Global Immersion Cooling Association

WELCOME TO OUR GICA ANNUAL CONFERENCE 2026

FOLLOW US

Follow GICA on LinkedIn

Industry updates, webinars, events and GICA initiatives.

BECOME A MEMBER

Connect. Collaborate. Contribute.

Learn more about GICA membership

www.gi-ca.org

WHO WE ARE

WE ARE GICA

The Global Immersion Cooling Association (GICA) is an international organization dedicated to **advancing immersion cooling technology.**

Founded in 2025 by industry innovators across automotive, cooling and renewable energy, GICA brings together:

OEMs · Technology Providers · Research Institutes · Suppliers · Policymakers

OUR GOAL

Accelerate the global adoption of immersion cooling to enhance energy efficiency, reliability and environmental sustainability.

PUBLIC

WHY GICA EXISTS

IMMERSION COOLING IS BIGGER THAN ONE INDUSTRY

The challenges are connected.
The solutions should be too.



Data Centers

High-density computing & AI infrastructure



Automotive

E-mobility & advanced thermal management



Energy

Efficiency, sustainability & infrastructure



Advanced Engineering

New applications and thermal challenges

PUBLIC

WHAT WE DO

TURNING INDUSTRY KNOWLEDGE INTO COLLABORATION

01

RESEARCH & STANDARDS

Collaborating on standards and technical development to support safe, interoperable solutions.

02

EDUCATION & ADVOCACY

Webinars, whitepapers, industry insights and knowledge sharing.

03

NETWORKING & COLLABORATION

Connecting OEMs, suppliers, researchers, technology providers and regulatory stakeholders.

PUBLIC

WHAT GICA HAS BEEN DOING

FROM CONVERSATION TO COMMUNITY

Over the past year, GICA has been building a growing platform for:

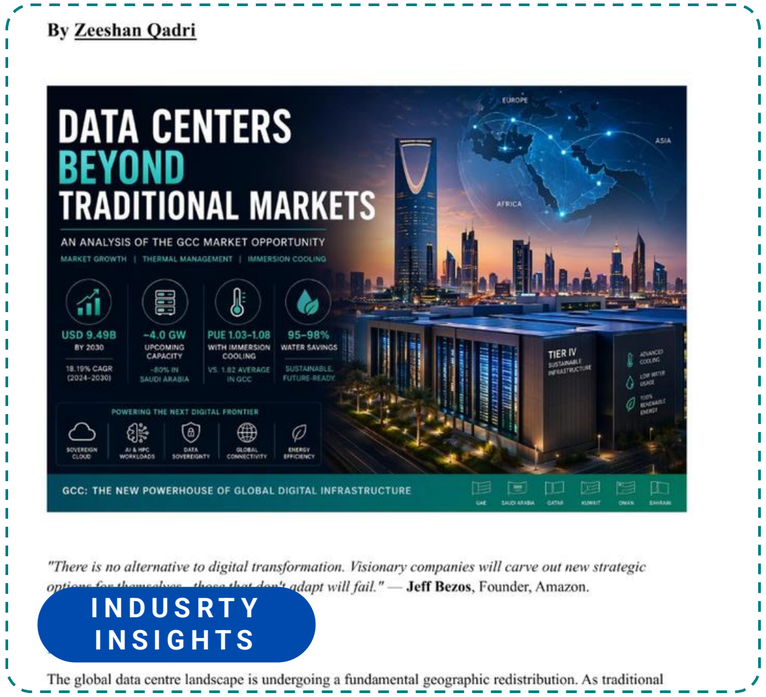
Knowledge sharing · Industry dialogue · Collaboration · Community



CONFERENCE



WEBINARS


By Zeeshan Qadri

DATA CENTERS BEYOND TRADITIONAL MARKETS

AN ANALYSIS OF THE GCC MARKET OPPORTUNITY

MARKET GROWTH | THERMAL MANAGEMENT | IMMERSION COOLING

USD 9.49B BY 2030 — 18.19% CAGR (2024-2030)

~4.0 GW UPCOMING CAPACITY — ~80% IN SAUDI ARABIA

PUE 1.03–1.08 WITH IMMERSION COOLING — VS. 1.82 AVERAGE IN GCC

95–98% WATER SAVINGS — SUSTAINABLE, FUTURE-READY

POWERING THE NEXT DIGITAL FRONTIER

SOVEREIGN CLOUD | AI & HPC WORKLOADS | DATA SOVEREIGNTY | GLOBAL CONNECTIVITY | ENERGY EFFICIENCY

GCC: THE NEW POWERHOUSE OF GLOBAL DIGITAL INFRASTRUCTURE

"There is no alternative to digital transformation. Visionary companies will carve out new strategic options for themselves, those that don't adapt will fail." — **Jeff Bezos**, Founder, Amazon.

The global data centre landscape is undergoing a fundamental geographic redistribution. As traditional

INDUSRTY INSIGHTS

GICA MEMBERS

A COMMUNITY BUILT ACROSS INDUSTRIES

Different industries. Different expertise.One shared opportunity.

EXOES

Litens

Castrol

INVENTEC PERFORMANCE CHEMICALS

NGen
Next Generation Manufacturing Canada

PHILLIPS 66

APL

mema.
The Vehicle Suppliers Association

Shell

OCP BRONZE™ Member

Alcatex, Inc.

CARRAR

GAMMA TECHNOLOGIES

AUVSI™

Global Immersion Cooling Association

GICA ANNUAL CONFERENCE 2026

Cross-Industry Experience in Immersion Cooling



WHAT WE WANT TO EXPLORE TODAY

TODAY IS ABOUT THE EXPERIENCE

NOT JUST:

“What is immersion cooling?”

BUT:

“What have different industries learned from it?”

APPLICATION | CHALLENGES | LESSONS | OPPORTUNITIES | ADOPTION

Real-world experience. Different perspectives. One conversation.

PUBLIC

TODAY'S VOICES

INDUSTRY LEADERS.
REAL-WORLD PERSPECTIVES.

Across data centers, engineering, semiconductors, energy and advanced thermal management.



Allison Boen

AlcateX, Inc.



Arnaud Desrentes

EXOES



Dr. Dereje Agonafer

UTA THE UNIVERSITY OF TEXAS AT ARLINGTON



Jean-Jacques Chanut

2crsi



John Bean

GRC



Samantha Yates

intel



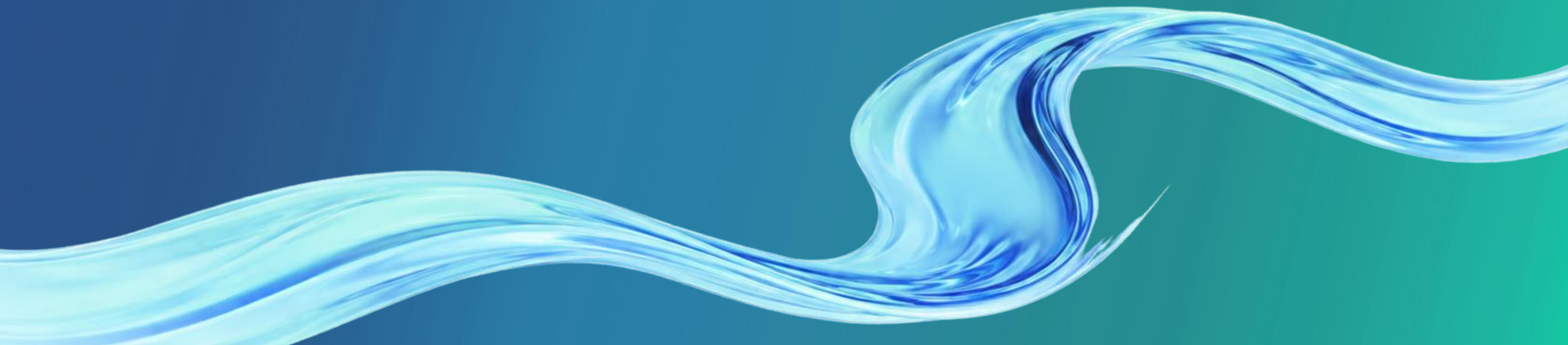
Jen Reilly

Shell

Global Immersion Cooling Association

LET’S START THE CONVERSATION.

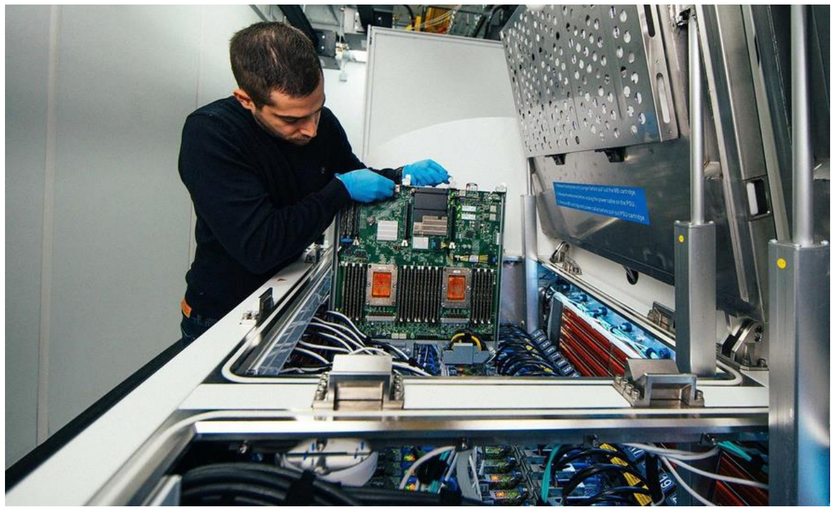
Cross-Industry Experience in Immersion Cooling



Immersion Cooling

from EV batteries to AI data centers

EXOES



PUBLIC

ABOUT THE

Speaker



Arnaud Desrentes
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President of GICA

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BIO

18 years as EXOES CEO & founder

Former engineer in thermal management at Stellantis

50+m$ raised

Financial Times top 1,000 European fastest growing company 2023

Liquid cooling is growing everywhere

1 · WHY NOW

CARS

>67%

liquid share of EV thermal systems (2025)

TRUCKS & BUSES

26%

of the 3.7 B$ battery thermal market, +12.6%/yr

ENERGY STORAGE

24.5 B$

liquid cooling for stationary BESS by 2033

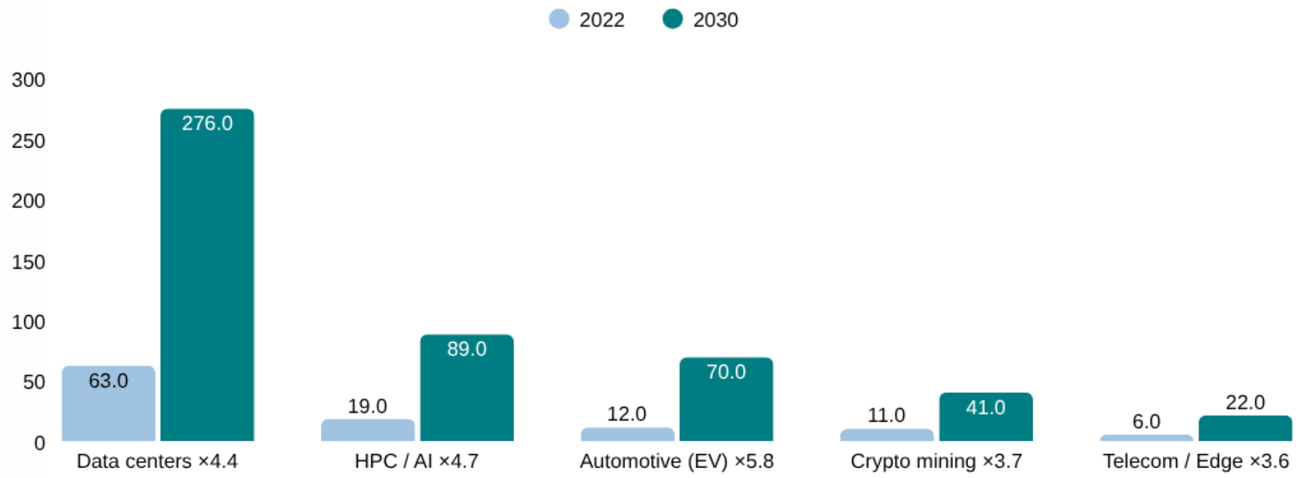
DATA CENTERS

8 → 33%

liquid share of DC cooling, 2021 → 2028

×4.5 immersion cooling revenue, 2022 → 2030

China + North America + Europe, M$ — growth multiple under each sector



Liquid cooling is becoming the default for high-power batteries and AI racks — **immersion is the next step wherever it brings value**

Sources: Grand View Research, R&M, Mordor Intelligence (immersion, read from GICA charts) · Persistence MR 2025 · GMI 2025 · ResearchAndMarkets 2025 · Omdia

One physics problem, many industries

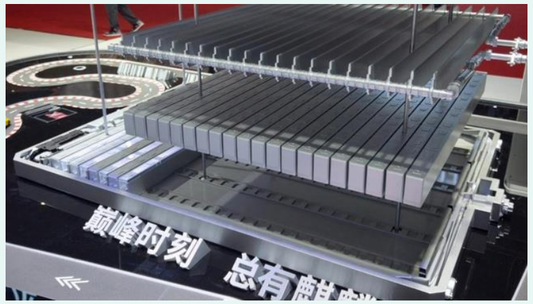
1 · WHY NOW



1 WHY NOW

Heat density is exploding — in packs and in racks

Market outlook



2 BATTERIES

Ultra-fast charging & GB 38031: can cold plates keep up?

