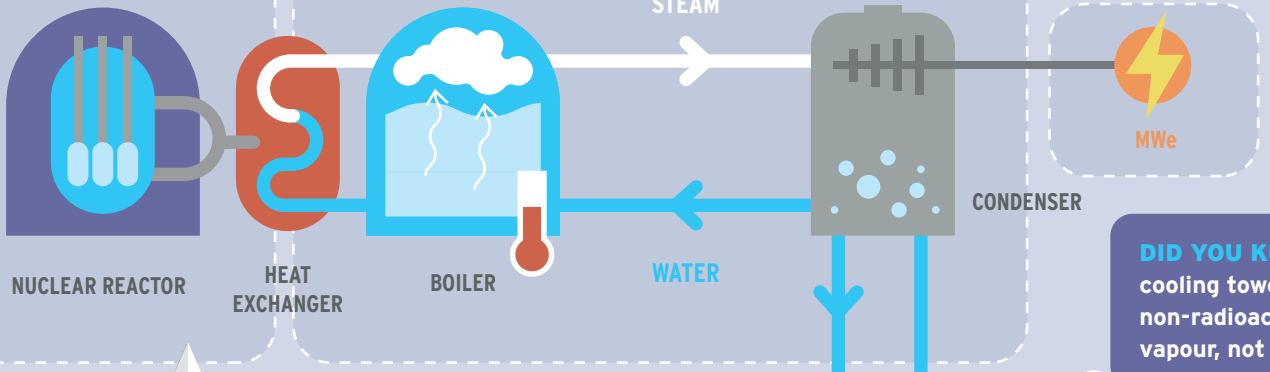
WATER & NUCLEAR POWER
SUPPORTING ALBERTA'S ENERGY FUTURE

Alberta is exploring nuclear power generation as a potential source of both electricity and industrial steam.

DID YOU KNOW that any water released from nuclear power facilities to the environment does not come into contact with reactor fuel? Independent cooling loops and physical barriers maintain separation[1].

DID YOU KNOW that water plays a key role in nuclear power electricity generation by producing steam and transferring heat, similar to other thermal power generation technologies? The energy source differs, but the steam cycle is similar[2].

DID YOU KNOW that cooling water supports heat removal and power production, while multiple redundant safety systems are designed to maintain reactor cooling even during disruptions to normal water supplies[3]?

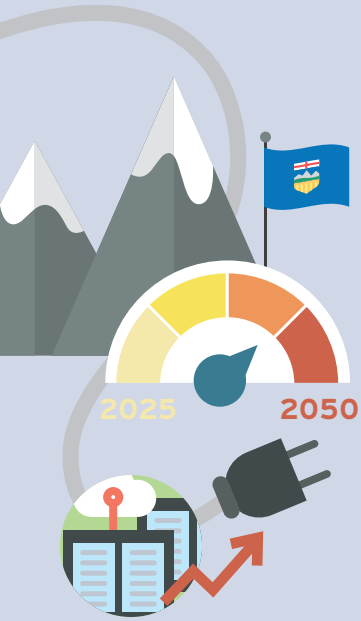


DID YOU KNOW that cooling tower plumes are non-radioactive water vapour, not smoke[4]?



DID YOU KNOW that evaporative cooling towers are only one of many cooling technologies available for thermal power generation?

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DEMAND FOR NUCLEAR POWER

Alberta's average internal electricity load (AIL) is preliminarily projected to increase from approximately 10.3 GW in 2025 to 14.8 GW by 2050 **(Figure 1)**, while peak demand rises from 12.8 GW to 19.3 GW[5]. This growth reflects increasing demand from population and economic growth, transportation and building electrification, and large industrial loads such as data centres, hydrogen production, and carbon capture projects. Nuclear power could contribute reliable, continuous generation to help meet a portion of this additional demand alongside other generation sources.

