THE OHIO ACADEMY OF SCIENCE

Data Centers & Critical Infrastructure Design Challenge

Briefing Packet for Students and Advisors

Fall 2026 · Presented at the OAS Annual Meeting, October 23

Challenge site: New Albany International Business Park

REPORT DUE	FINALISTS NAMED	FINALIST PRESENTATIONS	ENTRY FEE
September 28	October 2	October 23	$50
5:00 p.m. ET	Three teams advance	OAS Annual Meeting	per team

01

The Challenge

The Ohio Academy of Science invites undergraduate and graduate teams to identify and solve a real-world problem created by the rapid growth of Ohio's data center industry. Each team chooses a focus area and frames a specific problem within it. No single discipline can answer a problem like that alone, so teams should bring together students from different fields.

GUIDING QUESTION

How might we address a critical challenge, whether technical, environmental, social, or logistical, created by the rapid growth of data centers in Ohio, using a multidisciplinary approach grounded in science, engineering, and systems thinking?

WHO	Undergraduate and graduate students; a single team may mix both. Teams of 4 to 6 members.
ELIGIBILITY	Open to all students, participation is not limited to Ohio students, and teams may span multiple schools.
CHALLENGE SITE	New Albany International Business Park, one of the nation's densest data center clusters.
WHAT YOU SUBMIT	A written report (PDF, maximum 10 pages including images) framing a problem and proposing a solution.
REPORT DUE	Monday, September 28, 2026, 5:00 p.m. ET
FINALISTS NAMED	By Friday, October 2, 2026. Three teams advance.
FINALIST PRESENTATIONS	Friday, October 23, 2026 at the OAS Annual Meeting, in person, before the Meeting audience and invited judging panel.
PRIZES	$1,000 first · $500 second · $500 third, awarded per team. All three finalist teams are invited to publish in *The Ohio Journal of Science*.
ENTRY FEE	$50 per team, paid through the submission form. There is no pre-registration; teams enter by submitting. Fees are non-refundable.
WHAT THE FEE COVERS	Challenge entry, plus complimentary Friday, October 23 registration to the OAS Annual Meeting for every student member of a submitting team. Saturday, October 24 attendance is not included and may be registered for separately.

02 Timeline and Key Dates

The challenge runs in two judged stages: a written round open to all teams, and a live presentation round for the three finalists.

DATE	MILESTONE	WHAT IT MEANS FOR TEAMS
Sept 28	**Written report due**	Final PDF and $50 team entry fee submitted via JotForm by 5:00 p.m. ET.
By Oct 2	**Finalists announced**	Three teams advance. Presentation format and logistics are sent with the announcement.
Oct 2 to 23	**Presentation preparation**	Finalist teams develop a live presentation of their solution.
Oct 23	**Final presentations and awards**	Finalists present in person at the Annual Meeting; winners announced.

03 Eligibility and Team Composition

- **Team size.** 4 to 6 student members. All members must be enrolled students at the time of submission.
- **Level.** Open to undergraduate and graduate students. A single team may include both.
- **Faculty advisor.** Optional. Teams may work with a faculty mentor but are not required to.
- **Institution.** Open to all students, participation is not restricted by state, and teams may include members from more than one institution.
- **Roster.** The full team roster is submitted with the report. Rosters are final at submission; finalist teams present with the members listed on their submission.

04 Challenge Categories

Each team selects one category and frames a specific, well-defined problem within it. The category sets the focus, whereas the four pillars in Section 5 shape how every team approaches its solution. Categories are used to route submissions to judges with relevant expertise, so please choose the one that best fits your problem.

CATEGORY	FOCUS
POWER GENERATION & GRID INTEGRATION	Meeting continuous, high-density energy demand while accounting for grid capacity, reliability, and interconnection.
COOLING SYSTEMS & WATER MANAGEMENT	Managing the substantial heat and water demands of continuous data center operation.