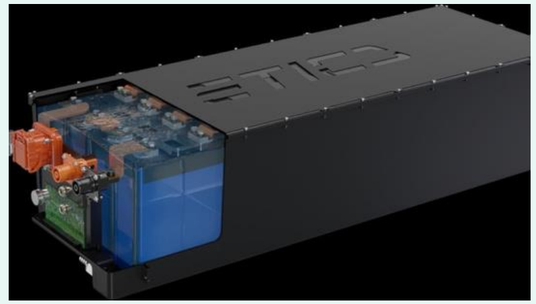
Charging · safety · cold plates · immersion · proof



3 DATA CENTERS

AI racks above 120 kW: efficiency, water, heat reuse

PUE · water · EU regulation



4 CONVERGENCE

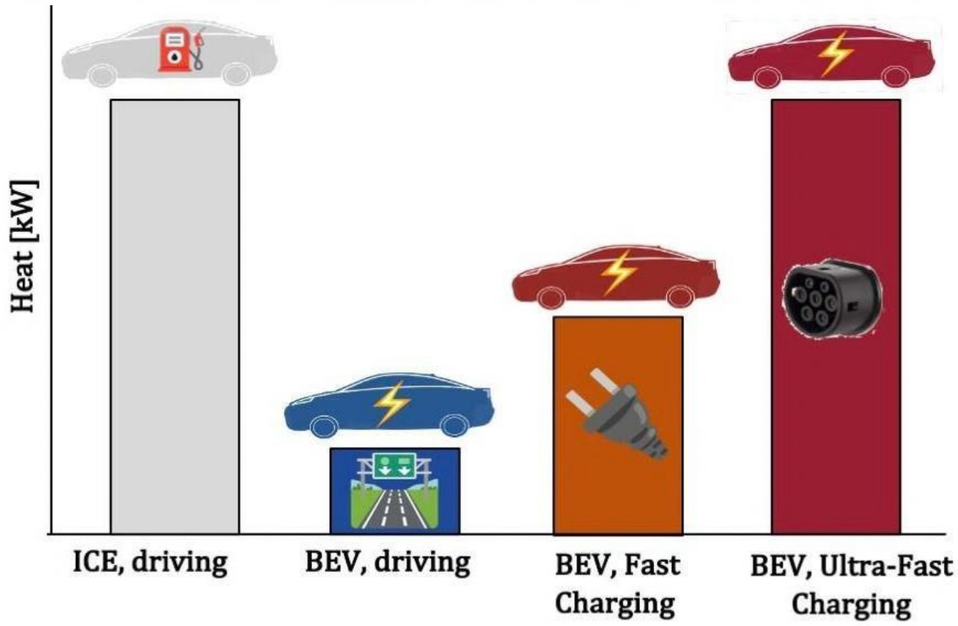
Field-proven in both worlds, one set of standards

Deployments · standards · testing

Common thread: when heat density outgrows cold plates, immersion becomes the safety and efficiency enabler — in cars and in racks

Ultra-fast charging is a heat problem

2 · BATTERIES



Ultra-fast charging dissipates as much heat as an ICE at full load — with a far smaller temperature margin to reject it





MEGAWATT CHARGING IS HERE

1–1.5 MW

chargers for passenger cars already shown by Huawei (2,400 A), Zeekr and BYD

BYD SUPER E-PLATFORM · the new benchmark

1,000 V	1,000 A	10C	5 min
max voltage	max current	peak C-rate	for +400 km

Sources: GICA webinar Sep 2025 (heat comparison, Shanghai/Beijing show photos); BYD Super e-Platform launch (2025): 1 MW, 2 km of range per second

GB 38031-2025: the new safety bar



Mandatory in China from **July 2026** — thermal runaway must no longer propagate

2 h

no fire, no explosion
after a cell thermal runaway

5 min

warning before any hazard
smoke kept out of the cabin

300

fast charges, then
mandatory short-circuit test

1 MW

chargers for passenger cars
BYD · Huawei · Zeekr — 2 km/s

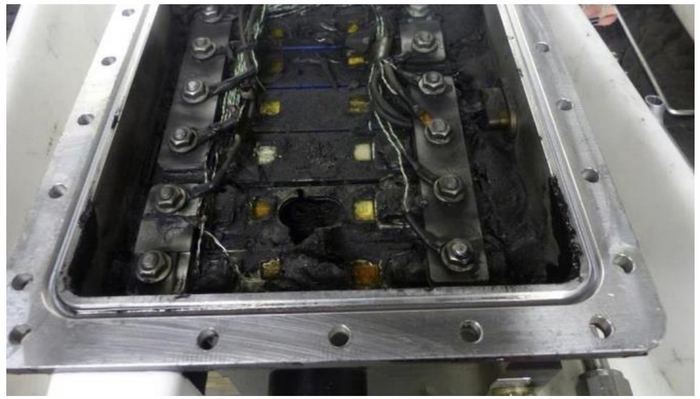
Sources: GB 38031-2025 overview (GICA webinar, Sep 2025); BYD Super e-Platform (1000 V · 1000 A · 10C); CATL Qilin pack — first to pass, using aerogels + inter-cell cold plates

Proof: no thermal propagation

2 · BATTERIES



COLD PLATE — FAILED



IMMERSION — CONTAINED

Same large NMC module, same abuse test: A-B comparison after thermal runaway (Shell & Exoes).
Also confirmed: nail penetration on 12 NMC prismatic cells without active cooling (BP & Exoes) and overvoltage trigger in a 2-phase truck module (Carrar) — neighbors stay near ambient.

100+
abuse tests in full immersion
zero thermal runaway propagation

12 large cells
NMC module, nail penetration
no active cooling · Exoes & partners

~24 °C
neighbor cells, 2-phase
overvoltage trigger · Carrar

Courtesy of Shell, BP, Exoes and Carrar (GICA webinars Sep 2025 & May 2026, Battery Show Detroit Oct 2025)

EXOES

Data centers: same heat, new stakes

3 · DATA CENTERS

1.02–1.05

annual PUEs
Denvr dataworks

> 6 yrs

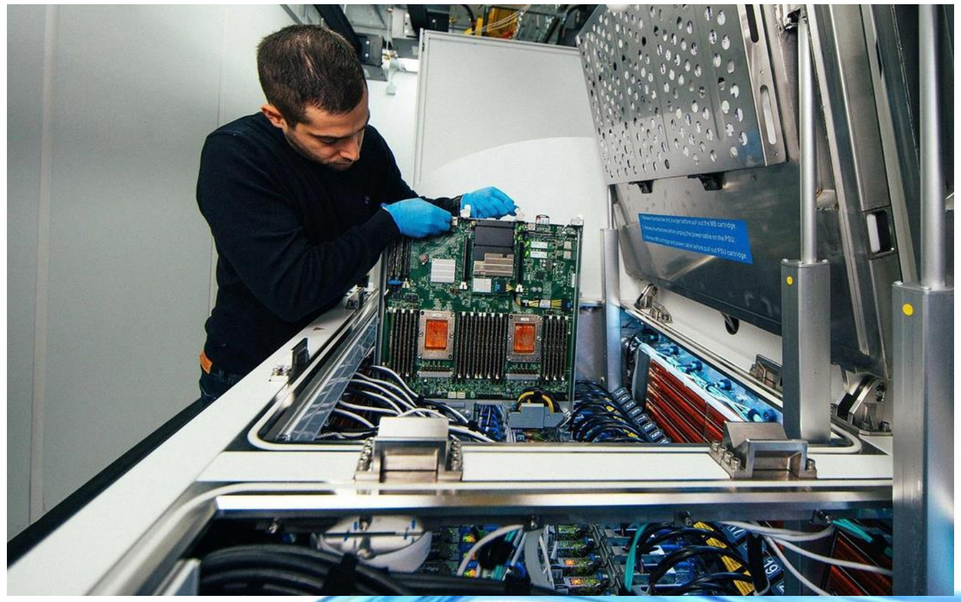
continuous operation
Alibaba Cloud, Zhangbei

0 L

water evaporated
water-free IT cooling · Digital Realty + Submer

10 → 20%

EU waste-heat reuse
Favorable for temperatures > 50°C

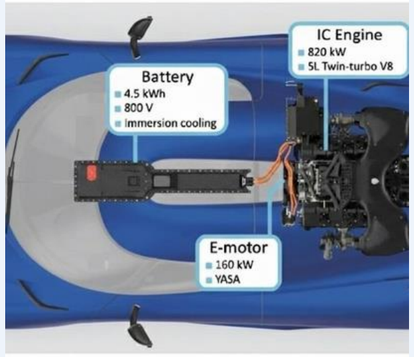


Rack power already **120–140 kW** (NVIDIA GB200 NVL72) — air limit ≈ 40 kW

Sources: NVIDIA (2025); Alibaba Cloud / DCD; Microsoft Azure two-phase pilot 2022–23 (photo); Digital Realty + Submer, Barcelona; EU Energy Efficiency Directive (GICA May 2026)

Field-proven in many industries

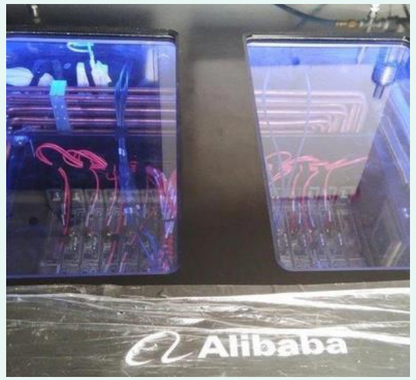
4 · CONVERGENCE



2017 KOENIGSEGG

800 V

Immersion-cooled battery for extreme power in a compact pack



2019 ALIBABA CLOUD

> 6 yrs

Single-phase server immersion in industrial operation



2021 MERCEDES-AMG

150 kW

Peak from a 6.1 kWh pack (25C) · ~20k cars on the road



2021 JOHN DEERE

< 1 °C

Cell temperature spread on tractors & excavators



2024 ETICA AG · BESS

No Fire

Designed to mitigate fire risk

Also deployed: McLaren Speedtail, Renault Mégane & Volvo XC90 demonstrators (TotalEnergies), Microsoft Azure 2-phase, Digital Realty + Submer. Sources: Orovel, Mercedes-Benz, Kreisel, Etica AG, DCD

Next: accelerate the standards

4 · CONVERGENCE

DATA CENTERS

Mature

OCP immersion requirements (since 2020) · ASHRAE TC 9.9 guidance (since 2018)

AUTOMOTIVE & BESS

Immersion-agnostic

No test for fluid circulation, leakage, or fluid escaping the pack

1 **Material compatibility**
protocols from OCP practice

2 **Fluid qualification**
minimum spec: dielectric, aging, PFAS-free

3 **Operations & service**
handling, leaks, recovery, recycling

→ Immersion-specific annexes to
ISO 6469 · SAE J2929 · UL 2580 · UL 9540A

MEMBER SPOTLIGHT

EXOES

- **Engineering**
- **Prototyping**
- **Testing**
- **Test benches**

Advanced Liquid Cooling Technologies
Turnkey solutions
From battery cells to MW-scale data centers
From liquid only to complete critical systems

EXOES: Batteries and Heat pumps

ON PURPOSE THERMAL TEST SOLUTIONS · engineering, design & turnkey delivery



Turnkey containerized products



Climatic chamber test equipment



Tailor-made thermal test benches

20
years of expertise

100+
major industrial customers

100%
on-time delivery

100%
FAT first-pass success

EXOES: Chips cooling and CDUs

DATA CENTER COOLING TEST SOLUTIONS · from cold plate R&D to MW-scale CDU qualification



01 LAB Cold plate test bench

30 kW

3 TTV positions × 10 kW · cold plate & TIM development



02 RACK ExoRack™ RE-Series

22–400 kW

22 kW blade to full OCP ORV3 rack · 108 TTV, silicon-free



03 TEST CENTER Containerised test center

5–10 MW

MW-scale CDU testing · outdoor, scalable by module

Key takeaways

- Immersion cooling proved in **many industries**: on-road, off road, data centers, energy, marine, defense, etc.
- **Physics never lies:** immersion cooling provides undoubtable advantages over other technologies
- Still a **niche market** -> we need to continue to push and work together!

PUBLIC

ABOUT THE

Speaker



Arnaud Desrentes
CEO of EXOES
President of GICA

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Q&A

Single Phase Immersion Cooling (SPIC): Opportunities, Challenges and Path Forward

Bridging innovation, challenges and industry adoption

Dereje Agonafer, Presidential Distinguished Professor
National Academy of Engineering Member
University of Texas at Arlington

PUBLIC

ABOUT THE

Speaker



Prof. Dereje Agonafer

Presidential Distinguished Professor
University of Texas at Arlington

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BIO

Presidential Distinguished Professor of Mechanical and Aerospace Engineering
at UTA and member of the National Academy of Engineering (NAE). An electronics thermal-management authority focused on cooling powerful computing systems, he joined UTA in 1999 after 15 years at IBM.
As early as 2013, his group immersed high-powered servers in dielectric mineral oil, using third-generation Open Compute servers to study immersion
cooling, server form factor, heat-sink optimization and dielectric-fluid performance. This reliability research was later cited in OCP's Immersion Requirements.
Today, an OCP academia-industry collaboration with Intel, Shell, ExxonMobil, Valvoline Global Operations, Magnalytix, Submer and Supermicro addresses contamination, corrosion, materials compatibility, fluid chemistry and hardware
reliability, guided by a "chip-to-chiller" perspective.
He has advised 275 graduate including 46 doctoral students. Honors include election to the NAE (2019) and ASME Honorary Membership (2023).

Outline

Seven parts, from why SPIC matters now to where the industry is heading.