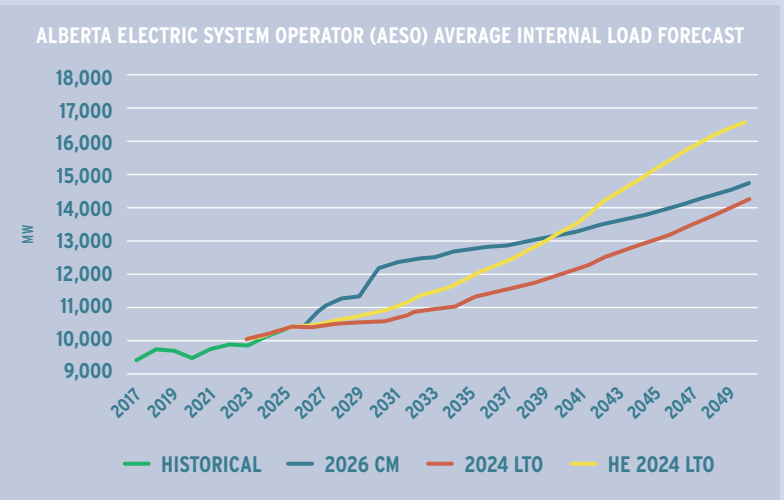


Figure 1: AESO's 2026 Current Measures Scenario Average Internal Load Forecast towards 2050 (in blue)[5].

COOLING TECHNOLOGY DETERMINES NUCLEAR POWER WATER USE

Nuclear facilities generate electricity using steam, and residual heat must be released through the cooling system. More thermally efficient reactors generate less residual heat per unit of electricity, while warmer ambient air and source-water conditions can increase the water required for cooling.

Figure 2 illustrates the influence of cooling technology on consumptive water use, using dry air cooling, closed-loop pond cooling, and evaporative cooling as representative low, medium, and high water use systems, respectively. The analysis considers nuclear reactors with thermal efficiencies of 35% to 40% and temperature conditions representative of northern and central Alberta. The ranges shown for each cooling technology reflect these regional temperature and thermal efficiency variations.

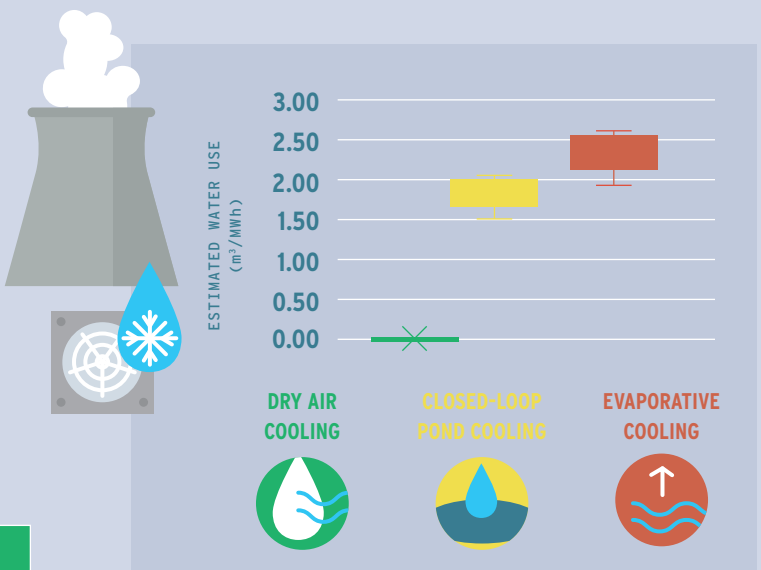


Figure 2: Estimated water use of nuclear power generation for dry-air cooling, closed-loop pond cooling, and evaporative cooling systems (m³/MWh).