CATEGORY	FOCUS
AIR QUALITY, HEAT ISLANDS & NOISE	Addressing localized air quality, waste heat and heat island effects, and noise from facilities and equipment.
LAND USE, COMMUNITY & SOCIAL IMPACT	Siting, land use, and the effects of a facility on the surrounding community.
CYBERSECURITY & NETWORK INFRASTRUCTURE	Securing and structuring the network and data infrastructure the facility depends on.
SUPPLY CHAIN, LOGISTICS & ECONOMIC IMPACT	Materials, sourcing, construction and operational logistics, and regional economic effects.

05 The Four Disciplinary Pillars

Whatever category a team chooses, every submission must address all four pillars. Teams are strongly encouraged to include at least one member with background in each area. This is a multidisciplinary challenge by design, and each pillar is scored independently.

#	PILLAR	WHAT IT COVERS
1	**SCIENTIFIC FOUNDATION**	The underlying science governing the chosen challenge and solution: physics, chemistry, biology, environmental science, etc.
2	**APPLIED SCIENCE & ENGINEERING**	Translating those principles into technical solutions, systems design, and engineering approaches.
3	**SUPPLY CHAIN & LOGISTICS**	Implementation feasibility: materials, infrastructure, sourcing, timelines, and operational needs.
4	**ENVIRONMENTAL & SUSTAINABILITY ANALYSIS**	Ecological impacts, resource use, emissions, community effects, and long-term viability.

06 The Challenge Site: New Albany International Business Park

This challenge is anchored to the New Albany International Business Park in central Ohio, home to one of the densest concentrations of data center development in the United States, including major campuses operated by leading technology companies.

Rather than the confidential specifications of any single operator, teams design around a representative facility using the shared baseline parameters below. Individual operators closely guard their exact power draw, water use, and cooling design. Working from a shared, sourced set of

parameters ensures every team begins from similar real-world conditions, so submissions stay comparable and judging stays fair.

BASELINE SITE PARAMETERS

Treat these as reasonable planning assumptions for a representative New Albany area facility, not the specifications of any actual data center. Each figure is sourced in Section 12. Where a value is a design choice rather than a fixed input (cooling approach, for example), that is intentional: your team must decide which to use and justify the choice.

PARAMETER	VALUE	REF
FACILITY TYPE	AI-capable, either large-scale colocation or hyperscale (LBNL Table 4.1). Teams state which they are designing for.	1
CRITICAL IT LOAD	`100 MW`	2
TOTAL FACILITY POWER DRAW	`About 130 to 140 MW` (IT load × PUE). This is also your contract capacity with AEP Ohio, and it is the figure that triggers Schedule DCT, not the critical IT load.	3
PUE (Power Usage Effectiveness)	`1.3 to 1.4` (planning assumption)	3
SITE WUE (Water Usage Effectiveness)	`0.36 L/kWh` U.S. average in 2023, projected to `0.45–0.48` by 2028. Ranges from near zero for air-cooled systems to above 1.0 L/kWh for water-cooled chillers without economizers.	4
WATER, EVAPORATIVE COOLING	Roughly `230,000 to 630,000 gal/day` (high-water case; derived from WUE, see below)	4
WATER, CLOSED-LOOP COOLING	Near zero for cooling; domestic use only (low-water case)	5
LAND FOOTPRINT	`40 to 130 acres`, depending on building density and site layout (derived; see ref. 6)	6
GRID STATUS	Subject to AEP Ohio Schedule DCT (applies at 25 MW+ metered demand). See ref. 7 for terms.	7
STAFFING	`50 to 150` full-time employees	8
OPERATING PROFILE	`24 / 7 / 365`, continuous high-density load	9

The distinction between large-scale colocation and hyperscale is not about size. It is about who owns the facility and who the compute serves. A colocation facility leases capacity to tenants, so the operator, the tenants, and the utility are separate parties with separate incentives. A hyperscale facility is owned and operated by the company running the workloads. That choice changes your

stakeholder map, who signs the AEP tariff, and who controls the cooling design. State which you are designing for in your problem definition.