01 Context and fundamentals
Why now, PUE and how SPIC works
Slides 4–5

02 Key advantages and opportunities
Energy and thermal performance; market growth and target segments
Slides 6–7

03 Extendibility
Power per chip and heat flux at the die, by company
Slide 8

04 Challenges and lessons learned
Barriers, lessons and conclusions
Slides 9–10

05 Prof. Agonafer's work with immersion cooling (2013 —)
Timeline, thermal and reliability findings, OCP corrosion and signal-reliability work
Slides 11–15

06 Path to the mass market
Four steps to the mass market
Slide 16

07 Where the industry is heading
3D ICs, TIMs and targeted cooling, perspective, takeaways
Slides 17–20

THE CONTEXT

Why now?

AI accelerators have outgrown air cooling. Nvidia GB200 NVL72 racks draw 120–132 kW [1], while air cooling serves only about 20–30 kW per rack [2].

Single-phase immersion cooling (SPIC) is one of the liquid options now competing for these loads.

AT A GLANCE

RACK POWER

120–132 kW per GB200 NVL72 rack [1]

KEY CHALLENGE

Industry-average PUE stuck at ~1.54–1.59 since 2020 [3], [4]

OPPORTUNITY

SPIC PUE 1.03–1.08 [5]

How single-phase immersion cooling (SPIC) works

Servers sit in a dielectric liquid that stays liquid; a pump carries the heat to a heat exchanger.

1. **Immerse:** Servers sit in a tank of dielectric liquid, typically a synthetic hydrocarbon such as PAO (820–840 kg/m³) [6].
2. **Absorb:** Heat passes into the liquid by convection; warm liquid rises. Server fans are removed.
3. **Circulate:** Warm liquid leaves the tank and is pumped through the coolant distribution unit (CDU).
4. **Exchange:** A plate heat exchanger moves the heat into the facility water loop.
5. **Reject: Warm facility water lets an evaporative or dry cooler release heat to outdoor air instead of a chiller.**

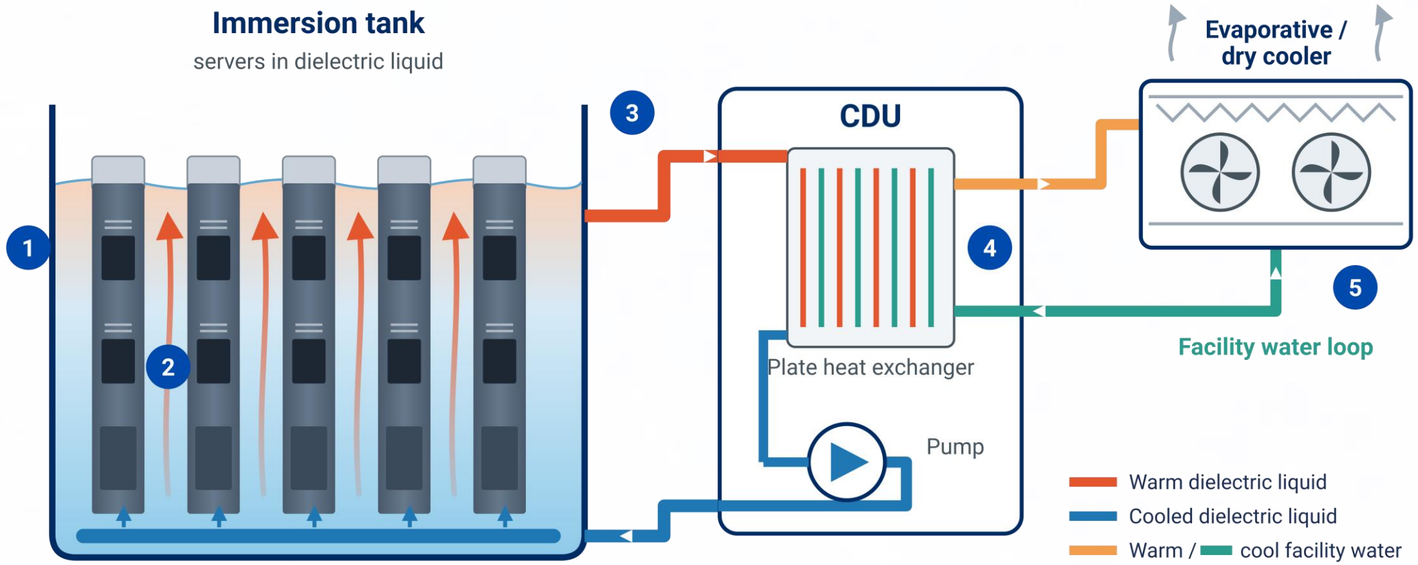
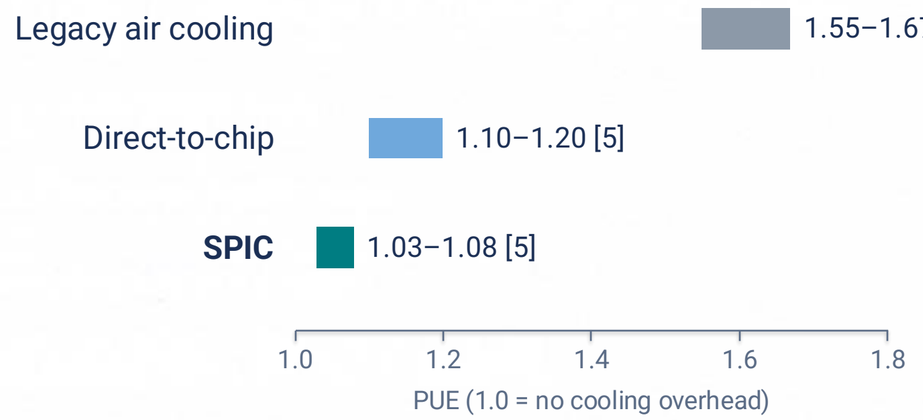


Fig. 1. SPIC loop (schematic, not to scale). Numbers match the steps on the left.

Key advantages: energy and thermal performance

Removing fans and air handling cuts cooling overhead to a few percent of IT load.

Fig. 2. Reported PUE ranges by cooling method



≥ 20%

lower server energy than air cooling [7]

10–20%

lower server power consumption [8]

34.4%

lower thermal resistance than air (mineral oil) [7]

< 1.08

facility PUE, supercomputer case study [8]

Opportunities

A fast-growing market with clear target segments for single-phase systems.

Fig. 3. Forecast market growth, CAGR (%)



Single-phase held ≈62% of the immersion market in 2025 [9]; a supercomputer case reported 1–3 year payback [8].

New high-density AI/HPC builds

Above ~100 kW per rack, single-phase offers the highest density ceiling with the most mature fluid supply [1].

Hot, water-scarce regions

Middle East ≈6% of world capacity; a 150 MW Abu Dhabi project is due in late 2026 [9].

Small and edge sites

Sites below 1 MW forecast to grow 19.4% per year, 2026–2031 [9].

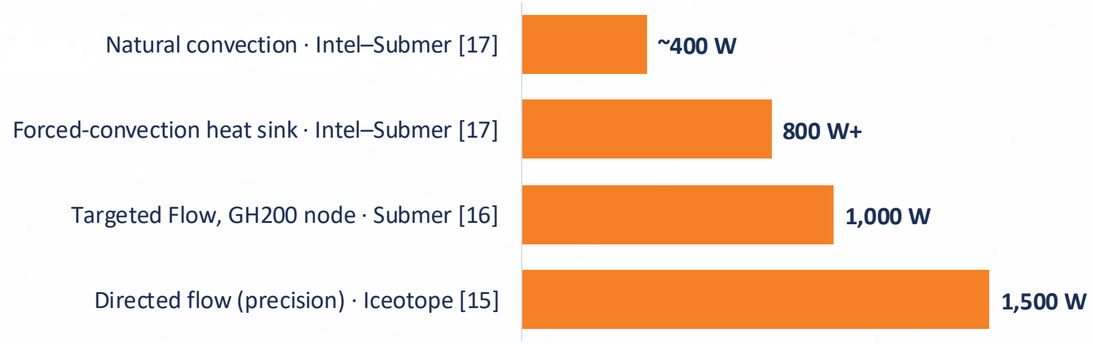
Maturing supply chain

Intel-certified system with Shell, Supermicro and Submer [13]; Trane acquired LiquidStack in 2026 [14].

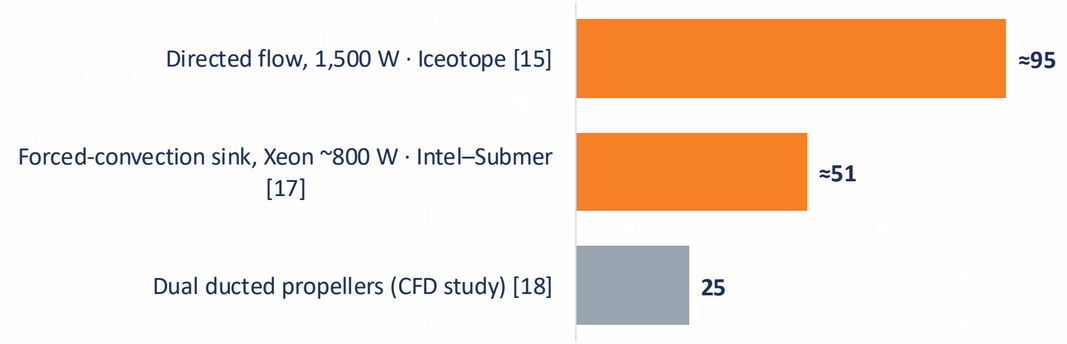
SPIC records

Local flow, not the tank, sets the ceiling: ~400 W passively, 800 W+ forced, 1–1.5 kW with targeted or directed flow.

Power per chip (W)



Heat flux at the die (W/cm²)



At system level: rack-, tank- and server-scale SPIC deployments from other vendors

GRC	LiquidStack	Submer	Firmus / SMC
70 kW per rack, pPUE 1.02 at TACC [19]	110 kW per tank (rated) [20]	SmartPodXL+, 100 kW per tank (rated) [21]	512 H100s, 6.58 kW per server, PUE 1.10 [22]

⚠ Chip-level values vendor-measured on CPUs, Intel test chips and a GH200 node (no temperatures published for GH200); no published GPU W/cm² yet. W/cm² uses an estimated 15.8 cm² die area [23].

[15] Iceotope, 1500 W blog, 2024. [16] Submer, Targeted Flow, 2024. [17] Intel–Submer FCHS case study, 2023. [18] Jin et al., Appl. Therm. Eng., 2025. [19] GRC TACC release (vendor). [20] DCD, LiquidStack, 2023. [21] Gigabyte–Submer (vendor). [22] Firmus/SMC, MLPerf, 2024 (vendor). [23] SemiAnalysis, Sapphire Rapids die analysis (analyst). [24] Iceotope white paper, 2024.

Challenges and limitations

The barriers are mostly ecosystem, warranty and fluid-specific design, not physics.

GPU ecosystem

Nvidia recommends direct-to-chip cold plates for Blackwell; immersion needs extra qualification [1].

Warranty

Intel's rider covers only 4th/5th Gen Xeon with a qualified Shell fluid [13].

Fluid selection

Across 15 liquids, junction-to-coolant resistance ranged 4.9–7.8 K/W; viscosity limits performance [25].

Fluid volume and service

Hundreds to thousands of liters per rack equivalent; servers lifted out with hoists [26].

Optics and materials

Fluid at optical interfaces degrades links; material compatibility must be tested [27].

Cost and standards

≈2× air-cooling capex [28]; fluid chemistry not standardized, often single-vendor [29].

Lessons learned

1. **Fluid choice is a design variable**
   Conductivity and density improve cooling; viscosity limits it [25].

2. **Redesign heat sinks and tank flow**
   Optimal fin pitch depends on the fluid (PAO-6: 2.2 mm beat 1.2 mm); T-type inlet/outlet beat Z-type [30].

3. **Benchmark against cold plates**
   Gain over best-practice air is under 10% [31]; cold plates matched immersion in a life-cycle study [32].

4. **Secure warranty before purchase**
   Coverage is tied to processor generation and fluid [13].

5. **Plan mixed halls**
   Air, cold plates and immersion already operate in one facility [33].

Immersion research milestones at UTA since 2013

12+ years of research in immersion cooling, thermal design and materials reliability.

2013

Full-server immersion

High-powered servers immersed in dielectric mineral oil [34]

2016

IT reliability in oil

Mineral oil immersion and IT reliability study

2019

Data-center reliability

Reliability considerations for oil immersion-cooled data centers

2020

Extreme temperatures

Immersed server operated at extreme temperatures

2022

Component aging

Capacitance change stays within allowable range after aging in fluid

2023

High-power servers

Forced vs natural convection on a 3.76 kW server; heat-sink optimization

2025 —

OCP collaboration

Copper corrosion study with industry partners, presented at the 2025 OCP Global Summit

[34] H. Patel, UTA MS thesis (advisor D. Agonafer), 2013.

UTA thermal management research

UTA's thermal studies run from fluid and heat sink to full servers, hybrids and flow inside a live server.

Mineral-oil server

Oil thermal resistance 0.128–0.175 °C/W [35]

Mixed convection

EC-100 fluid at 115–200 W [36]

Forced vs natural

Forced flow keeps components "much lower" than natural convection at 3.76 kW [37]

Heat-sink optimization

Fin thickness matters more than fin count [38]

Hybrid cold plate

Cold-plate compact model in immersion [39]

Flow and extremes

PIV in an immersed M50CYP server [40]; immersed server at extreme temperatures [41]

[35] Eiland et al., ASME JEP, 2017. [36] Saini et al., InterPACK, 2023. [37] Gupta et al., InterPACK, 2023. [38] UTA heat-sink optimization, 2023. [39] UTA hybrid model. [40] UTA MS thesis (PIV), 2024. [41] Bansode et al., ASME JEP, 2020.

