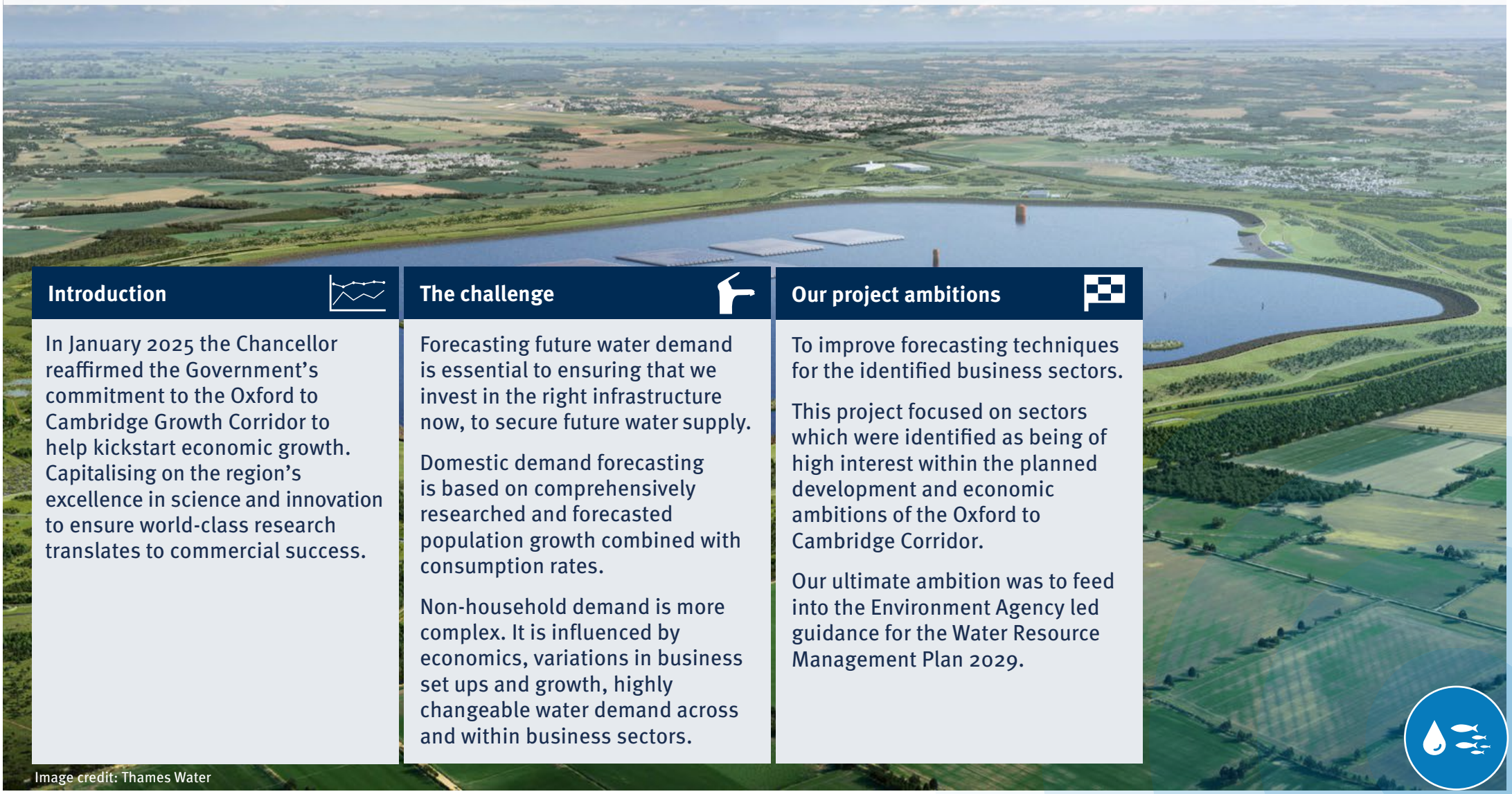
Oxford to Cambridge

Future water demand

Environment Agency



Introduction

In January 2025 the Chancellor reaffirmed the Government's commitment to the Oxford to Cambridge Growth Corridor to help kickstart economic growth. Capitalising on the region's excellence in science and innovation to ensure world-class research translates to commercial success.