WORKED EXAMPLE: WHERE THE WATER NUMBER COMES FROM

Water Usage Effectiveness (WUE) is the liters of water a facility consumes per kilowatt-hour delivered to IT equipment. Daily water use follows directly:

100 MW × 24 h = 2,400,000 kWh of IT energy per day

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at 0.36 L/kWh  →    864,000 L/day  ≈  228,000 gal/day
at 0.48 L/kWh  →  1,152,000 L/day  ≈  304,000 gal/day
at 1.00 L/kWh  →  2,400,000 L/day  ≈  634,000 gal/day
```

Your cooling design sets your WUE, and your WUE sets your water number. Teams are expected to state the WUE they are designing to and show this calculation rather than quoting a headline figure.

ON COOLING SYSTEMS

Most large data centers have historically used evaporative cooling: water is pumped through the facility, absorbs heat, and evaporates. Closed-loop systems instead recirculate coolant, using little to no water for cooling but often more energy. Cooling has historically accounted for a substantial share of a data center's electricity use, with estimates running as high as 40 percent for high-density AI facilities. This water-versus-energy tradeoff is exactly the kind of multidisciplinary tension the four pillars are meant to surface, and teams in several categories will need to take a position on it.

There are two details to keep in mind. First, the direct water a facility draws is only part of the picture: In 2023, U.S. data centers consumed roughly 66 billion liters directly and nearly 800 billion liters indirectly through the electricity they purchased, a ratio of about twelve to one. The water question and the energy question are coupled in this way. Second, LBNL notes that some hyperscale facilities report site WUE figures well below the national average, in the range of 0.1 to 0.3 L/kWh, though the specifics of those systems are not known. Whether those figures generalize to a new facility, and what design choices they reflect, is a worthwhile detail for a team to investigate.

YOUR SOLUTION SHOULD DEFINE

- **Problem definition:** a clearly framed challenge within your chosen category and the given site context.
- **Proposed solution:** addressing all four pillars, with technical grounding and both environmental and logistical reasoning.
- **Operational context:** how the solution performs under real-world, continuous 24/7 operation.
- **Stakeholder map:** who is affected by or involved in the solution: utilities, communities, regulators, operators, policymakers.

07

What to Submit: The Written Report

The first round is judged on the written report alone. Make it self-contained and clear, as judges will not see a presentation at this stage.

FORMAT REQUIREMENTS

- **Length:** maximum 10 pages for the main report, including all images, diagrams, tables, and captions. Pages beyond the tenth will not be judged.
- **Not counted:** a cover or title page, reference list, and any appendices do not count toward the 10 pages.
- **Page setup:** 8.5 × 11 inch pages, margins of at least 1 inch on all sides, body text at 11 point or larger in a standard face such as Calibri, Arial, Times New Roman, or Garamond, single or 1.15 line spacing. Text inside figures and captions may be smaller but must be legible on screen at 100 percent.
- **Required diagram:** a clear visual system design must be embedded in the main report.
- **Stakeholder map:** must be embedded in the main report. Can be explained in text or accompanied by a diagram.
- **AI use statement:** required in every submission, included as an appendix. Name any generative AI tools your team used and describe what each was used for. If your team used no generative AI tools, state that.
- **File format:** a single PDF. Confirm the file uploads successfully before the deadline.
- **Entry fee:** $50 per team, paid through the submission form at the time you submit. The fee is per team, not per member, and is non-refundable.
- **Submission:** via JotForm. The form collects your project title, team roster, institution(s), chosen category, and faculty advisor (if any), and is where the entry fee is paid. Your entry is complete once both the report and the fee are received.

NOTE ON APPENDICES