Reliability findings from the Agonafer group (UTA)

The group covers six of the eight reliability areas mapped across the field; GPUs and field data remain open.

Passives and board

Capacitance change within allowable range after aging [42]; board materials and passives show small changes [42], [43]

Substrates and PCBs

Substrate mass loss <0.2% (80 °C, 336 h) [44]; halogen-free substrate core [43]; PCB thermomechanical properties [45]

Power modules

−8–12% output after 1,000 h HTOL at 85 °C [44]

Thermal interface materials

TIM resistance decreases over 1,500 cycles at 400 W [44]

Polymers and cables

Polymers are the weak link: PVC properties change [46]

Test methods

JEDEC air-cooling cycling tests do not transfer directly [42]; immersion HTOL and power cycling build on UTA methods [42], [44]

[42] Shah et al., ASME JEP, 2022. [43] Bansode et al., ASME JEP, 2024. [44] Suthar, UTA PhD, 2025. [45] Ramdas et al., UTA, 2019. [46] Shah et al., ASME JEP, 2019.

UTA–OCP collaboration on copper corrosion

Assessing the impact of various system-level contaminants on copper corrosion in immersion cooling systems.

- Joint initiative between UTA and leading industry partners
- Fundamental reliability study addressing material, electrical, signal and thermal degradation in immersion systems
- Findings will be presented and published with the OCP community to guide next-generation immersion standards



OCP–Academia Industry Collaboration team at the 2025 OCP Global Summit, featuring Dr. Samantha Yates (Intel Principal Reliability Engineer), UTA researchers and industry partners highlighting the joint effort on fundamental immersion reliability studies.

Research roadmap

1. Establish contaminant levels for copper corrosion
2. System-level performance evaluation
3. Signal integrity and SIR (Surface Insulation Resistance) degradation
4. Acceleration models for induced copper corrosion

Collaborators

University of Texas Arlington · OPEN Compute Project · intel · ExxonMobil · Shell · Valvoline · MAGNALYTIX · SUPERMICRO · Submer

Contaminant concentration thresholds for copper corrosion — establishing quantitative limits (e.g., sulfur, chloride, bromide, and TAN levels) beyond which immersion fluids induce measurable copper corrosion, giving the industry actionable fluid-cleanliness specifications rather than qualitative guidance.

System-level thermal performance under corrosion-induced degradation — assessing how corrosion products and fluid degradation affect heat transfer at the board and component level, since contamination that alters copper surfaces can simultaneously compromise thermal performance and reliability.

Surface insulation resistance (SIR) evaluation — Building on the contaminant threshold findings from Objective 1, this objective aims to evaluate how these contaminants and corrosion by-products in immersion - cooled environments impact the electrical insulation reliability of PCB surfaces. Using standardized SIR test coupons, controlled exposure tests will be conducted in fluids containing defined concentrations of halides, sulfur residues, and TAN-increasing acidic compounds to replicate corrosion-susceptible conditions. By applying a constant bias voltage and monitoring leakage current over time, this objective will quantify reductions in surface insulation resistance caused by contaminant transport, ionic deposition, and corrosion film formation on PCB surfaces.

Development of acceleration models for contaminant-driven corrosion — The objective of this task is to develop predictive acceleration models that quantify the effects of different contamination chemistries—halides, sulfur, and total acid number (TAN)—on copper corrosion under immersion and embedded microfluidic cooling environments. These models will establish correlations between contaminant concentration, temperature, and exposure duration to predict long-term material degradation and define safe operating envelopes.

PUBLIC

Electrical and Signal Reliability

Do contaminants and corrosion by-products degrade board and memory reliability in immersion?

A ENVIRONMENTALLY INDUCED DEGRADATION

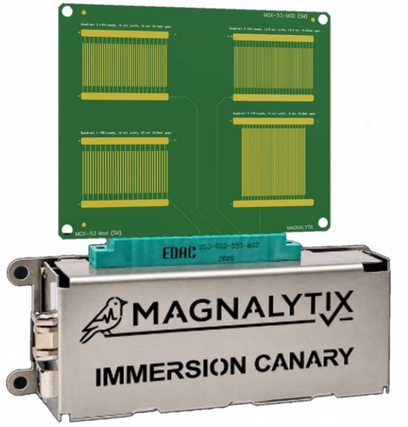
with Magnalytix

- Magnalytix SIR boards aged in contaminated fluids
- Contaminant levels set by Objective 1 thresholds
- SIR and leakage current vs. exposure time

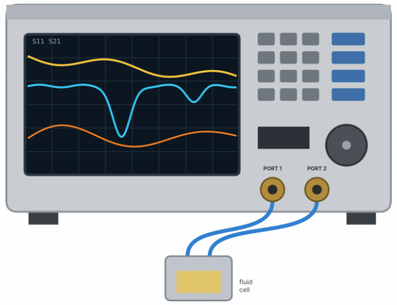
B DDR5 MARGIN AND SIGNAL INTEGRITY

Intel software · Supermicro servers

- DDR5 rank margin vs. contamination level
- Intel margin test software on Supermicro servers
- VNA testing: fluid dielectric constant and loss tangent



Magnalytix Immersion Canary (MGX-53 SIR board)



VNA: fluid dielectric constant and loss tangent

Surface insulation resistance (SIR) evaluation — Building on the contaminant threshold findings from Objective 1, this objective aims to evaluate how these contaminants and corrosion by-products in immersion-cooled environments impact the electrical insulation reliability of PCB surfaces. Using standardized SIR test coupons, controlled exposure tests will be conducted in fluids containing defined concentrations of halides, sulfur residues, and TAN-increasing acidic compounds to replicate corrosion-susceptible conditions. By applying a constant bias voltage and monitoring leakage current over time, this objective will quantify reductions in surface insulation resistance caused by contaminant transport, ionic deposition, and corrosion film formation on PCB surfaces.

Four steps to the mass market

All four steps have started; none is finished.

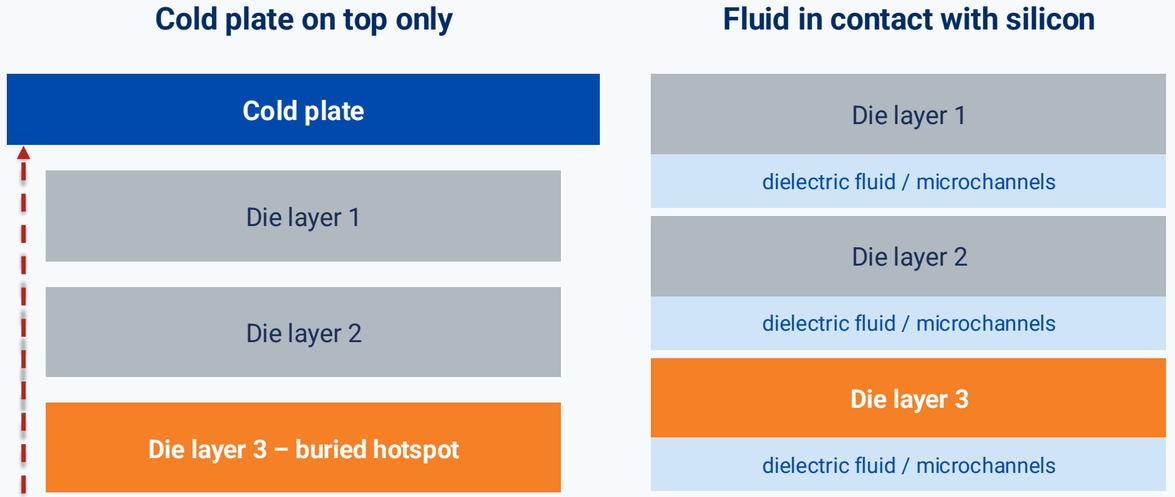
Step	What it needs	Where it stands
1. Shared reliability data	Pooled materials and field data	One 4-year fleet study [47]; Intel 2,500 h [48]; UTA aging [42], [44]
2. Standard test methods	Common qualification criteria	Materials, fluids ✓ [49], [50]; thermal reporting ✗
3. Aligned supply chain	Joint qualification and warranty	CPU path ✓ [13]; **no GPU path yet**
4. Fit with operations	Fits today's halls and staff	Hybrid on facility water [51]; chassis in racks [15]

[13] Intel Newsroom. [15] Iceotope, 2024. [42] Shah et al., 2022. [44] Suthar, UTA PhD, 2025. [47] Zhong et al., ECTC, 2023. [48] Mitra et al., 2025. [49] OCP compatibility testing v1.5, 2026. [50] OCP Immersion Requirements Rev. 2.1. [51] Hnayno et al., 2023.

3D ICs and immersion cooling

As chips stack in 3D, direct fluid contact with silicon may become immersion's decisive advantage.

- Residual heat grows: cold plates capture ~60–90% of server heat, so a 600 kW rack still leaves 60–240 kW for other cooling [52], [53] ⚠
- Buried hotspots: a top-mounted cold plate cannot reach inner layers efficiently [54]
- Direct contact: dielectric fluid enables interlayer and near-junction cooling [54], [55]
- Headroom: embedded cooling reaches 1,700–3,000 W/cm², 20–30× today's immersion records [56], [57]
- Co-design: two-phase cold plates in immersion sleds [58]; encapsulated GaN devices for water immersion [59]



Schematic, not to scale. Concept: [54], [55]

[52] DCD, NVIDIA GTC 2025. [53] Schneider Electric, WP133 (vendor). [54] arXiv:2508.05495, 2025. [55] On-chip embedded cooling review, Engineering, 2023. [56] van Erp et al., 2020. [57] Wu et al., 2025. [58] NVIDIA ARPA-E, 2023. [59] Gebrael et al., 2025.

Key takeaways

Rack power

Yes: rack power is rising ~15–20×, from ~30–40 kW (Hopper, 2022–23) to ~600 kW (Rubin Ultra, 2027), so liquid cooling is now the baseline.

Max heat flux

About 400 W per chip passively, 800 W+ with forced flow and 1.5 kW with directed flow (~50–95 W/cm² at the die); hybrids go further.

Mass market

Shared reliability data, standard tests, a GPU-qualified supply chain and designs that fit today's operations; all four have started, none is finished.

Direction

Coolant is moving closer to the silicon; for 3D-stacked chips, immersion's direct contact with silicon could become its decisive advantage.

Sources on the preceding slides.

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ABOUT THE

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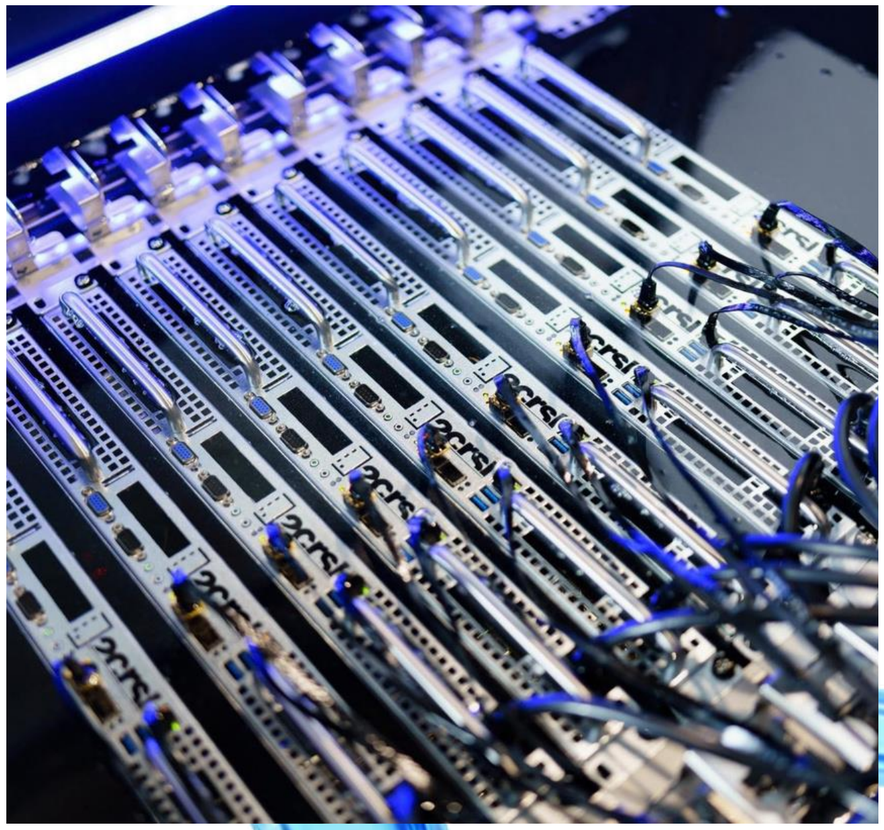
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Q&A

Immersion by design

GPU computing changed scale. Immersion is expanding its territory.



Jean-Jacques Chanut
Head of Product, 2CRSi

PUBLIC

ABOUT THE

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BIO

Jean-Jacques Chanut is Head of Product at 2CRSi. His focus is turning advanced cooling technologies into server platforms for AI, HPC and edge deployments.

Founded in Strasbourg in 2005, 2CRSi combines server design and manufacturing with in-house mechanical, electronic and thermal engineering.

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THE ARGUMENT

An early bet. A larger opportunity.

HPC

We built the expertise.

Dense GPU systems and immersion engineering.

AI

The direction was reinforced.

GPU computing became central to a much larger market.

EDGE

The opportunity is widening.

Bring that experience closer to users, machines and data.

OUR TRAJECTORY

Pioneering work, before the AI wave

2017

Early foundations

Immersion-adapted servers; early OCP GPU deployment.

2018

HPC

Immersion systems for demanding HPC workloads.

2023–24

AI & GPU services

HPC / AI GPU orders, then an immersion GPUaaS design.

