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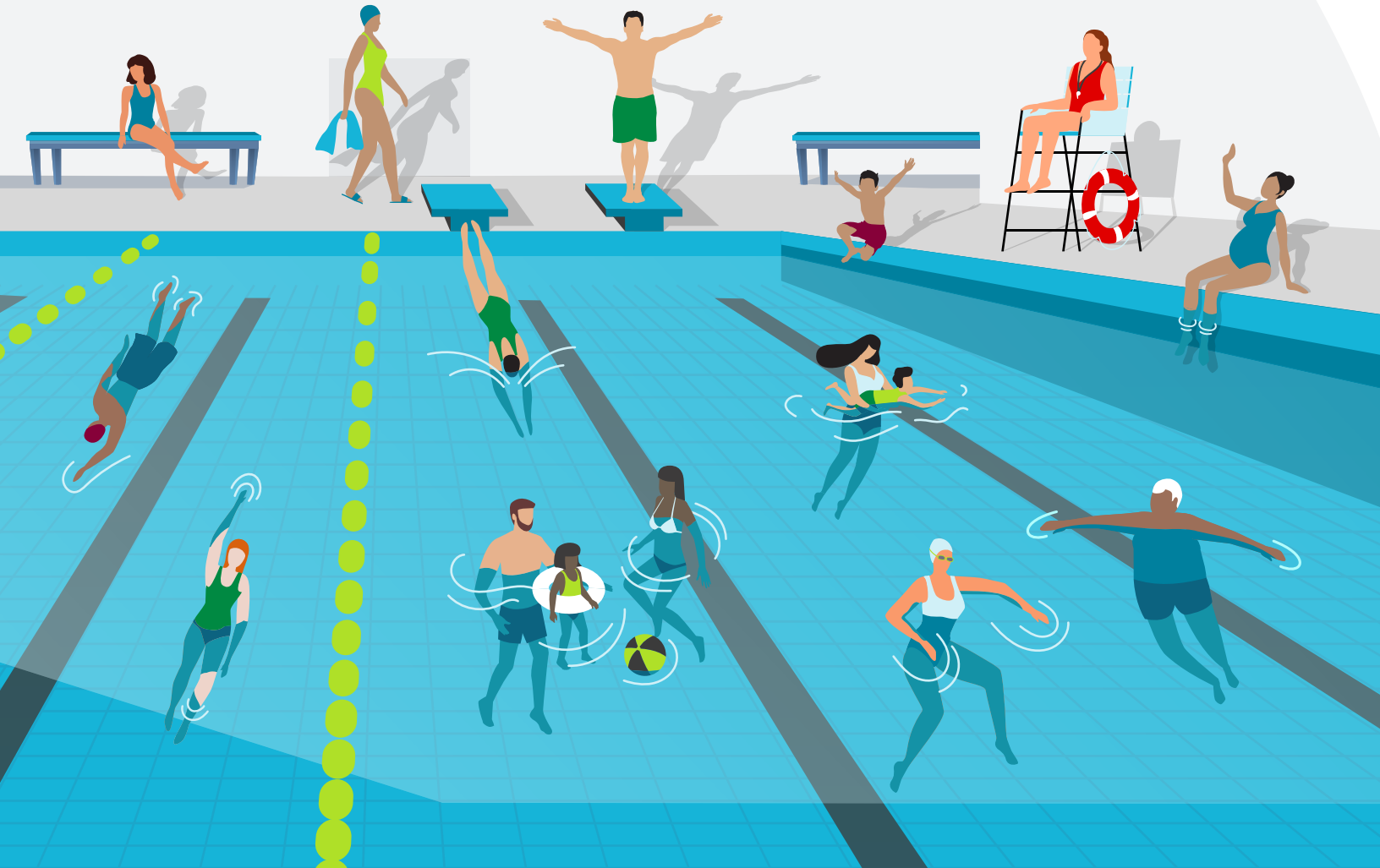
CLIMATE CHALLENGE NETWORK

Taking your indoor swimming pool to net zero



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01.
About this guide

Community-owned recreation facilities offer a significant opportunity for municipalities to reduce their energy use and greenhouse gas (GHG) emissions. Ice rinks are one high-potential area, which is why the Green Municipal Fund (GMF) published the guide *Taking your indoor ice rink to net zero*, which outlines practical tips based on nine real-life retrofit plans. Another is indoor swimming pools.