Supporting calculations, derivations, data tables, and references may be included as appendices and do not count toward the 10-page limit. Appendices are not scored. Judges may consult them as supporting reference while evaluating the main report, but every claim your score depends on must be justified within the 10-page limit. Do not move core analysis into an appendix to avoid the page limit.

REPORT STRUCTURE

The following structure follows a flow from problem, to solution, to feasibility, to impact. Teams are not required to use these exact headings, but teams that follow this structure will naturally address every judging criterion.

1. **Executive Summary.** The problem and your solution in brief.
2. **Problem Definition.** The specific challenge within your chosen category and the New Albany context.

3. **Scientific Foundation (Pillar 1).** The underlying science governing the problem.
4. **Proposed Solution and Engineering (Pillar 2).** Your technical approach and system design, including the required diagram.
5. **Implementation, Supply Chain and Logistics (Pillar 3).** Feasibility, materials, sourcing, and operational needs under 24/7 operation.
6. **Environmental and Sustainability Analysis (Pillar 4).** Impacts, resource use, and long-term viability.
7. **Stakeholders and Tradeoffs.** Your stakeholder map and a candid look at technical, economic, environmental, and social tradeoffs.
8. **Cost and Feasibility Awareness.** A simple comparison, not detailed finance.
9. **References.** Sources cited in the report.
10. **Appendices.** Required: AI use statement. Optional: calculations, sourced assumptions, supporting data.

08 Rules of Participation

ORIGINAL WORK

Everything you submit must be your team's own work. Teams may build on their own prior work, including course projects, capstone work, and research conducted elsewhere, provided the earlier work is clearly identified and cited in the report. Work produced by anyone outside the team, including a faculty advisor, must be cited as such and cannot be presented as the team's own.

A faculty advisor may mentor, ask questions, point to resources, and give feedback on drafts. The analysis, design decisions, and writing belong to the students.

MISCONDUCT AND USE OF GENERATIVE AI

Scientific fraud and misconduct are not condoned at any level of research or competition. This includes plagiarism, forgery, use or presentation of other researchers' work as one's own, data fabrication, and inappropriate usage of generative artificial intelligence (GenAI). The submission should reflect independent design and research done by the students and presented in their own words with proper citation, particularly if artificial intelligence is used. The project must not include fraudulent data, plagiarism, or inappropriate use of GenAI in presenting work that is not their own. Examples of improper use of GenAI include but are not limited to authorship of a written report or research paper by GenAI, fabrication of data with the intention of giving a false impression, manipulating images (except when used to improve readability), concealing outliers, and changing, adding, or omitting data points. Any use of GenAI must be adequately explained and cited. Fraudulent submissions will be disqualified. The Ohio Academy of Science reserves the right to revoke recognition of a project subsequently found to have been fraudulent. Every submission must include an AI use statement as an appendix, whether or not generative AI was used. A submission without one is incomplete, and a statement that misrepresents the team's use of these tools is a misconduct violation under this section.

ATTENDANCE AND TRAVEL

- Finalist teams will present in person at the OAS Annual Meeting on October 23. Remote presentations are not accepted.
- The team entry fee includes complimentary Friday, October 23 registration to the Annual Meeting for every student member of a submitting team, whether or not the team advances to the final round. Saturday, October 24 attendance is not included and may be registered for separately at standard rates.
- Travel, lodging, and other expenses are the responsibility of the team or its institution. Teams entering from outside central Ohio should plan accordingly.

09 What the Judges Look For