2025 →

Edge projects

Outdoor, residential and regional deployments.

Sources: 2CRSi history; issuer release, 29 Nov 2023; original 2CRSi project presentation (2024–25).

ENGINEERING HERITAGE

Immersion is a server-design decision

Front access

Connections designed for access.

Open chassis

Fluid exchange built into the design.

Adapted components

Heatsinks
Thermal paste
Cabling selected for immersion.



Source: 2CRSi, Immersion Cooling Servers — design features.

AI AS VALIDATION

The workload changed.
The GPU expertise carried forward.

HPC

Specialized, demanding computing workloads

AI

Training and inference at a much broader scale

Our interpretation: AI reinforced the relevance of our early engineering choices.

DEPLOYMENT REALITY • ENVIRONMENTAL CONSTRAINTS

The edge is not one environment

LOCATION	EXPOSURE / CONSTRAINTS	DESIGN PRIORITY
IT space	Controlled temperature; restricted access	Power and cooling capacity
Commercial space	People, noise and limited floor space	Acoustics, footprint and security
Industrial / outdoor	Heat, humidity, dust, water, vibration	Environmental protection and serviceability

Far edge can mean harsher sites — but not every edge deployment is harsh.

Source: Schneider Electric, “Not all edge computing environments are the same…”, 30 Jun 2020. Design priorities: synthesis.

OUR THESIS

More compute.
Less controlled surroundings.

WHY IMMERSION ENTERS THE DISCUSSION

Integrate the server and cooling as a deployable system.

A direction supported by our projects — not a claim that every edge site needs immersion.

PROJECT LENS 01 • FAR EDGE

A micro datacenter with Valeo

Compute near the source of data.

Outdoor edge immersion
Server and cooling integrated
Site constraints shape the solution



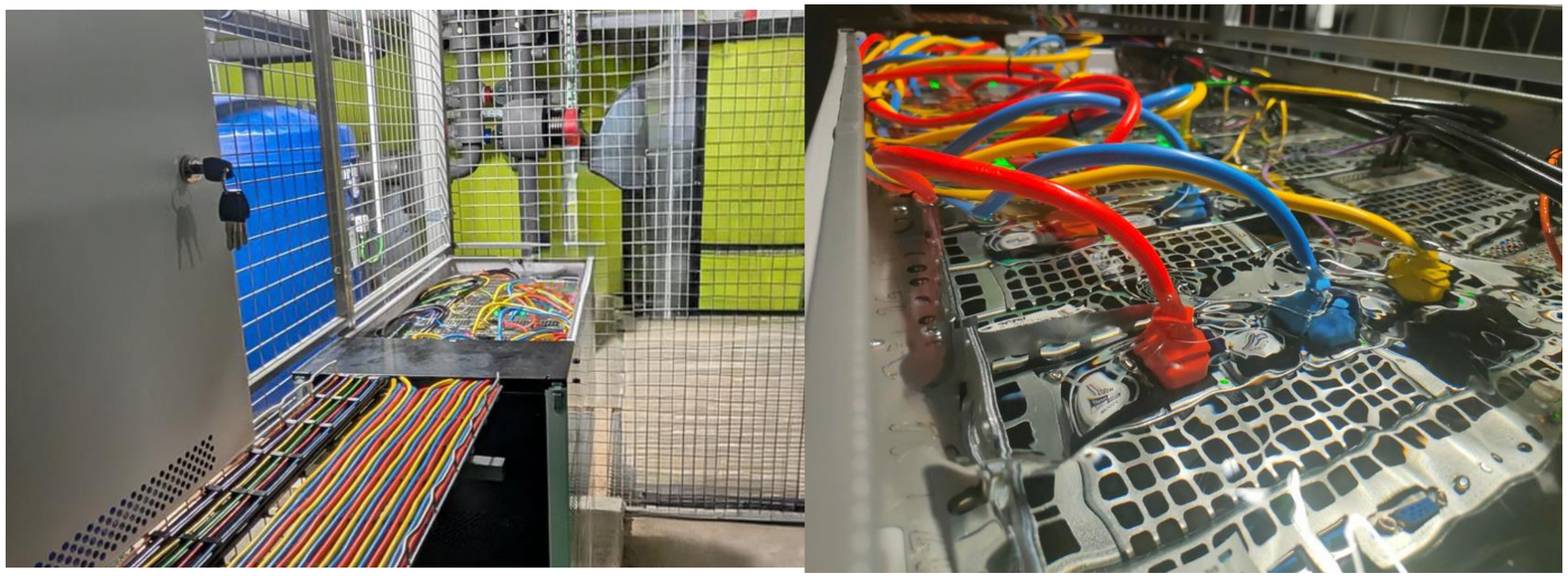
Source: original 2CRSi presentation. Project illustration; no quantified performance claim.

PROJECT LENS 02 • HEAT REUSE

Computing becomes part of the site

Residential environments

Connect IT heat to local demand.
Design the building interface.
Plan access and maintenance.



Source: original 2CRSi presentation — residential installation.

PROJECT LENS 03 • REGIONAL EDGE

HPC experience, deployed closer



Edge & regional data centers

Adapt the installation to the workload, the site and the operating model.

Source: original 2CRSi presentation — immersion installation.

THE DESIGN DISCIPLINE

A fit-for-purpose system

01

THERMAL

Size the heat-rejection system for the real ambient conditions.

02

OPERATIONAL

Make maintenance and remote operation practical.

03

SITE INTEGRATION

Match footprint, interfaces and heat reuse to the location.

Immersion is an option within the architecture; heat still has to leave the system.

LOOKING AHEAD

Born in HPC.
Reinforced by AI.
Expanding toward the edge.

2CRSi’s conviction

The next opportunity is not only denser computing.
It is computing in more places.

PUBLIC

DISCUSSION • 5 MINUTES

Where should compute live next?

Questions

Jean-Jacques Chanut

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PUBLIC

Global Immersion Cooling Association

GICA ANNUAL CONFERENCE 2026

MID-EVENT BREAK

10-MINUTE BREAK

While you take a break, discover more about GICA.

01 — MEMBERSHIP

INTERESTED IN JOINING THE GICA COMMUNITY?

Scan to learn more about GICA membership

Connect. Collaborate. Contribute.

02 — FOLLOW US

FOLLOW GICA

Stay connected with industry updates, upcoming webinars, events and GICA initiatives.

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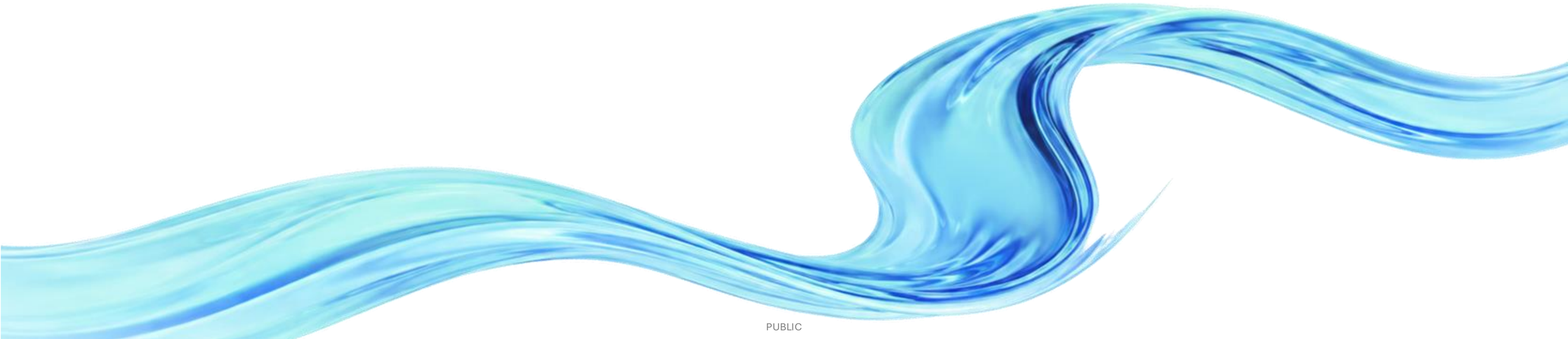
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Global Immersion Cooling Association

GICA ANNUAL CONFERENCE 2026

Immersion Cooling

Strategic to Future ITE (Information Technology Equipment) Thermal Management



PUBLIC

ABOUT THE

Speaker



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BIO

With extensive experience in data center infrastructure, thermodynamic systems, controls and cooling architectures, John brings a strong technology and innovation perspective to the conversation around immersion cooling. He has also played an active role in the development of the OCP Immersion Cooling ecosystem and served in several roles for ASHRAE Standards Development.

Immersion for ITE

- Rising CPU, GPU, and memory TDPs have driven thermal design needs and will continue to do so.
- Liquid cooling through direct-to-chip (DLC) cold plates and immersion is displacing air cooling.
- Cold plates effectively target high-heat-flux components. However, immersion can cool those components and **all** other heat-dissipating electronics within immersed ITE chassis.
- Immersion maximizes available site power for ITE.



INDUSTRY TRENDS — PUSH

Growing Demand on Key Resources
Increasing TDP and Heat Flux
Edge Deployments at Scale
Environmental Acoustics



KEY CHALLENGES

Warranty?
Adaptation to New Practices?





PRODUCTS/OPPORTUNITIES

Higher Efficiency -> More Power to ITE
Edge-Specific Offers
Lower Acoustics

PULL

PUBLIC

Industry Trends

Data Center Electricity Consumption Growth Outpaces GDP

- Estimated Data Center Average Hourly Demand from 22 GW in 2024 to 74 GW in 2030
- Estimated Cost per Commercial kWh from 12.8¢ in 2024 to 14.5¢ in 2030

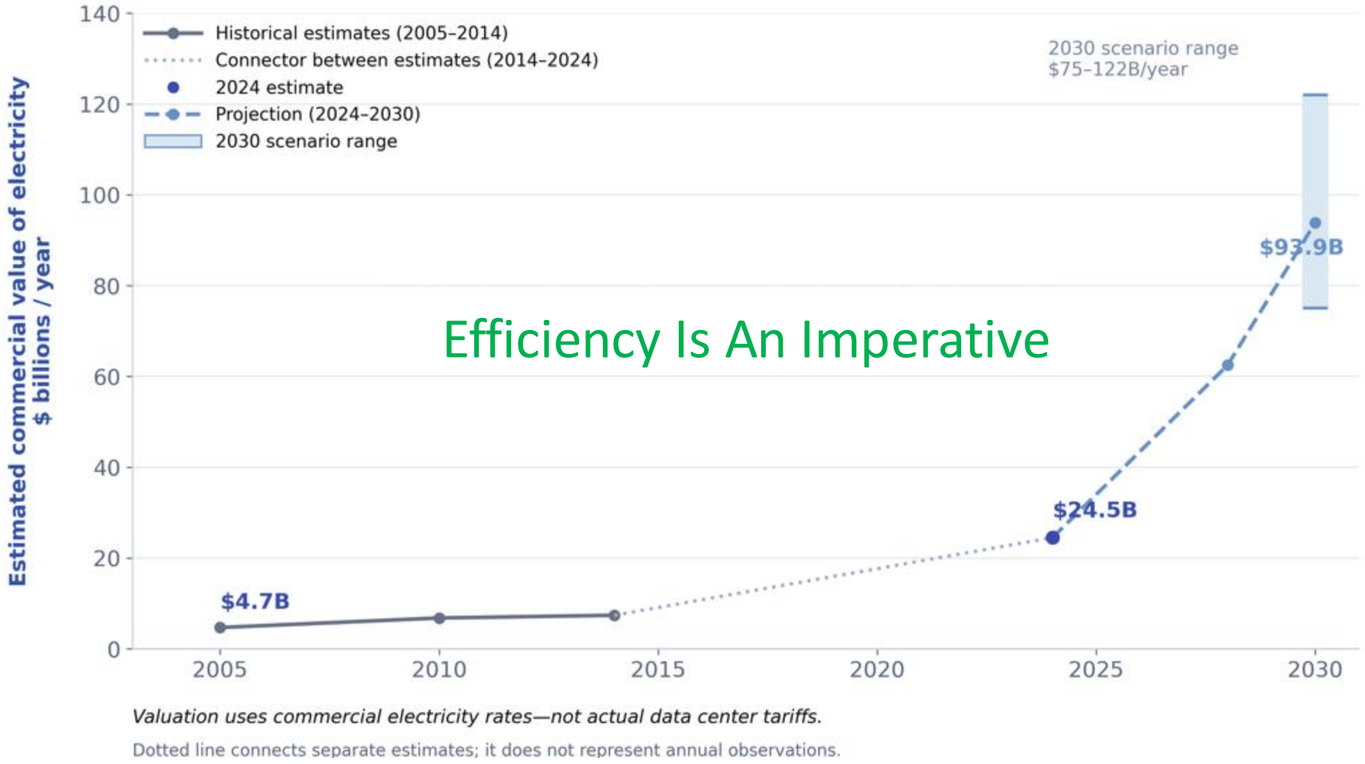
In Juxtaposition

- CBO's Real Potential GDP Growth Estimated at 1.8% Annually from 2024 to 2054 (March 2024 Outlook)

  Cumulative ≈ 11.3% from 2024 to 2030

Sources:

- United States Data Center Energy Usage Report — June 2016; Shehabi et al., Lawrence Berkeley National Laboratory.
- United States Data Center Energy Usage Report: 2025 Update — June 2026; Smith et al., Lawrence Berkeley National Laboratory.
- Retail Sales of Electricity—Commercial Price Data — 2005–2025 data; U.S. Energy Information Administration.
- Annual Energy Outlook 2026—Counterfactual Baseline, Table 3 — April 2026; U.S. Energy Information Administration
- **Chart Below Based upon GRC Calculations Leveraging Cited Sources – September 2026; Bean**