The challenge

Forecasting future water demand is essential to ensuring that we invest in the right infrastructure now, to secure future water supply.

Domestic demand forecasting is based on comprehensively researched and forecasted population growth combined with consumption rates.

Non-household demand is more complex. It is influenced by economics, variations in business set ups and growth, highly changeable water demand across and within business sectors.

Our project ambitions

To improve forecasting techniques for the identified business sectors.

This project focused on sectors which were identified as being of high interest within the planned development and economic ambitions of the Oxford to Cambridge Corridor.

Our ultimate ambition was to feed into the Environment Agency led guidance for the Water Resource Management Plan 2029.

Image credit: Thames Water

Forecasting for future water demand

To explore

To explore different methods for forecasting water demand.

To explore water use in different business sectors.

To create

New or improved forecasting methods for future water demand for non-household properties.

To learn

Whether new approaches can improve the robustness of water resource management plans.

What is the forecasted water in demand for the sectors that we reviewed.

Introduction

The uncertainty around the location and type of business growth that will emerge to support population growth in the Oxford to Cambridge Growth Corridor, makes it difficult to accurately forecast this element of future water demand. The economic growth ambition is focused on emerging business sectors which may, or may not, have large demands of water to operate.

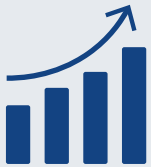
This concentrated growth ambition for the area makes it an ideal location to test new approaches, in a dynamic environment with lots of parallel complimentary research happening at the same time. There is a strong interest in the findings and recommendations that come out of this work.

Selecting sectors to trial forecasting methods

Several sectors emerged through scoping this project as being of high interest. High interest was based on a combination of:

Anticipated high or intensive water use

Anticipated growth (at this stage, scale and locations were not decided)



Recent planning constraints

Publicly stated industry growth ambitions

Existing ways of working

- Forecasting for domestic water demand
- Combining population growth scenarios from a range of sources such as: Office for National Statistics (ONS), local authority development plans, government announcements on topics like new towns, and per capita consumption rates

Forecasting for non-household (businesses) water demand

The Water Resources Management Planning guidelines set out the types of evidence water companies should consider when updating their plans. However, they don't provide a specific method for companies to use. As a result, most companies use broadly similar approaches, though some differences still remain.

Key components that are recommended in the guidelines:

- historic data collation
- group customers based on common water consumption drivers
- simple statistical or trend-based models
- running a range of scenarios helps assess the sensitivity
- manual adjustments based on conversations with high volume water users

What did we do?

We produced a future water demand forecast for

Biomedical businesses	Hospitals	Higher education facilities	Food and drink

We did further research for

Extracting information from local authority planning portals	Data centres	Hydrogen production

Our project findings

Recommendations

The design of new premises, particularly in the medical sector, show massive improvements in water efficiency compared to existing stock. Therefore there is potential for water use reductions by improving efficiencies in existing buildings.

A stipulated standard surrounding the water usage of certain sectors, such as data centres, would improve the forecasting and encourage water efficient design.

Work with Local Government Associations (LGAs) and Local Planning Authority teams to encourage consistency of planning application forms, ensuring that information on factors such as water use is collected in a standardised way.

Key messages

Available data
Market Operator Services Limited (MOSL), the market operator for the non-household water retail market in England, which opened in April 2017 currently only has a limited historic record, which includes the Covid period. However, they are continually improving their data which will make forecasting using historic trends easier in the future.

Business Planning
Businesses contacted had limited shareable growth plans. The food and drink industry is very much driven by consumer demand, making long-term planning difficult. None of the businesses had plans beyond 10 years, so they all fall short of the water resource planning horizon.

Data centre design
Designing data centres with hybrid cooling systems, that are predominantly air-cooled but can be switched to water-cooled in hot weather, will mean their annual water consumption will be low. However, they will have a large peak in water use at the times when resources are stretched.

Range in forecasts
There were large ranges of projected future water demand across our forecasts. For hospitals this was the comparison between modern water efficiency design and existing water use patterns. For the biomedical sector, the range was driven by whether demand was extrapolated from recent trends or from the pipeline of premises with planning permission.