In 2023, the Mayor's Megawatt Challenge program ran a cohort pilot project that developed net-zero feasibility studies for four community centres with indoor pools in the City of Barrie, City of Brampton and City of Richmond Hill. As with the indoor ice rinks, these feasibility studies followed the *GHG reduction pathway* approach laid out by the Federation of Canadian Municipalities (FCM). This guide outlines the typical measures taken and lessons learned so that more Canadian communities can take advantage of these studies and move forward on their own path toward net-zero swimming pools.

02.

Understanding the typical measures for net-zero indoor pools

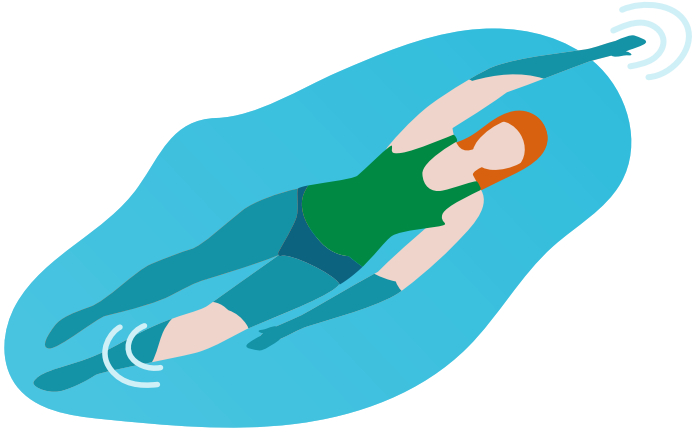
Improving how the buildings themselves were heated and cooled made up the largest reduction, at 60.8%. These lower-carbon upgrades included replacing conventional rooftop units, boilers and domestic hot water heaters with air-source heat pumps.

Pool-related measures came next, at 13.4%. These upgrades included:

- Replacing the make-up air unit that services changerooms with an energy recovery ventilation unit to recover energy from exhaust air,
- Installing fully automatic pool covers,
- Upgrading pool filtration systems to regenerative media filters, and
- Optimizing pool water temperature, air space temperature and humidity levels.

Renewable energy measures offered 9.1% of savings, and consisted entirely of installing solar photovoltaic panels for electricity generation. Solar thermal was considered but the net present value, total GHG savings and initial costs per tonne of equivalent carbon emissions were considerably better for solar photovoltaics.

Dehumidification produced 7.9% of savings. This involved installing high-efficiency dehumidifiers to reduce heating costs and emissions by using recovered energy from ventilation and compressor waste heat to either heat the pool or warm the air.



Ventilation measures reduced 6.6% of the overall emissions, through installing energy recovery ventilation units, implementing demand control through the roof top units, controlling ventilation through dehumidifier units and replacing supply and exhaust fans at end of life.

Plumbing system measures only accounted for 2.4% of the overall emissions avoided. Upgrading to more efficient fixtures will reduce water use and save costs but has a minimal effect on emissions.

Lighting measures such as occupancy and daylight sensors saved energy and costs but didn't reduce emissions.