Industry Trends

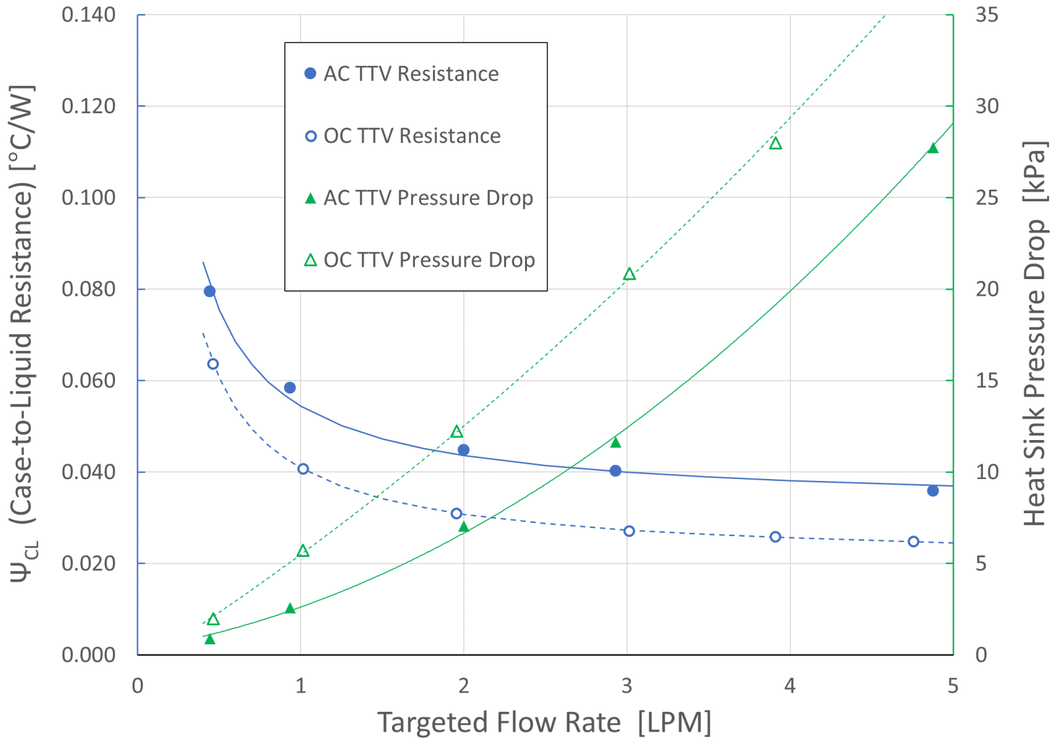
Power Trends Higher TDPs

- GPUs & CPUs: Currently, the Slope for CPUs is Shallower than GPUs *
- Memory HBM ~ 15% CAGR from 2015 to 2028 *
- NVIDIA GPU Maximum TDP Doubled from 700 W for H100 SXM (2022) to 1,400 W per GPU in GB300 NVL72 (2025), Including HBM Memory **

iDLC Technology

- Targeted Flow Rivals ψ_{CL} of PG25 Cold Plates
- GRC iDLC - Simple Plumbing with Low Pressure Head Required for Flow
- GRC iDLC - Enables Easy Integration into Immersion Cooling

Source Intel Presentation
OCP 19th March 2024



*Reference - Steve Mills et al., Open Compute Project, *30°C Coolant — A Durable Roadmap for the Future*, Revision 1.0, October 1, 2024. Licensed under CC BY-SA 4.0.

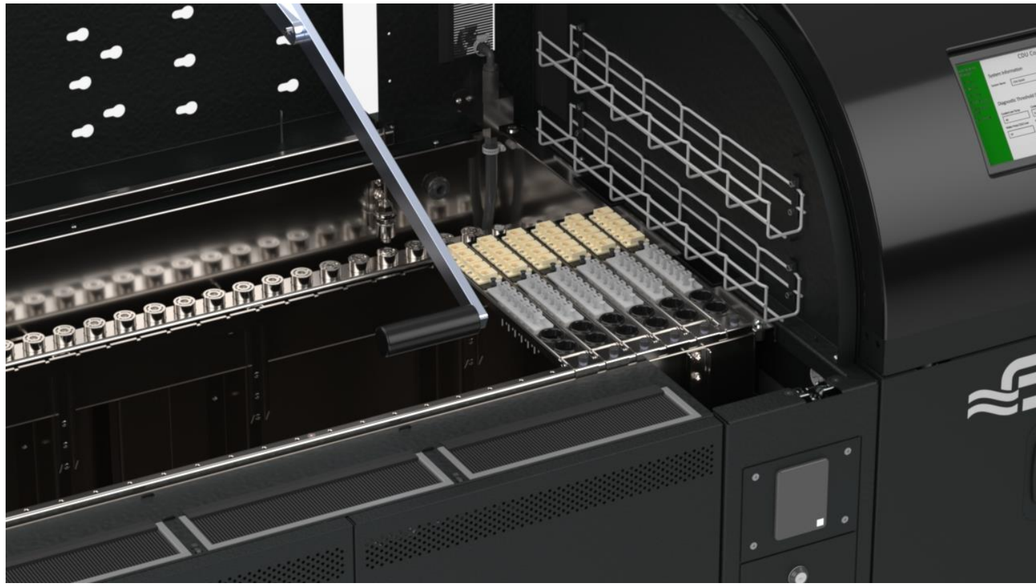
** Reference - NVIDIA, H100 specifications and Blackwell Ultra datasheet, p. 5; product announcements, 2022 and 2025.

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Key Challenges

Warranty & Adaptation to New Practices

- Warranty Dynamic Landscape – It Varies!
  - Paths Exist, Often on a Case-by-Case Basis
- User Experience with Immersion Differs from That with Air-Cooling
  - Immersion has Higher Reliability for ITE
  - Immersion Does Introduce an Adjusted ITE Service Routine
  - Immersion Fluids Require Compatibility Evaluation with ITE
  - Immersion Fluids Provide a Barrier Against Airborne Contaminants



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Large Form Factor

Targeting Enterprise and Edge Modular Data Centers

- Available in Both EIA-310-D 19” (54) RU and OCP ORV3 (50) OU
- Multiple Redundancy Schemes: N, 2N and N+X
- Upgradable to iDLC Technology
- Dynamic Fluid Level Management – Simplifies ITE Add/Delete
- Robust and Comprehensive Control Platform
- Integrated Secondary Fluid Containment
- Redundant Power Source A/B plus PoE for Controls
- Acoustically – Quiet at Full Load



ICEraQ NX 50OU/54RU w/ CDU 180

PUBLIC

Small Form Factor

Targeting Enterprise and Small Edge

- Available EIA-310-D 19” (10) RU
- Simple Deployment Liquid-to-Air Heat Exchanger
- Aligned with Higher-Power ITE 13 kW @ 35°C
- Dynamic Fluid Level Management – Simplifies ITE Add/Delete
- Built-in Redundancy and Resiliency
- Integrated Secondary Fluid Containment
- Redundant Power Source A/B
- Acoustically – Moderate at Full Load



ICEraQ Nano 1013

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Immersion Cooling at the Edge – Selected Industrial Applications

Challenges when deploying high-density AI inference into industrial sites where HVAC, power and specialist support are limited or unavailable.

Why Edge AI is Changing

- **Always on:** Edge workloads have shifted from periodic training to real-time inference that senses and acts on live data.
- **More compute, fewer resources:** Accelerators and complex models are reaching remote sites without dedicated cooling, ample power or on-site specialists.

Why Immersion Wins

- **Harsh-site ready:** Controlled compute nodes resist dust and airborne contaminants.
- **Operationally efficient:** Higher density and lower noise reduce reliance on site-built HVAC.
- **Repeatable and scalable:** Modular deployments support measurable, capture-ready heat reuse.

Why Local Deployment Matters

- **Sovereignty and security:** Keep sensitive data on-premise and reduce transit risk.
- **Ultra-low latency:** Enable immediate decisions for autonomous machines and site security.
- **Bandwidth optimization:** Lower transmission cost and preserve offline operation.

Edge AI Realities by Industry

Industry	Local Edge AI Inference	Site reality	Immersion value
Manufacturing	Vision inspection; robotics; predictive maintenance; process optimization	Dust, heat, vibration and noise; limited floor space; uptime tied to production	Dense, quiet local compute; fewer air paths and filters; repeatable modules across plants
Mining and heavy industry	Autonomy; ore sorting; telemetry; worker safety; equipment health	Particulates; temperature swings; remote access; intermittent WAN	Protected electronics; local continuity; compact deployment near operations
Energy and utilities	Asset inspection; anomaly detection; grid or process analytics; digital twins	Remote substations, plants and field sites; long service intervals	Sealed modular compute; dry heat rejection; remote operations
Ports, rail and logistics	Video analytics; autonomous vehicles; tracking; scheduling; safety	Outdoor or semi-conditioned sites; salt, dust and vibration; 24×7 flow	High-density vision compute near operations; less fan noise and contaminant exposure

ABOUT THE

Speaker



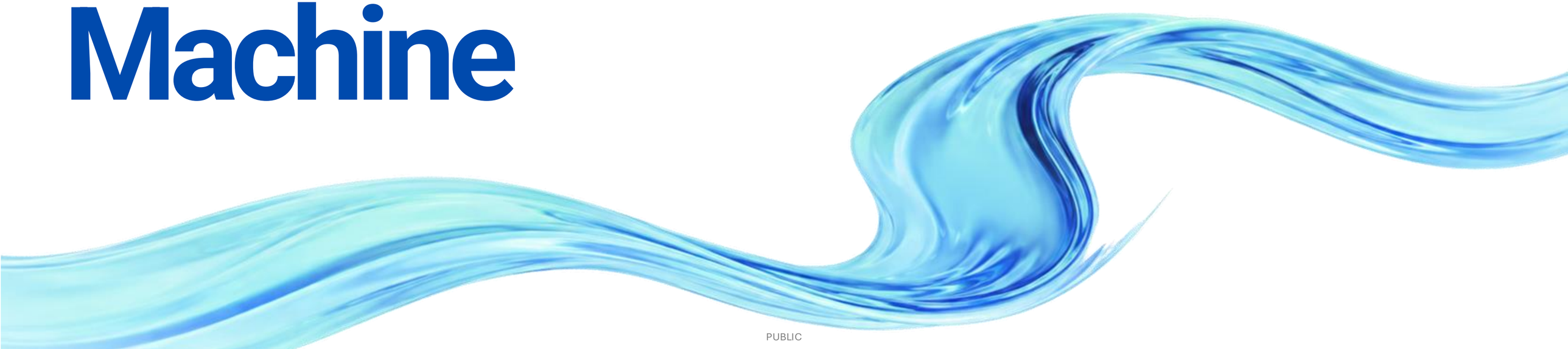
John Bean, Jr.

Chief Technology Officer
Green Revolution Cooling

Email
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Q&A

An IDM Cog in the Immersion Machine



PUBLIC

ABOUT THE

Speaker



Samantha Yates

Principal Engineer
Intel

samantha.yates@intel.com

BIO

Samantha Yates is a Principal Engineer of Product Quality and Reliability at Intel, where she developed new and innovative methodologies to assess the thermochemical reliability of products in liquid cooling solutions. She drives ecosystem standardization as the Immersion Reliability OCP Lead and is a coauthor of multiple OCP whitepapers on liquid cooling reliability. She was the Technical Program Manager of the team that evaluated the thermochemical quality and reliability of the Intel Datacenter Certified Immersion Solutions.

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THE IDM PERSPECTIVE

Introduction

Qualification of IDM products for immersion cooling requires ecosystem partnership and data sharing to optimize resources and justify the investment.

CHALLENGE

IMMERSION ECOSYSTEM

Diverse and evolving industry of fluids, tanks, and hardware options

QUALIFICATION COMPLEXITY

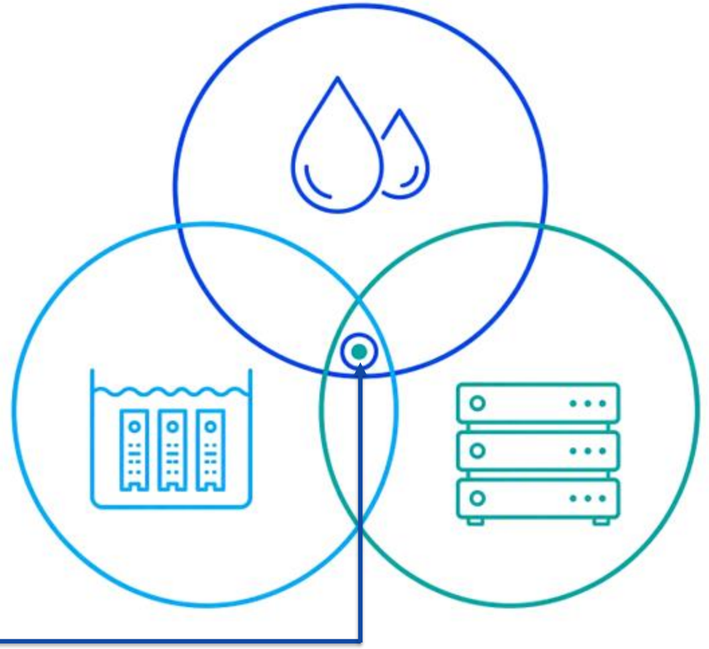
Innumerable combinations to evaluate

INDUSTRY DISCUSSION

How can we collaborate to simplify qualification?