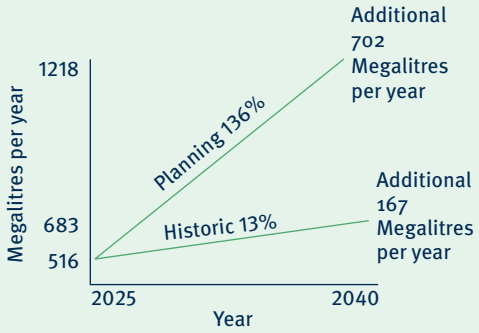
Our findings

Biomedical businesses

Forecast method

We used the Oxford to Cambridge Pan Regional Partnerships 'Science Innovation and Technology (SIT) Business Premises study'. From reviewing the study, we found 2 forecasts: one extrapolated from historic growth and one from planning permission being delivered within the next 5 years.

Forecast increase by 2040



Key message

There is a large range of water demand across our 2 forecasts, which highlights the balance needed when deciding which forecasts to plan water infrastructure against.

Confidence level: medium

Hospitals

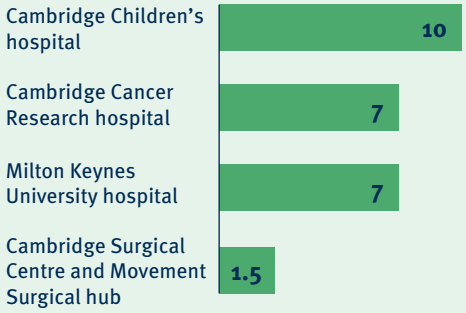
Forecast method

We focused on the areas where there would be most significant changes in water use:

- 3 planned new hospitals and one large expansion
- we based the water consumption rate on metre squared floor space

Forecast increase by 2040

Future water demand forecast by 2040 (megalitres per year)



Key message

The design of new premises, particularly in the medical sector, show significant improvements in water efficency compared to existing stock.

Confidence level: high

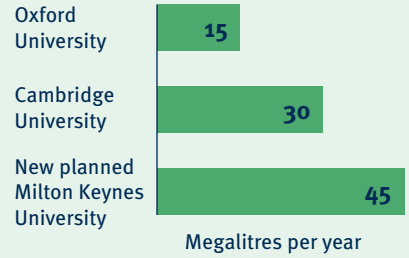
Higher education

Forecast method

To understand projections for student growth we:

- reviewed University business plans
- looked at Local Plans showing university growth
- held interviews with University staff

Forecast change by 2040



7 other existing universities had no planned expansion but instead planned improvements that could reduce water demand

Key message

Engagement with the sector provided a consistent message that universities are not currently expecting to expand their teaching numbers. However, there is optimism around growth in research and development activities.

Confidence level: low

Food and drink

Forecast method

We trialled models of statistical relationships between water consumption against the 3 variables:

- population
- employment in this sector
- Gross Value Added (GVA) in the food and drink sector

The best match was with the combined effect of population and Gross Value Added (GVA) in the food and drink sector.

Forecast increase by 2040

Based on the forecasting model developed, water consumption in this sector is expected to decline by 44,228m³ by 2040. We have low confidence in this due to the poor statistcial relationship found.

Key messages

We had a limited historic record to find a statistical relationship. This will improve over time.

Growth is consumer driven. No businesses had plans beyond 10 years, most less than 5. All fall short of the water resource planning horizon.

Confidence level: low

Further research

Data centres

Existing data

We looked at existing data centre water use.

Data Centre managers said that they were not planning on opening any water-cooling data centres.

Key messages following engagement

- The current water use from data centres identified is less than 1% of the total non-household (NHH) consumption within the OxCam Corridor.
- Participants did not consider water to be a constraint or a limiting factor in the development of new data centres.

We fed our learning into the Data Centre National Policy Statement through our response to the Appraisal of Sustainability Scoping Report consultation.