Written reports are scored on ten criteria, each worth 1 to 5 points, for a maximum of 50. The full score card accompanies this packet. Each criterion is scored independently.

#	CRITERION	WHAT FULLY ADDRESSING IT LOOKS LIKE
1	**SCIENTIFIC FOUNDATION (PILLAR 1)**	Grounds the problem and solution in correct, relevant scientific principles.
2	**APPLIED SCIENCE & ENGINEERING (PILLAR 2)**	Translates those principles into a sound technical solution and a coherent system design.
3	**SUPPLY CHAIN & LOGISTICS (PILLAR 3)**	Addresses implementation feasibility: materials, infrastructure, sourcing, timelines, and operational needs.
4	**ENVIRONMENTAL & SUSTAINABILITY ANALYSIS (PILLAR 4)**	Evaluates ecological impact, resource use, emissions, community effects, and long-term viability.
5	**PROBLEM DEFINITION & FRAMING**	Problem is clearly identified and framed within the chosen category and the site context.
6	**AWARENESS OF TRADEOFFS**	Demonstrates awareness of key tradeoffs across technical, economic, environmental, and social dimensions.
7	**VISUAL SYSTEM DESIGN**	Includes a clear, required diagram that communicates the system design effectively.
8	**STAKEHOLDER IDENTIFICATION**	Identifies the relevant stakeholders and clearly explains their roles.
9	**TECHNICAL SUPPORT & EVIDENCE**	Provides basic calculations, sourced assumptions, or modeling to support the proposed solution.

#	CRITERION	WHAT FULLY ADDRESSING IT LOOKS LIKE
10	**SOLUTION FEASIBILITY & REAL-WORLD VIABILITY**	Accounts for continuous 24/7 operation and basic cost and feasibility realities; the solution is plausible in practice.

JUDGING

- **Round 1, written:** all submissions are scored on the ten criteria above by OAS judges. A cutoff score is applied once scoring is complete, and the small subset above the cutoff is re-examined by comparison against each other to select three finalists.
- **Round 2, presentation:** the three finalists present live at the Annual Meeting before invited judges and the Meeting audience. Finalist solutions are compared and voted on by invited judges. Presentation format and instructions are sent to finalists with the October 2 announcement.

BY THE END OF THE CHALLENGE, PARTICIPANTS WILL BE ABLE TO

- identify and frame a specific challenge facing data center operations in Ohio.
- articulate the scientific and engineering principles underlying their solution.
- describe the supply chain, logistical, and economic factors relevant to real-world implementation.
- evaluate the environmental and sustainability impacts of their approach.
- identify stakeholders involved in or affected by the solution and explain their roles.
- support their work with diagrams, basic calculations, assumptions, and sourced references.
- identify potential implementation partners relevant to their category, including utilities, regulators, technology providers, and community organizations.

10

Recognition and Prizes

All three finalist teams win a cash prize, present at the OAS Annual Meeting on October 23, and are invited to publish their solution in *The Ohio Journal of Science*. Prize amounts are awarded per team and will be split evenly then distributed to team members directly.

FIRST PRIZE	SECOND PRIZE	THIRD PRIZE
$1,000	$500	$500
Invited to publish in *The Ohio Journal of Science*	Invited to publish in *The Ohio Journal of Science*	Invited to publish in *The Ohio Journal of Science*

11 Questions

Questions about the challenge, eligibility, or submission can be directed to the Ohio Academy of Science at info@ohiosci.org.

Full challenge details are posted at ohiosci.org/design-challenge, and submissions are made at form.jotform.com/OhioScience/AMDesignChallenge.

Learn more about the Annual Meeting at ohiosci.org.

12 References

Baseline parameters in Section 6 are drawn from the following public sources. Where a value is a design choice or a simple derivation, that is noted. News articles are entry points; the underlying primary documents, principally the LBNL report and the PUCO docket, are the citable sources and are linked directly.