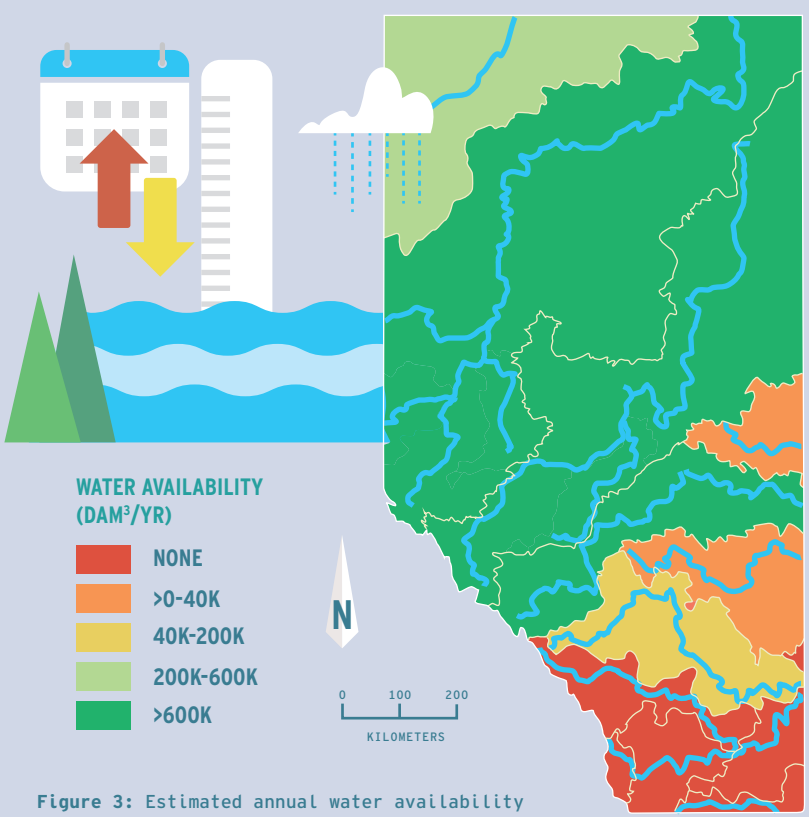


Figure 3: Estimated annual water availability in Alberta river basins (as of May 2026).

WATER SUPPLY FOR NUCLEAR POWER GENERATION

In Alberta, the amount of water available for use varies greatly by location, time of year, and year over year. This variability is managed by regulators and users to meet ecological and human needs while making water available for economic development. Rivers in southern Alberta, which flow through more populated areas, face higher competition for water resources compared to other regions.

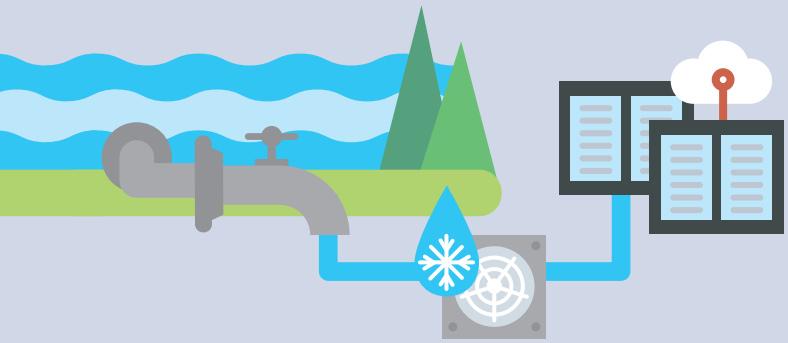
Figure 3 compares the water availability of Alberta's river basins. In some locations, limited water availability could introduce project risks for nuclear power generation. For each project, its basin-specific water context must be understood, together with potential water risks, impacts, and necessary mitigations.

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NUCLEAR POWER FOR DATA CENTRES?

Data centres are expected to contribute to Alberta's growing electricity demand, requiring additional power generation and its associated cooling requirements. Although modern data centres may use closed-loop or other low-water cooling systems, the facilities supplying their electricity may still consume water to reject heat.

Figure 4 compares the potential annual cooling water requirements of a small modular reactor (SMR) and natural gas combined-cycle (NGCC) power generation facilities supplying a continuous 1,200 MW to a data centre. The cooling water requirements of SMR and NGCC are expected to be of a similar order of magnitude when equipped with equivalent cooling configurations, though SMRs are less thermally efficiency and typically require more water.



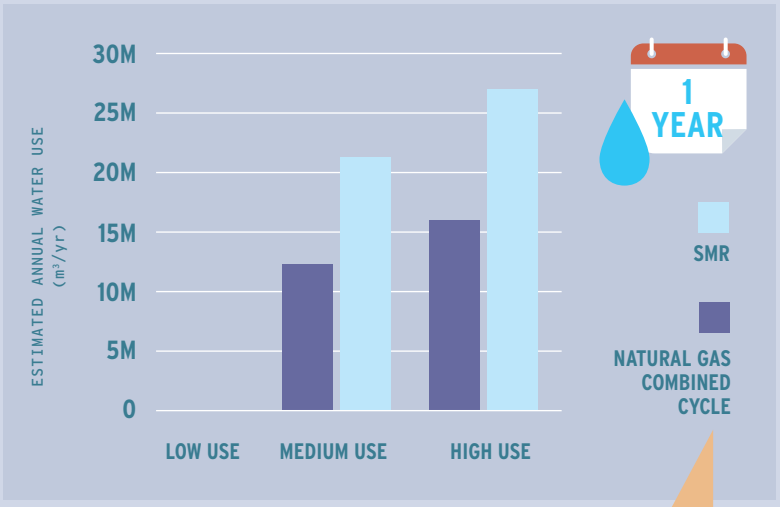


Figure 4: Estimated annual water demands for 1,200 MW of power load.