Figure 1: Annual emissions savings by system

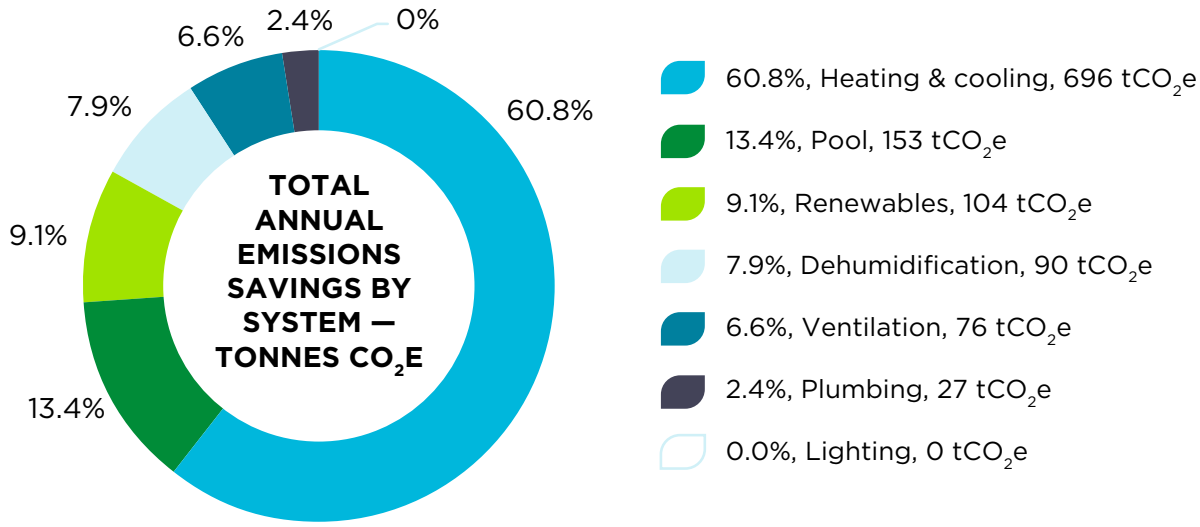
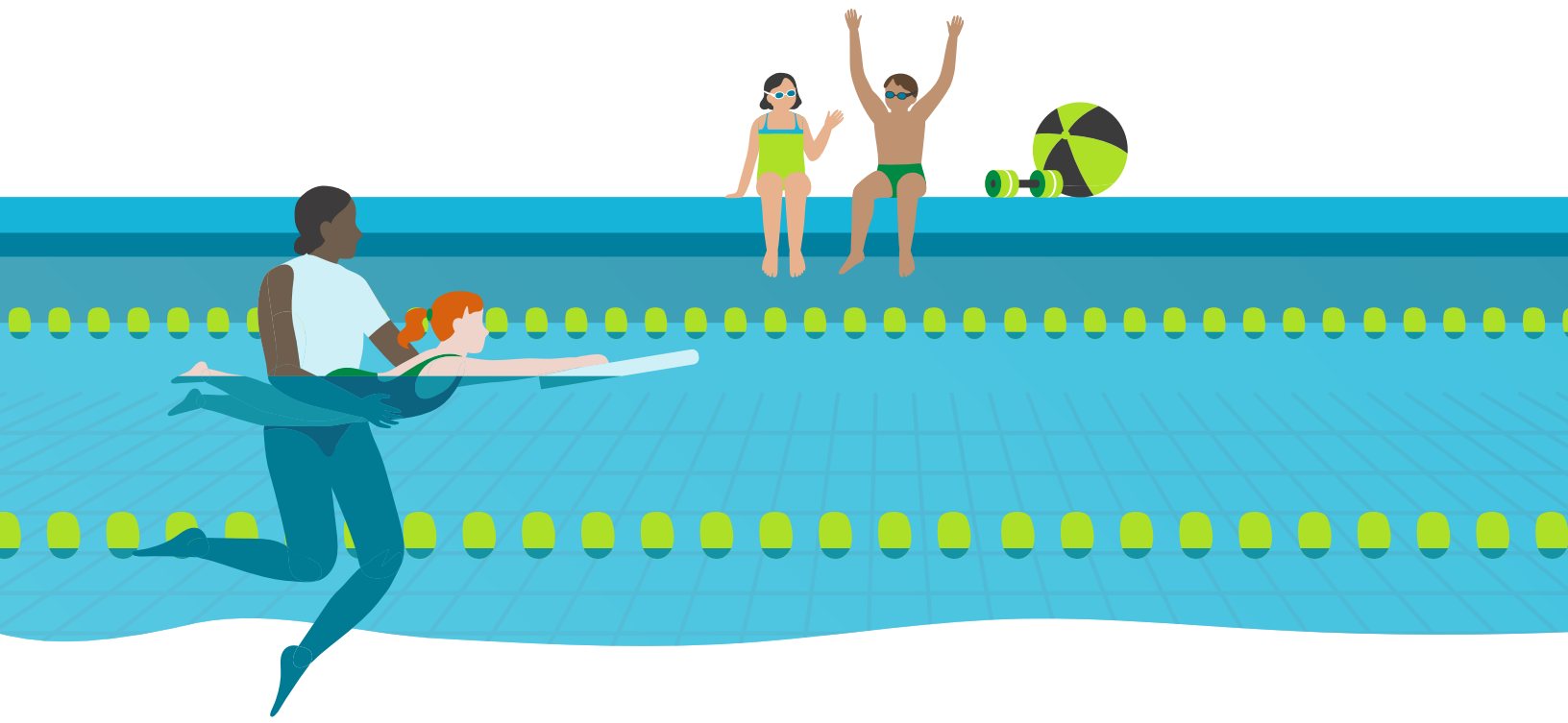


Figure 1 shows the breakdown of where emissions savings were found in the pilot project.