[1] **Facility type.** LBNL 2024 report, Section 4, "Data Center Classifications," Table 4.1, p. 36. Lawrence Berkeley National Laboratory classifies data centers by ownership and business model rather than by size. Large-scale colocation facilities are built by major colocation companies providing wholesale and retail leasing; hyperscale facilities are built by companies deploying internet services and platforms at massive scale. AI-accelerated servers are allocated evenly between these two categories in LBNL's model, so both are representative for a facility of this scale. Full LBNL PDF

[2] **Critical IT load, 100 MW.** A planning value set so the facility falls clearly under AEP Ohio's Schedule DCT. The tariff qualifies on metered demand at a single location, not on critical IT load, so the governing figure is the total facility draw above, roughly 130 to 140 MW, well above the 25 MW threshold. See also ref. 7. PUCO Case No. 24-508-EL-ATA. AEP Ohio Schedule DCT page · PUCO Opinion and Order

[3] **Total power draw and PUE.** Derived as IT load × PUE. A PUE of 1.3 to 1.4 is a planning assumption consistent with national benchmarks in: Shehabi, A., et al., 2024 United States Data Center Energy Usage Report, Lawrence Berkeley National Laboratory, LBNL-2001637, December 2024. DOI 10.71468/P1WC7Q. Full LBNL PDF

[4] **Site WUE and derived water use.** LBNL 2024 report, which reports a U.S. average site WUE of 0.36 L/kWh through 2023, projects 0.45 to 0.48 L/kWh by 2028, and gives a range across cooling architectures from near zero for air-cooled systems to above 1.0 L/kWh for water-cooled chillers without economizers. The gal/day figures in Section 6 are derived from those values at a 100 MW IT load; the arithmetic is shown in full so teams can reproduce and vary it. Full LBNL PDF

[5] **Closed-loop cooling.** Vantage Data Centers OH1, New Albany, Ohio. The operator states that the campus uses a closed-loop chilled water system with air-cooled chillers and air-side economizers, giving a water usage effectiveness near zero. A working example of the low-water case inside the challenge site itself. vantage-dc.com

[6] **Land footprint.** Derived from two New Albany International Business Park developments that publish both acreage and critical load. Vantage Data Centers OH1: 70 acres, three two-story buildings, 192 MW critical IT load, 1.5 million sq ft, about 2.7 MW per acre. Silicon Heartland Innovation Park (Lincoln Property Company and Harrison Street): a 190-acre site whose data center campus can accommodate up to 1.2 million sq ft and 144 MW of critical load, about 0.76 MW per acre. At a 100 MW critical IT load those densities imply roughly 36 and 132 acres respectively. The Silicon Heartland acreage covers the full mixed-use park, so its density is a conservative lower bound. Teams should state the density assumption behind their own figure. Vantage OH1 · LPC and Harrison Street announcement

[7] **Grid status, AEP Ohio Schedule DCT.** PUCO Case No. 24-508-EL-ATA. The Commission adopted the settlement on July 9, 2025; AEP Ohio filed its compliance tariff on July 11 and the tariff took effect July 23, 2025. Schedule DCT applies to data centers with a monthly maximum demand greater than 25,000 kW at a single location. The initial contract term equals the load ramp period, capped at four years, plus eight years. Minimum billing demand is capped at 85% of contract capacity and is owed regardless of actual use. Collateral, exit-fee, and load-study-fee provisions also apply. AEP Ohio Schedule DCT page · PUCO Opinion and Order

[8] **Staffing.** Bracketed by two New Albany facilities of known scale. Microsoft's Beech Road data center: 30 full-time employees to operate a single 245,000 sq ft building, per New Albany City Council proceedings, October 2024. Meta's New Albany campus: 300+ operational jobs supported once completed, across a multi-building, $1.5 billion campus, per Meta's own site fact sheet. A single facility at the 100 MW scale used here falls between those points. Note that these figures are not measured the same way. Microsoft's is staff required to operate, Meta's counts jobs "supported," which is broader. Teams citing employment figures should state which definition their source uses. nbc4i.com · Meta's New Albany Data Center

[9] **Operating profile, 24/7/365.** General industry characteristic of data center operation; no single source.

ADDITIONAL CONTEXT FOR STUDENTS

U.S. Department of Energy summary of the LBNL report: energy.gov · The Green Grid's WUE metric: thegreengrid.org