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WHITE PAPER:
THE CASE FOR NITRO-TURBODYNE'S WATERLESS, 100% RENEWABLE NITROGEN COOLING IN AI DATACENTERS

Problem/Solution

As AI workloads surge, traditional water-based cooling systems are becoming a liability — driving up operational costs, exposing datacenter owners to regulatory risk, and undermining sustainability goals. Additionally, communities – especially in desert or drought-prone areas – are making it difficult (if not nearly impossible) to establish data centers; even if the local government is friendly and needing jobs, activists are becoming more vocal about the use of hundreds of millions of gallons per year in water that will never be used by constituent population. Water treatment – both coming in to and out of datacenters is expensive to treat and process. Many data center owners are looking to large tracts of desert or empty land both for the space and the solar power that can be installed to reduce or eliminate the high electrical power costs. Of course, water is scarce in many of these locations, making remote locations minimally desirable.

The need for an environmentally friendly solution to cooling is critical to winning the hearts and minds of the population of the areas, and providing cooling in any environment without having to use local water is critical to most operations.

A waterless, nitrogen-based cooling system pioneered by Nitro-Turbodyne offers a proven, next-generation solution: it eliminates water consumption, slashes operational expenses by up to 44%, and future-proofs facilities against tightening regulations. This white paper presents a compelling, data-driven case for retrofitting existing AI datacenters with waterless, nitrogen cooling — delivering immediate cost savings, environmental leadership, and long-term business value.

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1. Introduction: The Cooling Challenge in AI Datacenters

AI datacenters are at the heart of the digital economy, but their cooling needs are outpacing the capabilities—and sustainability—of legacy water-based systems. With water scarcity intensifying and regulatory scrutiny mounting, owners face rising costs, operational risks, and reputational challenges. The solution: a transition to waterless, nitrogen-based cooling—a platform engineered for the demands of next-generation AI infrastructure.

While water permitting for a new data center can take from 6 to 24 months depending upon location, no water permitting is required for a data center. From a small, 1000-server data center to a 20,000 unit hyperscale unit, Nitro-Turbodyne can provide you with the cooling your system needs without the heavy permit for water use and discharge. No water or other medium is consumed, and none is discharged.

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2. Operational Cost Savings: Waterless vs. Water-Based Cooling

The True Cost of Water-Based Cooling

Water-based cooling systems incur substantial recurring expenses, including:

Cost Category	Annual Cost (per MW)
Water procurement & consumption	$400–$1,200
Chemical treatment	$10,000–$20,000
Discharge/wastewater fees	Several thousand dollars (depending upon location)
Maintenance (towers/chillers)	$15,000–$30,000
Infrastructure replacement	$5,000–$10,000
Total (excluding downtime)	**$30,000–$70,000**

> **Key Takeaway:** Water-based cooling can cost $30,000–$70,000 per MW per year—before factoring in downtime and regulatory compliance [1][2]. Compared to a nitrogen cooling system, annual costs are reduced

Waterless, Nitrogen Cooling: A New Standard for Efficiency

- **Zero water procurement, treatment, or discharge costs**
- **Minimal maintenance**: No scaling, corrosion, or biological fouling
- **Reduced downtime risk**: Fewer moving parts, no water supply interruptions

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3. Overall System Savings

Operational Expense (Opex) Savings: - Waterless systems deliver **35–44% annual opex savings** compared to water-based systems.

Comparison to Traditional Cooling

Traditional Air Cooling (1,000+ MW datacenter):

- Annual cooling cost: ~$50-80M (electricity for massive fan arrays)

- Water consumption: 2-4 billion gallons/year - COP: 3-5 - Space requirement: Extensive

Nitro-Turbodyne's Nitrogen Cooling: - Annual cooling cost:

~$4.4M (electricity) + $0.75-2.4M (Nitrogen supply) = **~$5.2-6.8M**

- Water consumption: Negligible and recoverable (only for chiller heat rejection)

- COP: ~182:1 - Space requirement: Compact (equipment is highly efficient)

Annual Savings vs. Traditional Cooling: ~$43-$75M per year

- **Total Cost of Ownership (TCO)** is **8–17% lower over five years**—factoring in energy, maintenance, and infrastructure longevity.

