TechnoEconomica
Tel: ++ 7740091449
info@technoeconomica.com
www.technoeconomica.com

Using Docks & Lakes as a Heat Sink

Clients: Wood Wharf Development – Canal & Rivers Trust – IBM – ETI

Better Management of Heat

Climate change triggered by the use of fossil fuels has generated the need to adopt more efficient systems. Data centres generating "waste" heat previously managed using electrically driven cooling equipment which is costly and is not carbon neutral. However, free cooling might be available from water

Docks Provide Free Cooling

bodies. Whereas early designs could not operate all year, incorporation of heat pumps into the cooling systems allows some systems to operate all year. The entire system is therefore made more carbon efficient by making use of free cooling coupled with intelligent system design.

Challenges Faced

Two challenges must be faced. Firstly, a robust analysis is required order to convince the regulator (the Environment Agency) that the environmental impact will be acceptably low. Secondly, analysis is needed to support detailed design.

In an enclosed water body such as a dock, lake or canals the regulatory situation is less well defined than for a fluvial situation. Temperature uplift no longer has the same meaning as in a river since the background temperature is also impacted by the rejected heat.

Many water bodies which are suitable for free cooling are becoming thermally "overcrowded". Where numerous systems aim to share the same resource, recirculation can be a threat to the efficiency of all the systems.

Needs of the Discharger and Regulator

The discharger will aim to obtain a licence to discharge at the earliest opportunity, using an efficient system which avoids recirculation. The regulator will require a robust analysis to show the long-term detailed variation of temperature throughout the water body. Constraints are expressed in statistical terms and monitoring may also be required once a system is operational.

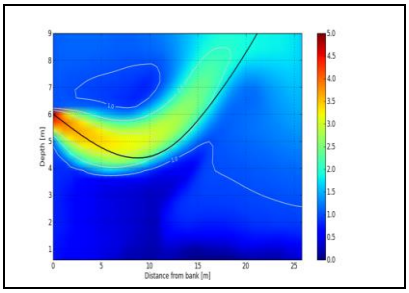
TechnoEconomica has over the past 15 years developed a successful methodology to provide a way forward for all the parties involved to arrive at a satisfactory solution.

Modelling Systems

TechnoEconomica has developed a modelling system (AQHM) to simulate the long-term thermal evolution of water bodies. It accounts for every aspect of heat exchange, including solar, atmospheric, ground and in particular the influence of foliage and buildings. The distribution of wind velocity at the water surface can be derived from wind tunnel studies or CFD.

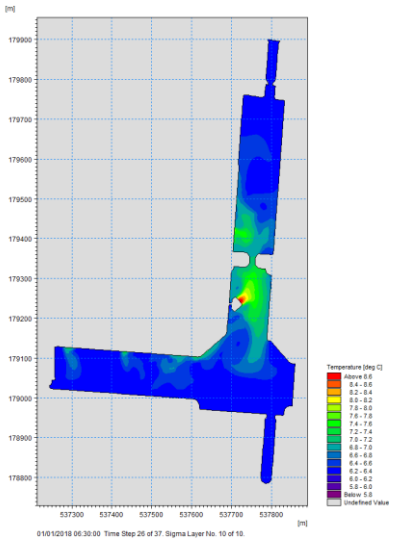
Calibration errors are less than 1°C over a year and the model runs fast enough to investigate 30-year climate change scenarios using UKCP18 data.

Integral plume or CFD models can be used to examine the near field of each outfall.



Near Field Plume Modelling – Temperature Distribution

Evolution of the possibly numerous plumes is carried out using DHI's MIKE3 modelling system.



3D Model of Plumes in a Dock - Surface Temperature Distribution

Ongoing Development

The models are undergoing continued development and improvements.

Services Provided

- Specification of thermal survey
- Analysis of thermal survey data
- Specification and analysis of wind tunnel test
- 3-D Modelling of thermal discharges
- Prediction of the long-term thermal evolution of lakes and docks
- Helping the client to navigate the regulatory issues

Contact

George Mitchell
+44 (0) 7740 091 449
george.mitchell@technoeconomica.com