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Immersion Solution



Diverse Immersion Ecosystem with Innumerable Combinations

- Fluid Options: Hydrocarbon, 1P Engineered Fluids, 2P Engineered Fluids
- Tanks Options : Open/Closed Bath, Enclosed/Remote Heat Exchanger
- Hardware Options : Config, Materials, Density, Open/Closed Chassis

KEY TAKEAWAY

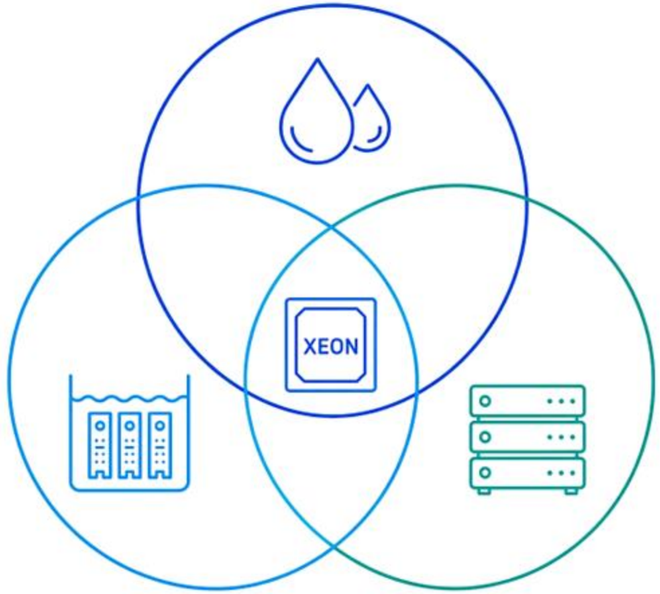
An immersion solution integrates a specific combination of fluid, tank, and hardware

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Solution Interdependencies

Immersion Fluid is in Direct Contact with the Tank and Hardware

- The immersion fluid changes over the service lifetime due to interactions with the tank and hardware



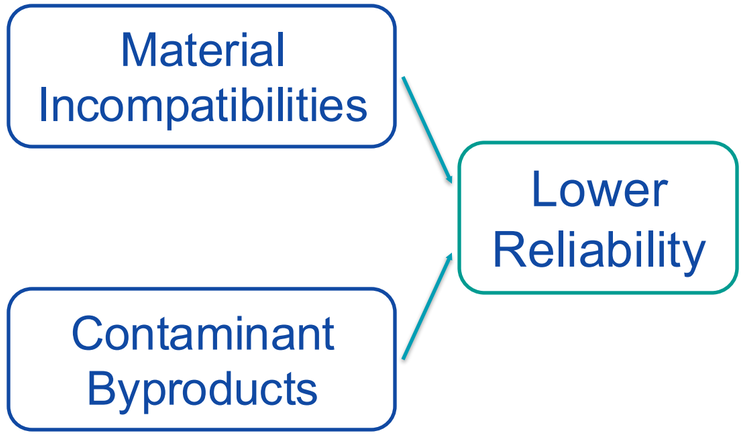
KEY TAKEAWAY

The reliability of an IDM product can be impacted by the changes in the immersion fluid from tank and hardware interactions

Thermochemical Reliability

Qualification Data Is the Foundation of Product Warranties

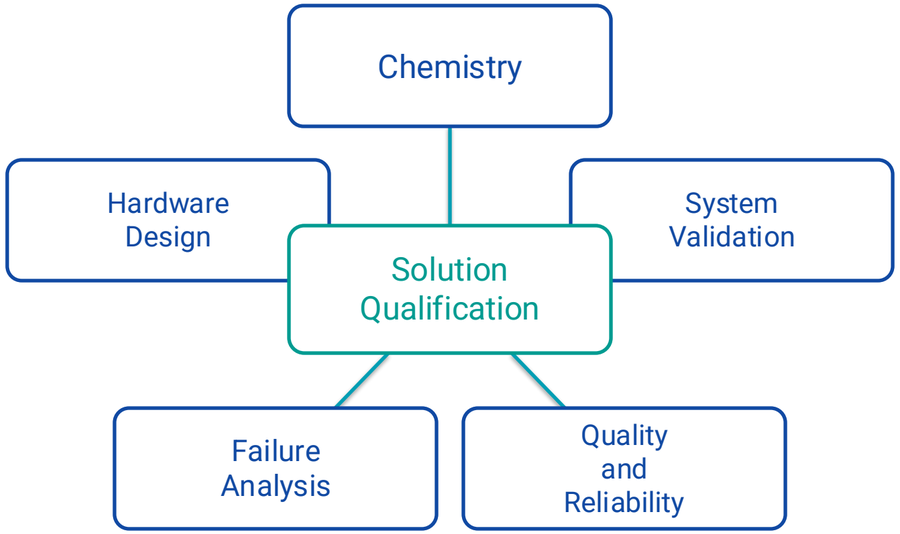
- Thermochemical Quality: Material incompatibilities of product materials
- Thermochemical Reliability: Product performance degradation from contaminant byproducts



KEY TAKEAWAY

Thermochemical failure modes need to be understood and mitigated to meet product reliability requirements

Solution Qualification



Qualification Requires a Coalition of Experts

- Hardware Design: Material Selection and Performance Capability
- System Validation: Performance Analysis and Debug
- Quality and Reliability: Risk Assessment and Test Plan Development
- Chemistry: Material Compatibility and Fluid Analysis
- Failure Analysis: Root Cause Hardware Failures

KEY TAKEAWAY

IDMs lack resources to qualify a product in every immersion solution

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Industry Standards

Industry Standards Inadequately Address Liquid Cooling Reliability

- Thermomechanical qualification of IDM products governed by globally recognized industry standards

KEY TAKEAWAY

No industry standards on immersion qualification requirements for IDM products

IEC

JEDEC®

AEC

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Ecosystem Collaboration

Ecosystem Collaboration is Essential to Self Align on Qualification Requirements

- Fluid environment requirements
- Unified wetted materials lists
- Qualification testing guidance

OPEN Compute Project®

KEY TAKEAWAY

End users need confidence that the immersion ecosystem has strong partnerships dedicated to ensuring their success

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End User Collaboration

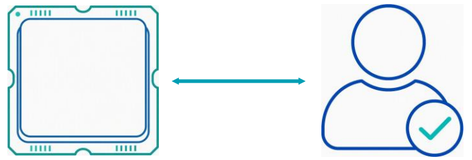
IDM Collaborates with End User to Collect Qualification Data on End User Solution

- IDM provides customized test plan to end user for IDM product qualification
- End user executes the test plan and provides the qualification data to the IDM

KEY TAKEAWAY

Customized IDM product qualification test plans developed based on specific end user solution configuration, hardware performance and reliability requirements

Qualification Partnership



IDM — End User

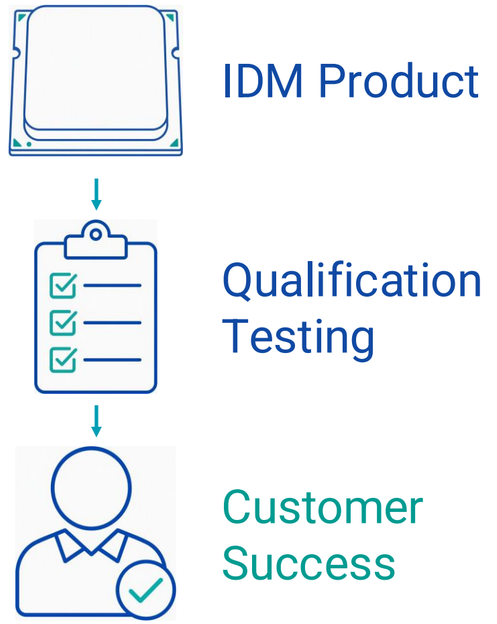
Shares use case requirements, performance data, and field data

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An IDM Cog

IDM Investment is Required to Enable Immersion Cooling for End Users

- Qualification testing is needed to verify the IDM product will meet performance and reliability requirements to ensure the end user will be successful



KEY TAKEAWAY

IDM investments in immersion qualification need to be justified with product design wins and demand

In The Immersion Machine

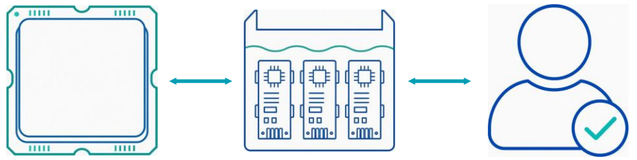
IDM Partners Isolated from End Users Directly Engaging with Immersion Ecosystem

- Missing design win data
- No clarity on end user requirements
- Unable to collect field reliability data

KEY TAKEAWAY

Ecosystem needs to advocate for additional investments in immersion qualification by establishing co-validation partnerships with their IDM and end user

Co-Validation Partnership



IDM — Immersion Ecosystem — End User

Shares design wins, user requirements, and field reliability data

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THE IDM PERSPECTIVE

Key Takeaways

- The complete immersion solution needs to be qualified to ensure the reliability of an IDM component.
- Immersion qualification requires diverse expertise and ecosystem alignment on test methodologies.
- Co-validation partnerships must connect IDM investment to end user demand and data.

CALL TO ACTION

STANDARDIZED QUALIFICATION

Align and adhere to a unified set of fluid, wetted materials, and testing requirements.

CO-VALIDATION PARTNERSHIPS

Share expertise and divide qualification testing roles and responsibilities.

DATA SHARING

Improve visibility into IDM product design wins, customer demand, and field data.

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ABOUT THE

Speaker



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Principal Engineer
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Q&A

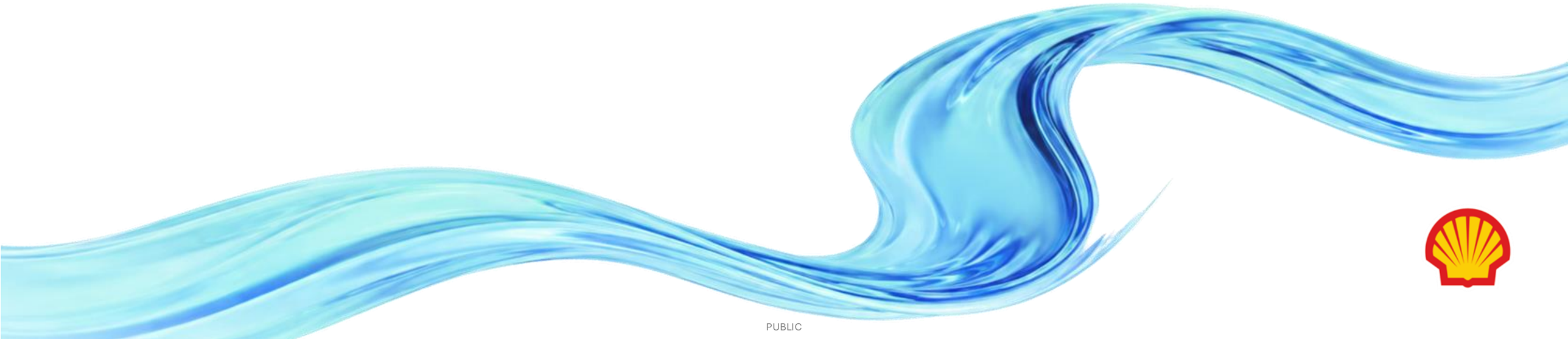
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Global Immersion Cooling Association

GICA ANNUAL CONFERENCE 2026

Beating the heat

From charging density to compute density — and beyond



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Global Immersion Cooling Association

GICA ANNUAL CONFERENCE 2026

ABOUT THE

Speaker



Jen Reilly

Global Marketing Manager
Shell

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BIO

Jen Reilly is a global B2B marketing leader at Shell with a strong track record of ecosystem collaboration focused on advanced thermal management technologies, untapped efficiencies and next-generation infrastructure solutions.

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HEAT

The invisible constraint

Heat is rarely the most glamorous part of the story. But it can quietly determine performance, safety, equipment life, resource use and beyond.

BEYOND COOLING



PROVING THE POTENTIAL

What have we learned?



SYSTEM-LEVEL VALUE

What can immersion unlock?



FROM PROOF TO PLATFORM

What’s needed to scale?

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The companies in which Shell plc directly and indirectly owns investments are separate legal entities. In this presentation "Shell", "Shell Group" and "Group" are sometimes used for convenience to reference Shell plc and its subsidiaries in general. Likewise, the words "we", "us" and "our" are also used to refer to Shell plc and its subsidiaries in general or to those who work for them. These terms are also used where no useful purpose is served by identifying the particular entity or entities. "Subsidiaries", "Shell subsidiaries" and "Shell companies" as used in this presentation refer to entities over which Shell plc either directly or indirectly has control. The terms "joint venture", "joint operations", "joint arrangements", and "associates" may also be used to refer to a commercial arrangement in which Shell has a direct or indirect ownership interest with one or more parties. The term "Shell interest" is used for convenience to indicate the direct and/or indirect ownership interest held by Shell in an entity or unincorporated joint arrangement, after exclusion of all third-party interest.

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We may have used certain terms, such as resources, in this news release that the United States Securities and Exchange Commission (SEC) strictly prohibits us from including in our filings with the SEC. Investors are urged to consider closely the disclosure in our Form 20-F, File No 1-32575, available on the SEC website www.sec.gov.

