Toronto, Canada

Deep Lake Water Cooling System: using Lake Ontario's chilly waters to cool down an entire district

The Deep Lake Water Cooling project realizes synergies between the City of Toronto's potable water network and the Toronto Financial District's cooling system, resulting in energy, water and monetary savings, while addressing climate change challenges.

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The project in brief

The Deep Lake Water Cooling project sources water from Lake Ontario, which is then diverted to the Toronto financial district cooling system, before entering the water distribution network. It is then released back into the lake, resulting in significant reduction of operating costs and greenhouse gas emissions. The project consists of three water intake pipes that pump fresh water through five kilometers of tubes, 83 meters below the surface of Lake Ontario, into the closed-loop chilled water distribution network. The water cools 63 buildings in the financial district, before being cooled down in order to enter the City's potable water distribution network. On an annual basis, the system saves about 85 million kilowatt-hours, and reduces greenhouse gas emissions by about 79,000 tons, compared to conventional cooling systems. The financial savings from efficiencies are passed on to consumers in the form of 10% tariff reductions. Potable water quality in summer has also improved dramatically. Not only has this project been ecologically beneficial but also, in 2011, it made a net profit of CAD $9.3 million.

Date	2000-2004
NEXUS Sectors	Water-Energy-Economy
NEXUS Innovations	Design + Technology; Institutions; Delivery Models
Scale	City-wide
Budget	CAD $200 million

What makes it "Urban NEXUS"?

Originally, the City water system and the City cooling system were two distinct entities. During the 1990s, the City sought to harness energy from the nearby lake. The technology already existed, yet the water cooling system implied that the water used to cool down buildings would have to be returned to Lake Ontario, thereby causing serious damage to the ecosystem due to its high temperature. To avoid this side-effect, the City of Toronto created a new Urban NEXUS institution, the Enwave Energy Corporation, formerly owned jointly by the municipal government and the Ontario Municipal Employees Retirement System (OMERS) which financed the project. Today the public-private partnership has enhanced cooperation between the business district and greater Toronto, most notably integrating what used to be two segregated systems: the cooling system of the financial district with Toronto's potable water network. The integrated system is also part of the City's Climate Change Action Plan, and contributes to the goal of resilience to climate change. The Deep Lake Water Cooling System has created a strategic cross-sectoral NEXUS with increased systemic efficiency, and reduced human impact on the environment. In addition, the integration also boosts resource efficiency, as water is used in two ways instead of one. As a side effect, the system calls for changes in user behavior, as it requires workers to adapt from an individually controlled air conditioning system to a centralized one.

Urban NEXUS Definition

The Urban NEXUS is an approach to the design of sustainable urban development solutions. The approach guides stakeholders to identify and pursue possible synergies between sectors, jurisdictions, and technical domains, so as to increase institutional performance, optimize resource management, and service quality.

It counters traditional sectoral thinking, trade-offs, and divided responsibilities that often result in poorly coordinated investments, increased costs, and underutilized infrastructures and facilities. The ultimate goal of the Urban NEXUS approach is to accelerate access to services, and to increase service quality and the quality of life within our planetary boundaries.

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Further Reading

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Scope for improvement

Since the two systems are linked, the water cooling system demands the exact same quantity of water as the water distribution system in order to function. Currently, the integrated system has reached its maximum capacity. This means additional buildings can no longer be connected to the cooling system because the water used to cool them down would exceed water demand. Moreover, the cooling system is vulnerable to flaws in the water distribution system, especially in summer, when water demand is unusually high. One possible way to address these risks would be to store cool water in case of emergencies. There is also the possibility that storage tanks could be used to cool down more water and reduce the risk of malfunctioning due to an inadequate water supply at times of peak demand.

Replication

The feasibility of such a project depends on geographic proximity to a water source whose temperature does not exceed four degrees Celsius. It also needs a concentrated high cooling demand. In order for a project of this scale to succeed, strong institutional integration is necessary. The project has been replicated in the Canadian city of Windsor.

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