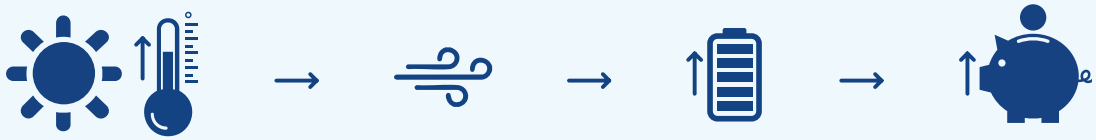
Water-Energy balance

Efficiency gains:

- Node4 reported that their adiabatically-cooled data hall has achieved better Power Usage Effectiveness compared to their other halls which use air cooling.
- Ark Data Centres noted that evaporative cooling systems help to reduce energy consumption compared to air-based methods.

What happens in hot weather?

Air cooled data centres
In hot weather, air cooling is not as efficient as it would be in cool weather.



Water-cooled data centres
Water-cooled data centres are more efficient in hot weather but have a greater water consumption than air-cooled centres.

In hot weather, data centres which are water-cooled use less energy and so have lower operating costs in hot weather than data centres that only use air cooling.

Hybrid approach
To optimise operational performance, data centres change how they operate depending on outside temperatures.
They use water evaporation during warmer summer months and air cooling during cooler times of the year.

Water sources

Water Soruce	Pros	Cons
Potable	"Cheap" and easy to implement	Possible impact on the environment depending on location Water doesn't need to be drinking water quality
Grey water/ Rainwater	Alleviates strain on local water supplies	Possibly needs treatment More expensive to implement
Black/Brackish/ Sea water	Less concerns around the availability of water (if data centres are near a source)	Would need more treatment Expensive set up and maintenance

Further information

Local hydrogen energy production

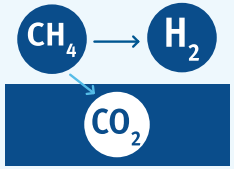
When producing hydrogen, there are 2 main uses for water: to be converted into hydrogen and to be used to cool the process. The 2 primary methods of hydrogen production are currently green and blue.

Green hydrogen

Green hydrogen is produced via electrolysis, powered by renewable energy sources such as wind or solar. This process splits water into hydrogen and oxygen.

Blue hydrogen

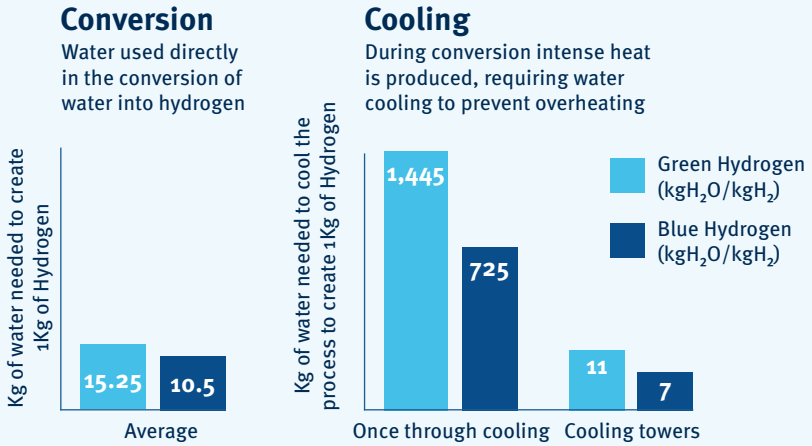
Blue hydrogen is derived from natural gas through steam methane reforming or autothermal reforming. These processes emit carbon dioxide, which is captured and stored using carbon capture and storage (CCS) technologies.



Water use in hydrogen production

Hydrogen production typically requires high-purity water. Should lower-quality water be used, then additional pre-treatment is needed.

New technologies are allowing systems to be designed and operated with lower quality water sources.



Existing data

We were unable to identify any existing or planned hydrogen production in the corridor.

Extracting information from local authority planning portals. What is AI's role in supporting this?

A targeted search was done across the planning portals of Greater Cambridge Shared Planning, Buckinghamshire Council (Aylesbury Vale Area) and North Northamptonshire Council (Corby), focussing on applications related to "Data Centres".

- 67 planning applications were identified.
- 49 were excluded from further analysis, after being classified as "No Significant Increase Expected". This was typically because they involved minor infrastructure works to existing facilities.
- The remaining 18 applications were retained for further review, based on their potential to impact water demand.

How can it be improved?

Water demand is not a required field, so data needs to be interpreted and water usage inferred from other indirect metrics such as building type, scale and proposed operational use.