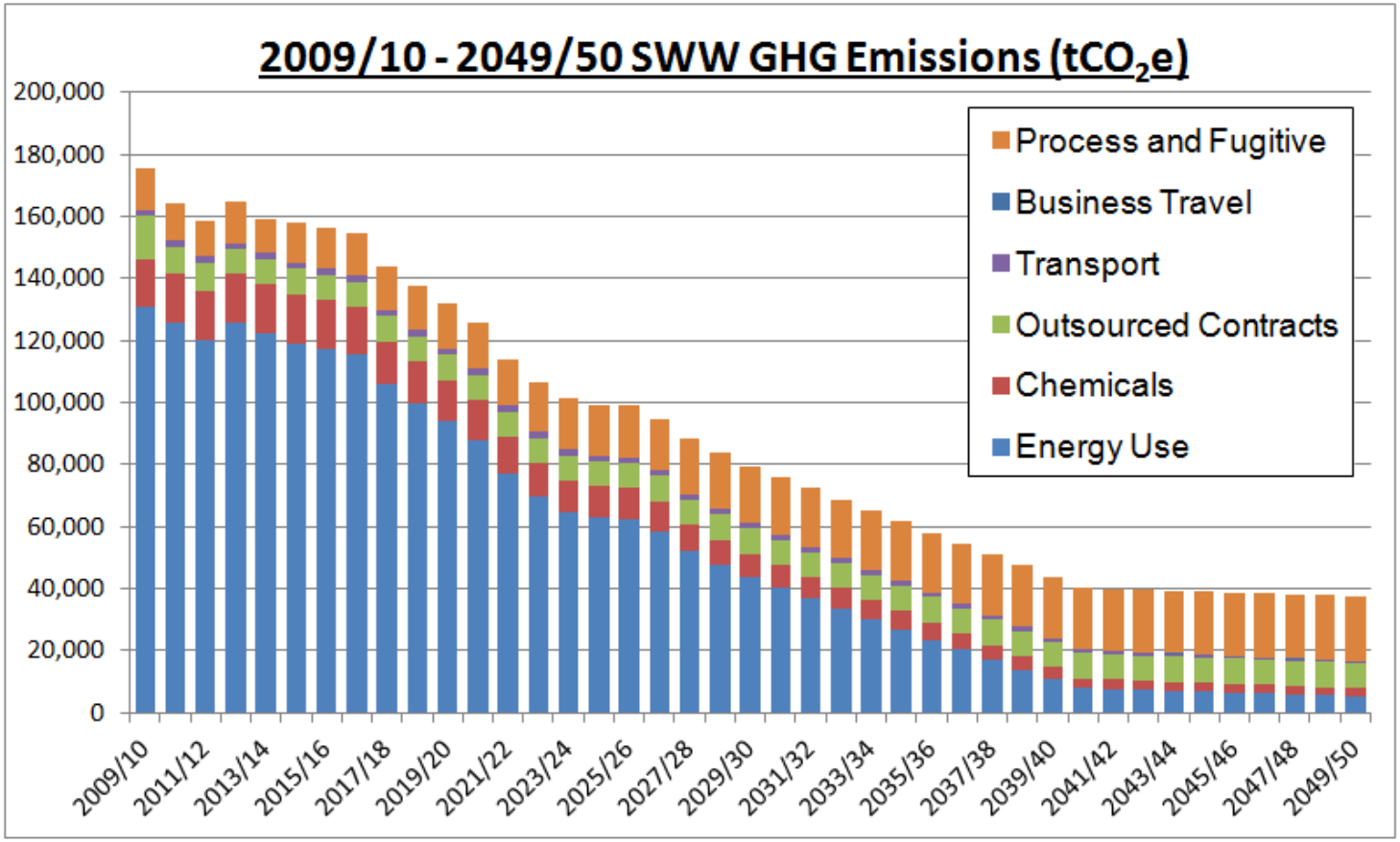
Results under DECC Central Scenario



Modelled output shows a **78.6%** reduction is achievable by 2050 under this DECC grid decarbonis-ation scenario