Many measures in net-zero plans have interactive effects, are specific to the facility and are difficult to consider separately. The following are individual measures that on their own had some of the largest emissions savings in the facilities studied.

Table 1: Individual measures with the biggest emissions savings in the pilot facilities

Top emission reducing pool measures	Average emissions savings (tCO_2e)	Average emissions reduction (%)
Replacing gas-fired rooftop units with air-source heat pump rooftop units (cold water backup)	67	16%
Replacing gas-fired space-heating boiler with air-source heat pump boiler (cold water backup)	53	14%
Replacing domestic gas-fired hot water boiler with air-source heat pump boiler	52	13%
Energy recovery ventilator	35	7%
Pool cover	29	7%
Optimizing pool water, air temperature and humidity	10	3%
Efficient plumbing fixtures	10	2%



03.

“Early win” operational improvements to help make the case for your net-zero plan

Many of the measures with the highest emissions reduction for the cost per square foot are operational improvements. These can often be done immediately or within the first few years, resulting in early cost and emissions savings. Early wins can build support and confidence in the net-zero plan.

Operator training is critical for efficient pool operations. It was identified by most municipalities as an area where additional support would be needed. Factor this into your net-zero plan, first to establish good operations with current systems and then to get the most out of new equipment.

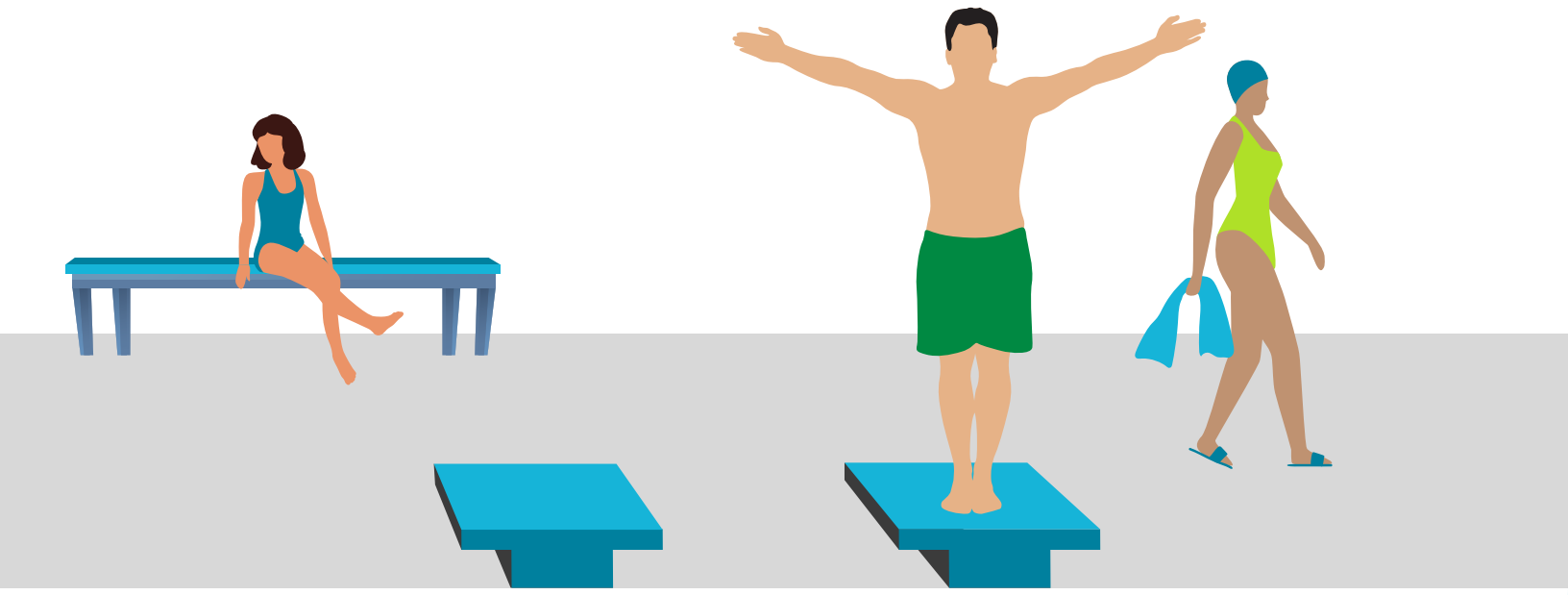
These operational improvements include:

- Finding and maintaining the best air temperature, in balance with pool water temperature and relative humidity (see Table 2)

Table 2: Air, water and relative humidity for pool types

Type of pool	Air temperature °C	Water temperature °C	Relative humidity %
Recreational	24 to 29	24 to 29	50 to 60
Therapeutic	27 to 29	29 to 32	50 to 60
Competition	26 to 29	24 to 28	50 to 60
Diving	27 to 29	27 to 32	50 to 60
Elderly swimmers	29 to 32	29 to 32	50 to 60
Hotel	28 to 29	28 to 30	50 to 60
Whirlpool/spa	27 to 29	36 to 40	50 to 60

- Reducing temperatures and relative humidity when the pool is unoccupied. It's important to balance space heating and pool evaporation.
- Minimizing the supply of make-up water for the pool to limit water use and reduce heating and cooling of make-up water.
- Installing variable-frequency drives on pool pumping.
- Ventilating only as much as is needed: don't over-ventilate when the pool facility is in use and minimize or eliminate ventilation during unoccupied periods.
- Implementing demand control ventilation in spaces that have variable occupancy.

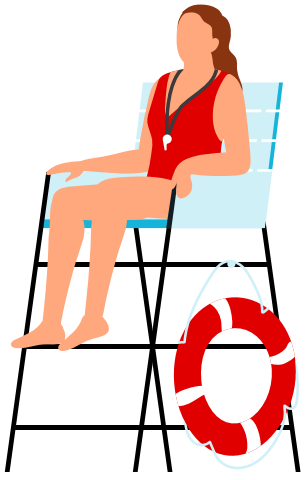


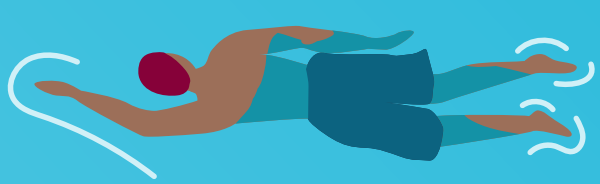
04.

Emissions reduction through optimized monitoring and management

A building automation system or building management system (BAS/BMS) is a crucial tool to keep facilities running effectively and efficiently. Many immediate emissions savings can come from reprogramming a BAS or using it more effectively. If you are considering a GHG emissions reduction plan, you should be installing or expanding your BAS and/or reprogramming it. Installing a BAS where there wasn't one can result in average emissions savings of 10% or more.

In pool facilities, ensure the pool dehumidifier is well integrated into the BAS as it interacts with multiple systems. Look at scheduling, especially for unoccupied periods. Set up trend logs and archive them.





05.

Measures considered but not included in final plans

Envelope measures including triple-pane windows, airtightness measures and upgrades in exterior wall and roof insulation were considered and priced. However, they did not make the final plans as the cost per tonne of emissions avoided was too high. Geothermal was also reviewed and considered but was not cost-effective.

06.

Where to find support for your own net-zero swimming pool plan

- **Community Building Retrofit**
  Community Building Retrofit (CBR) funding from FCM supports feasibility funding and plan implementation if the facility meets the minimum requirement of 30% reduction in GHG emissions by 2030.
- ***Recreation Energy Conservation Program***
  If your municipality is located in Alberta, you can receive up to $750,000 from Municipal Climate Change Action Centre (MCCAC) for retrofits that reduce energy costs in arenas, swimming pools, multiplexes, and parks.

6.1. Additional resources

- *Mayors' Megawatt Challenge*
- *Green Municipal Fund*
- *Net Zero Pools Guide (Australia)*
- *Passive House concept for indoor swimming pools: Guidelines*

Acknowledgements

This was prepared in partnership with the Climate Challenge Network (CCN).

Its content is based on the results and lessons learned from a pilot project led by CCN, titled Mayors' Megawatt Challenge Cohort Project for Net Zero Indoor Swimming Pools. The project brought together three municipalities in southern Ontario between 2022–2023 to develop feasibility studies for net zero carbon emissions in four community centres. All of the community centres had indoor pools and one also had an indoor ice rink.

The Federation of Canadian Municipalities' Green Municipal Fund (GMF) is a globally unique and catalyzing mix of funding and capacity building. GMF leverages a $1.65 billion (and growing) investment from the Government of Canada to give municipalities nation-wide the tools they need to accelerate their transition to a resilient, net-zero, sustainable future. For more than two decades, GMF has helped communities adopt high-performing climate solutions and practices faster.