Cooling System	Annual Opex Savings	5-Year TCO Improvement	Water Use (liters/MW/year)
Water-cooled	Baseline	Baseline	500,000
Waterless (LN2-based)	35–44%	8–17%	0

4. Environmental Benefits: Zero Water, Zero Compromise

Waterless Cooling: A Sustainability Game-Changer

- **Zero Water Usage Effectiveness (WUE):** No water consumed, no wastewater generated, no WUE reporting to investors, regulators, customers required.
- **Zero-WUE facilities *are eligible for green financing, tax credits, and improved sustainability ratings.***

- **Nitrogen as Coolant:** Nitrogen is abundant, non-toxic, and environmentally benign — comprising 78% of Earth's atmosphere. The Nitro-Turbodyne system does not consume nitrogen; therefore, it does not emit any harmful gases. There are no EPA or other restrictions for releasing nitrogen into the environment, so no environmental permitting is required for a Nitro-Turbodyne waterless cooling system.
- **No chemical additives or hazardous discharge**: Eliminates environmental compliance burdens, waste-water treatment equipment, or discharge permits.

Key Finding: Nitro-Turbodyne's waterless nitrogen cooling enables datacenters to achieve a WUE of zero—setting a new benchmark for environmental stewardship and regulatory compliance.

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5. Business Value: Regulatory Risk Mitigation & ESG Leadership

Navigating a Tightening Regulatory Landscape

Water use in datacenters is under unprecedented scrutiny:

- **United States:**
  - *Minnesota H.F. 16 (2025):* Mandatory water permits, conservation, and drought-triggered restrictions.
  - *South Carolina HB 4583:* Requires closed-loop, zero net water withdrawal.
  - *California AB 1577:* Monthly water reporting, potential potable water bans.
  - *Arizona:* Groundwater moratoriums and permit denials for new projects.
- **European Union:**
  - *EU Taxonomy & Energy Efficiency Directive:* Water efficiency is now a prerequisite for sustainable investment and permitting.
- **Global:**
  - *Chile:* Google faced permit revocation due to water use.
  - *The Netherlands:* Moratoriums on new datacenters over water concerns.

Business Impact: Over **$130 billion** in US datacenter projects were delayed or abandoned in Q1 2026 due to water-related moratoriums and regulatory hurdles. Meta invested **$500M+** in water recycling to secure permits; Microsoft faced multi-year delays in Wisconsin [3][4][5].

ESG and Green Financing Advantages

- **WUE is now a core ESG metric**—publicly reported and scrutinized by investors, regulators, and customers.
- **Zero-WUE facilities** are eligible for green financing, tax credits, and improved sustainability ratings.
- Major operators (Microsoft, Google, Meta, Amazon) are setting aggressive water reduction targets—waterless cooling is the fastest path to compliance and leadership.

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6. Industry Trends: The Shift Toward Waterless Cooling

- **Major operators are retrofitting for zero/low water use:** Nvidia, Microsoft, Google, and Meta are deploying advanced cooling and waterless systems in new and existing facilities.
- **Legislative momentum:** States and countries are moving toward mandates for closed-loop or zero-water cooling.
- **Retrofit incentives:** Utilities and governments are offering incentives for facilities that transition to waterless cooling.

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7. Conclusion

Summary

- **Up to 44% annual opex savings**
- **8–17% lower TCO over five years**
- **Zero water consumption and discharge**
- **Elimination of regulatory and ESG risk**
- **Future-proofed, sustainable operations**

The message is clear: Water-based cooling is becoming unsustainable—financially, environmentally, and operationally. Waterless, nitrogen-based cooling is a proven, next-generation platform that delivers immediate and long-term value for AI datacenter owners.

Now is the time to act.
Retrofitting your facility with waterless, nitrogen cooling will:

- Slash operational costs
- Eliminate water-related regulatory risk

- Enhance your ESG profile and unlock green financing
- Position your datacenter as a leader in sustainable AI infrastructure

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Nitro-Turbodyne has years of experience working with nitrogen for cooling, power production, and environmentally friendly systems that are not only innovative, but save operators money, time, and OPEX.

Contact us today to schedule a consultation and discover how your datacenter can benefit from the waterless revolution.

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