2009/10 Baseline GHG Emissions = 175,318 tCO2e

2049/50 GHG Emissions = 37,556 tCO2e

SWW 'Pathways to 2050': the outputs

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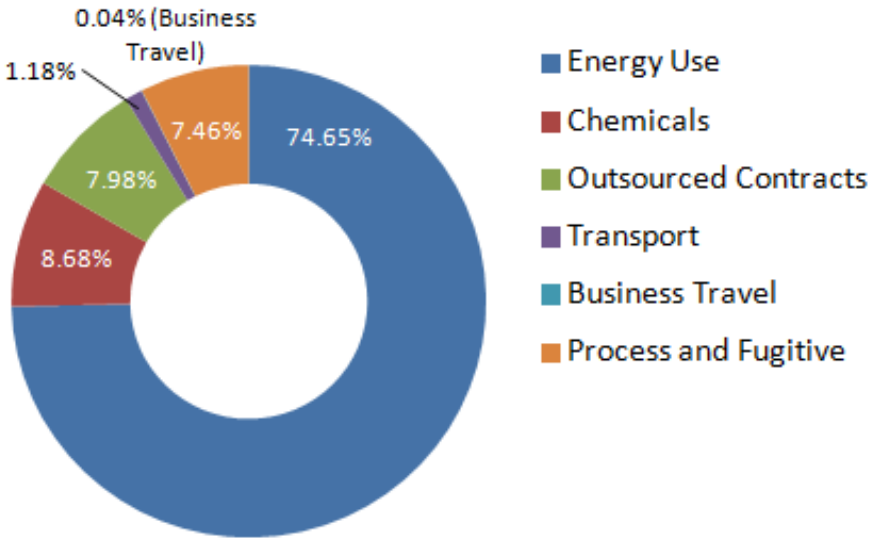
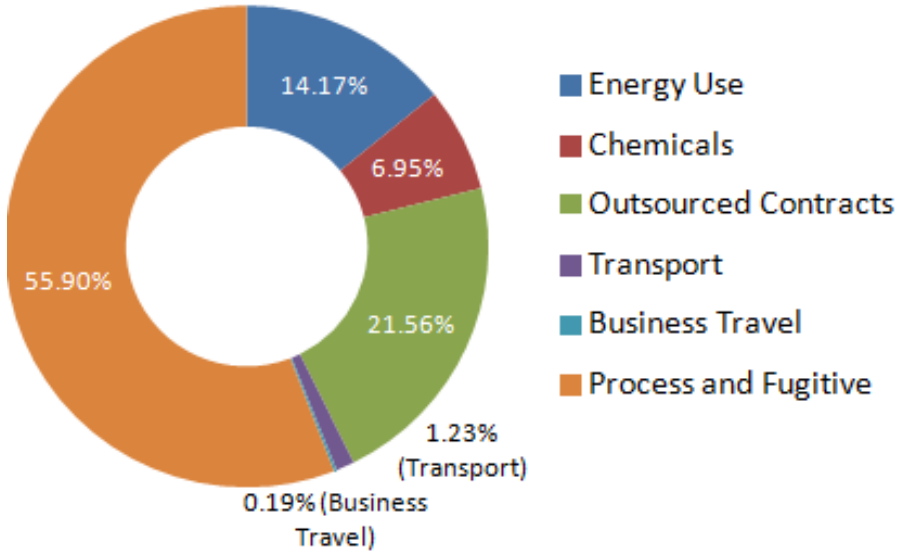
2009/10 Baseline

GHG Emissions = 175,318 tCO2e



2050

GHG Emissions = 37,556 tCO2e



80% reduction: Possible or not possible?

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Under the constraints of the modelling only 2 of the scenarios achieve 80% reduction

Table 1: 2049/50 emissions (tCO2e) and emissions reduction from baseline using different scenarios

Scenario	2049/50 Emissions (tCO_2e)	Reduction from Baseline
DECC Central Scenario	37,556	78%
Slow Progression	51,462	70%
Gone Green	34,851	80%
No Progression	85,440	51%
Low Carbon Life	35,117	80%

Grid decarbonisation delivers around a half of the reductions under most scenarios

Table 3: Amount of operational greenhouse gas emissions reduction accountable to grid decarbonisation

Scenario	Reduction From Baseline (tCO_2e)	% Accountable to Grid Decarbonisation
DECC Central Scenario	135,616	45.95%
Slow Progression	121,710	40.39%
Gone Green	138,321	46.91%
No Progression	87,732	20.40%
Low Carbon Life	138,055	46.86%

In conclusion

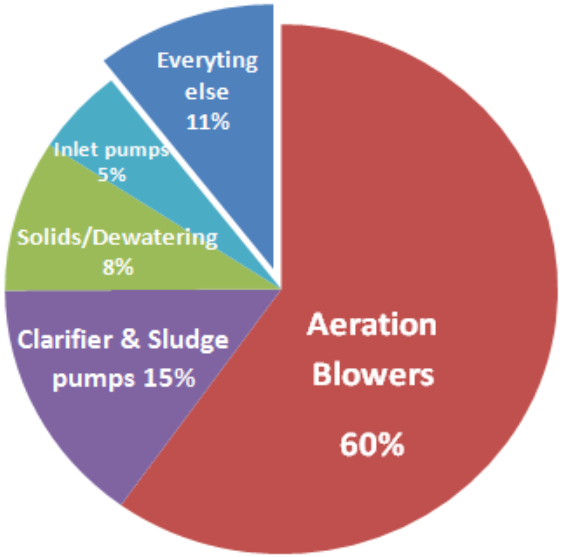
- 80% emissions reduction is just feasible but only under the most optimistic grid decarbonisation scenarios
- Planned electricity grid decarbonisation accounts for c.50% of required reduction
- There are clearly limits to embedded renewable energy deployment, but 50% of required reduction could be achieved from this if 3rd party renewable energy supply is included
- Energy efficiency plays a less significant role than expected due to temporary effectiveness of most interventions, sustained efficiencies tend to be the result of technical innovations
- Upward growth is checked by falls in PCC and leakage reduction
- Ultimately - Long term targets are helpful for strategic planning and can help drive innovation

SOUTH WEST WATER

www.southwestwater.co.uk

Where is the energy used?

SOUTH WEST WATER



Across the business pumping accounts for 80% of our usage

On a sewage treatment works aeration is the biggest consumer

If a site has a UV plant, it can be a big user, especially on wet days

POWERDOWN