While nuclear power facilities are expected to use more water than NGCC on a per-unit basis, meeting the projected electricity load associated with data centres will require incremental generation capacity, and thus water consumption, regardless of power source. Trade-offs related to greenhouse gas emissions, fuel supply, air quality, system reliability, and economics must also be considered when selecting a power generation technology.

COMPARING WATER SUPPLY TO DEMAND

Cooling water requirements and water availability both vary throughout the year. Seasonal changes in ambient air and source-water temperatures affect cooling efficiency and, consequently, the volume of water required to reject heat. River flows also fluctuate seasonally, meaning that periods of higher cooling demand may not align with periods of greater water availability.

Figure 5 shows how the evaporative cooling demands of a 1,200 MW nuclear reactor in the Peace River region could vary throughout the year. **Figure 6** shows the demands as a percent of water availability.

In the Peace River, seasonal increases in cooling water demand are generally matched by available river flows. This relationship may differ in basins where low-flow conditions occur during periods of peak cooling demand.

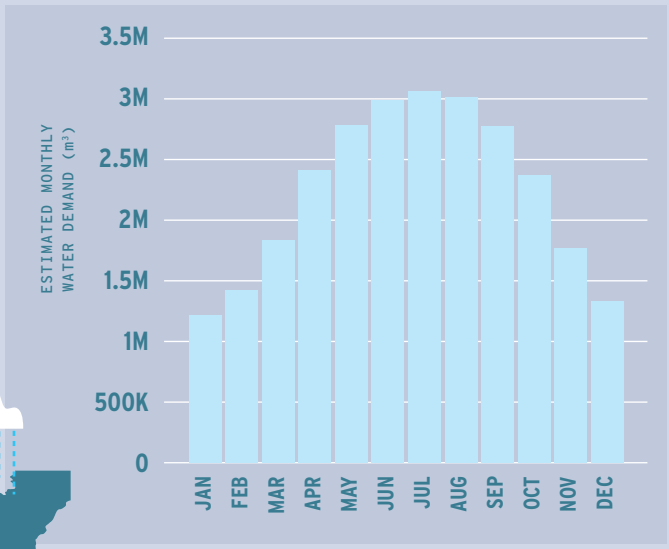


Figure 5: Change in the evaporative cooling water demands of a 1,200 MW reactor in the Peace River region.



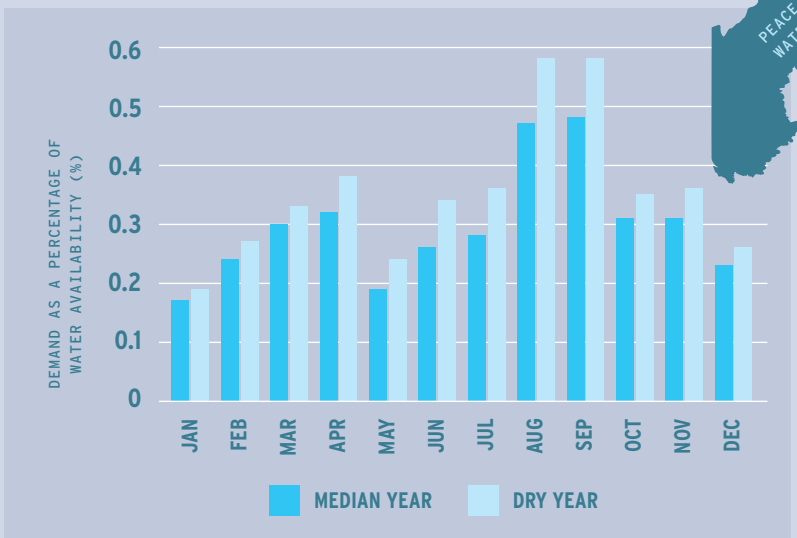


Figure 6: Estimated water demand of a 1,200 MW reactor as a percentage of water availability in the Peace River.

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5. https://aesoengage.aeso.ca/2026-long-term-outlook-plan

All information was gathered from this Hazen Company research paper.

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