Shell Triple 10 Challenge

3 ambitious technical targets relevant to mass-market electric mobility



- Sub-10-minute charge time
- 10km/kWh driving efficiency
- 10 tCO_2e lifecycle emissions

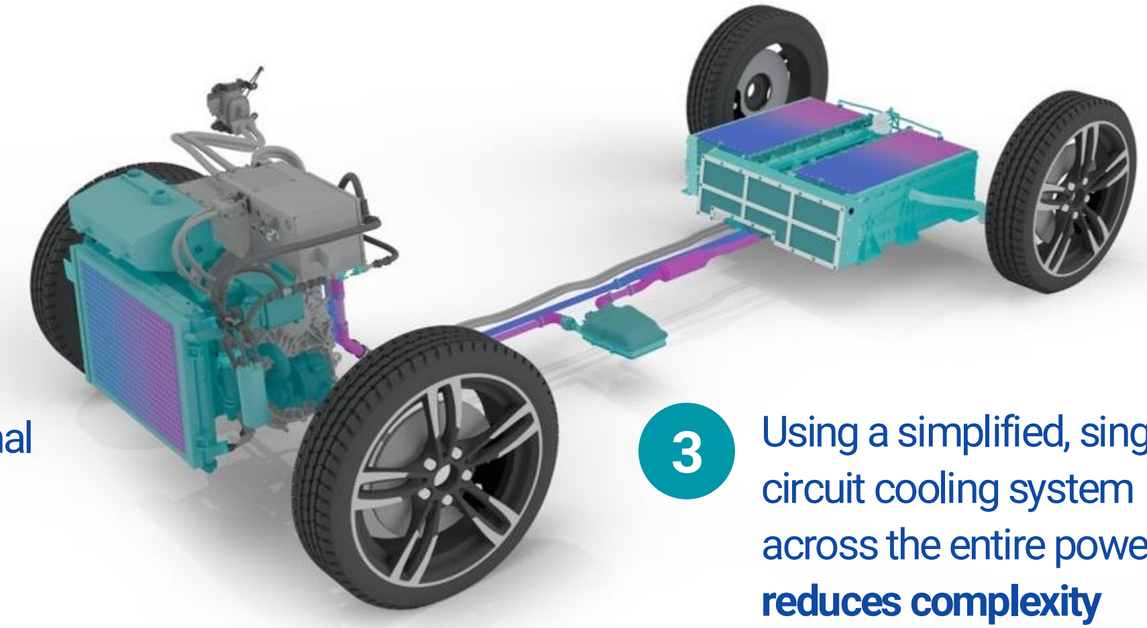
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Get closer to the problem

Innovation • Collaboration • System integration

1 Shell's thermal fluid has nearly **100% contact** with battery cells, compared with ~15% for traditional water-glycol cooling plates

2 Immersion can manage heat more effectively, with **2.5x more watts/cell** than conventional base plate cooling[1]



3 Using a simplified, single-circuit cooling system across the entire powertrain **reduces complexity**

[1] Compared to today's fastest charging BEVs.

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A bold alternative

to conventional design parameters



CHARGE FASTER

From 10–80% charge in **9 mins 54 sec**

Almost **90%** more range added per minute

GO FURTHER

Over **30%** better energy efficiency[1]

~30% lighter[2] with a 210 kg, 35-kWh battery

DRIVE CLEANER

10 tCO_2e footprint[3]

Around **50%** lower lifecycle emissions[4]

[1] Compared with many current-generation EVs

[2] 1,150-kg overall weight compared with an average 1,650-kg kerb weight of B-segment EVs

[3] The concept car demonstrates what is technically achievable under optimized conditions, including charging over a 200,000-km vehicle lifetime via the Shell Recharge network in the UK, using certified 100% renewable electricity. Results are derived from a Shell internal life cycle assessment (LCA) in line with ISO 14040 and14044 standards drawing on emission factor data from component suppliers and manufacturers, recognized LCA databases and published literature. Actual results may vary under real-world conditions.

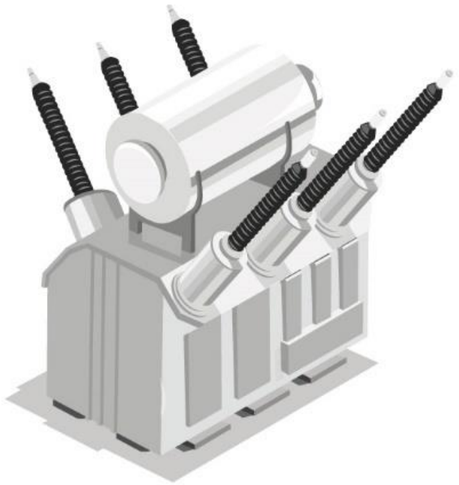
[4] Compared to typical BEVs, based on a comparison with a published LCA study conducted by Ricardo et al. (2023) and assuming a 200,000-km vehicle lifetime. Differences in underlying methodological assumptions and vehicle specifications (including vehicle size and battery capacity), and use-phase conditions mean that the emissions reduction should be regarded as indicative only. Actual outcomes may vary in real-world applications.

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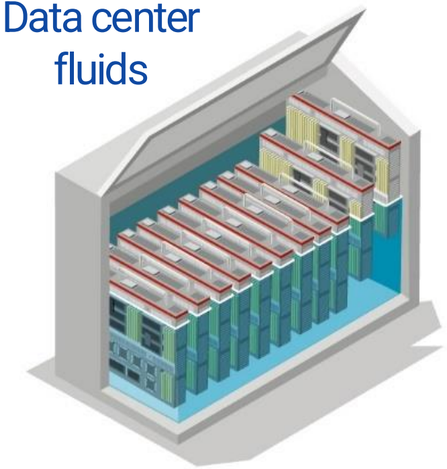
A logical extension…

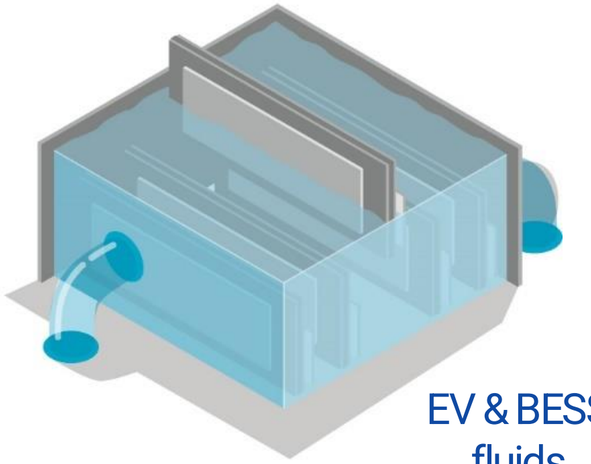
…not a leap

Transformer oils



Data center fluids





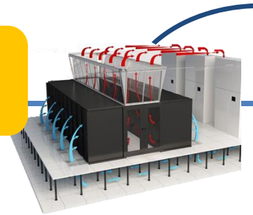
EV & BESS fluids

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From the road to the data center

Shell's deployment of a hybrid liquid cooling environment at the Element Critical facility in Houston, TX

Traditional air cooling



PUE of 1.6 – 2.5

- Density limit of **~30kW**/rack
- Exit temperatures of around 120°F (~50°C)

Direct-to-chip liquid cooling



PUE of 1.2 – 1.4

- Density limit of **~62kW**/rack
- Exit temperatures of around 80°F (~26°C)

Single-phase immersion cooling



PUE of 1.03 – 1.1

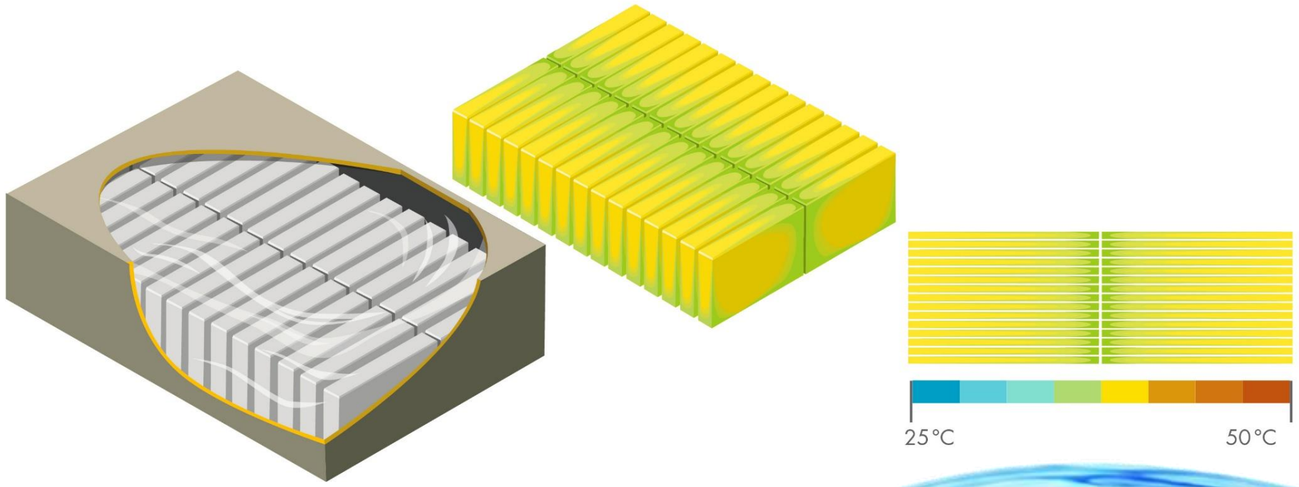
- Density up to **100kW**/rack

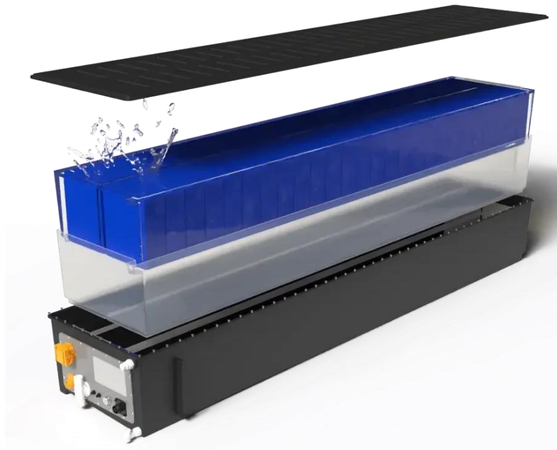
PUE = Power Use Effectiveness

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Back to the battery

What could better thermal control change over the economic life of a BESS asset?





Pictured on right: ETICA's patented LiquidShield™ immersion technology featuring Shell BESS Fluids

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One principle

Three value stories

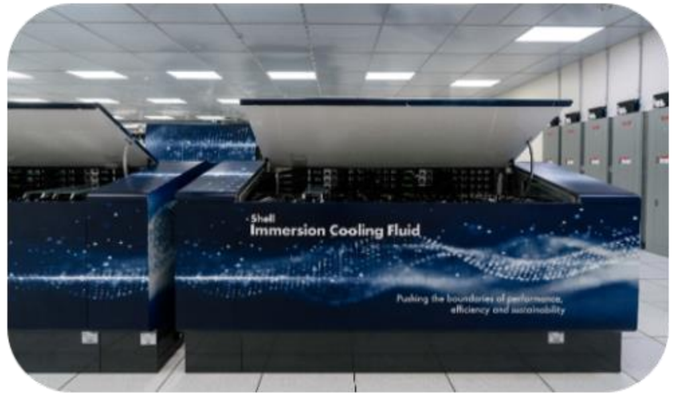
EV	Convenience, efficiency, simpler architecture + safety
BESS	Availability, asset life, reduced risk and bankability
Data center	Capacity, efficiency, reliability and site feasibility

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Beat the heat.

Redesign the possible.







BESS image courtesy of ETICA

An invitation to explore what's possible

Data center solutions

www.shell.com/liquid-cooling

Electric vehicle innovation

www.shell.com/triple10challenge

20 Years

No.1 Global Lubricants Supplier

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ABOUT THE

Speaker



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Q&A

Global Immersion Cooling Association

GICA ANNUAL CONFERENCE 2026

WHY CROSS-INDUSTRY MATTERS

NO SINGLE INDUSTRY HAS ALL THE ANSWERS.

Immersion cooling is shaped by challenges across:

COMPUTING ↔ AUTOMOTIVE ↔ ENERGY ↔ INFRASTRUCTURE ↔ THERMAL MANAGEMENT

That is why the conversation needs to happen across industries — not within silos.



WHAT HAPPENS NEXT

THE CONVERSATION CONTINUES

01

SHARE YOUR EXPERIENCE

Tell us what you want GICA to explore next.

02

JOIN THE NEXT CONVERSATION

Heat Reuse & Immersion Cooling

GICA Webinar
Early December 2026

Interested in speaking? Talk to the GICA team.

03

STAY TUNED

A major GICA announcement is coming in January 2027.

JANUARY 2027

Something big is coming.

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Global Immersion Cooling Association

GICA ANNUAL CONFERENCE 2026

SURVEY

WE WANT TO HEAR FROM YOU

What should GICA focus on next?

Please complete the GICA Conference Survey located on the back of your name badge.

Your feedback will help us understand:

- What industries we should engage
- What topics matter most
- What content you want from GICA
- Where we can create more value for the community

SCAN

WRITE

SHARE

Global Immersion Cooling Association

GICA ANNUAL CONFERENCE 2026

JOIN THE COMMUNITY

DON’T JUST ATTEND THE CONVERSATION. BE PART OF IT.

CONNECT. COLLABORATE. ADVANCE.

Become part of a growing community working to advance immersion cooling through:

- Industry collaboration
- Knowledge sharing
- Technical development
- Global networking

Learn more about GICA membership

www.gi-ca.org

Global Immersion Cooling Association

GICA ANNUAL CONFERENCE 2026

NOW, LET'S NETWORK.

The presentations may be ending.
The conversations don't have to.

6:00–7:00 PM

Networking · Food · Bar

Meet someone from a different industry. Start a conversation. See where it leads.

Global Immersion Cooling Association

THANK YOU

GICA Annual Conference 2026

Cross-Industry Experience in Immersion Cooling

www.gi-ca.org

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LEARN MORE ABOUT MEMBERSHIP