



Scaling Open Collaboration for Immersion Cooling Adoption

Rolf Brink *Promersion & Co-chair Immersion Sub-Project*

Jessica Gullbrand *Eaton & Co-chair Immersion Sub-Project*

Allison Boen *Alcatex & Community Outreach*

Rachel Bielstein *Baltimore Aircoil Company & Co-chair Community Outreach*

Gemma Reeves *AlfaLaval & Chair Community Enablement*









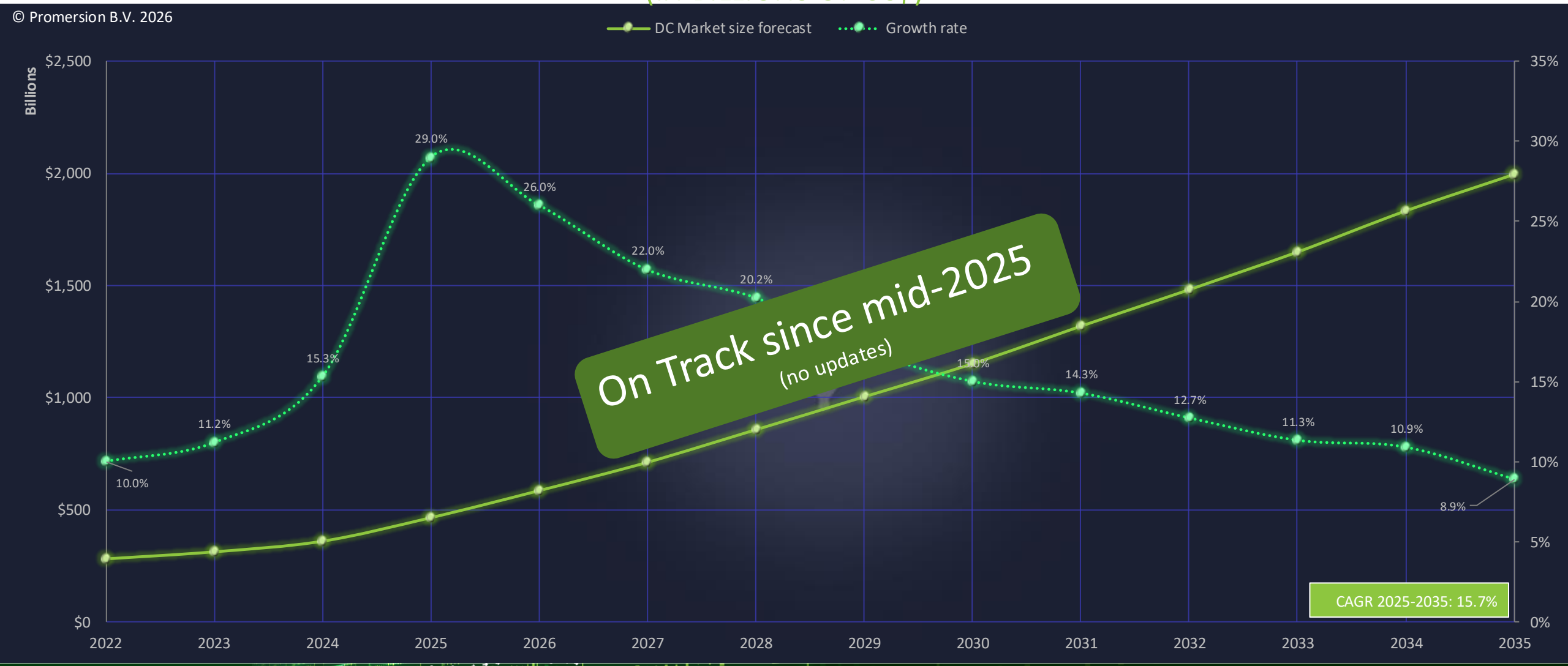
Immersion Agenda for Wednesday Oct. 14

Immersion Ecosystem 11:10-11:30 am	UL Solutions: Advancing Immersion Cooling Safety: From Fluid Qualification to System Compliance
Lunch: 11:30-12:30 pm	
Immersion Ecosystem 12:30-12:45 pm	SWRI: OCP/SwRI Collaboration - Data Center Immersion Fluids Consortium
Reliability 12:50-1:45 am	Community update: Reliability Committee Update Samsung: Material Compatibility and Long-Term Hardware Integrity of Enterprise SSDs in Two-Phase Immersion Cooling Intel & ExxonMobil: Rack Scale Reliability Demonstration Testing Methods and Results from the Intel Datacenter Certified ExxonMobil - Micron - BAC Immersion Solution
Fluids 1:50-2:45 pm	Community update: Immersion Fluids Committee Update Kyzen: Before the Fluid: How Pre-Immersion Cleaning Chemistry Shapes Long-Term Electronic Reliability Evonik: Moving Beyond Interchangeability: Characterizing Esters among Coolants for Immersion
Break: 2:45 pm-3:15 pm	
Fluids 3:15-3:35 pm	Magnalytix & ExxonMobil: Fluid Oxidation and Electronic Reliability: A Multi-Fluid EID Measurement Study
IT Equipment 3:40-4:15 pm	Community Update: Immersion IT Equipment (ITE) Committee Update Solidigm: A Practical Infrastructure Solution for Component and Device Level SSD Qualification in Single-Phase Immersion Cooling
Solutions 4:20-5:00 pm	Community Update: OCP Solutions Technical Committee DenvrData & Unicom: Deploying Immersion Native ITE in AI NeoCloud: An OCP Collaboration Story Continued
Liquid Cooling Bazaar 5:00-6:00 pm	Promersion: Liquid Cooling Market Update: Industry Dynamics, Adoption Signals, and the Road to Scale **Everything you always wanted to know about liquid cooling but were afraid to ask**
Forever Fluid 7:30 – 10:30 PM	Immersion Project Community outreach on behalf of Cooling Environments **Forever Fluid, Networking Event @ Scott's Seafood Ballroom**



DC MARKET SIZE FORECAST UPDATE
(IN BILLIONS OF US$)

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OCP GLOBAL SUMMIT | 2026
Scaling Innovation for the AI Era.

GLOBAL LIQUID COOLING MARKET SIZE FORECAST UPDATE

(IN BILLIONS OF US$)



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- Industry Analytics Updates:
  - **2pm, Marriott Rooms 3 & 4**:
    Europe on a Different Clock: Data Center and Liquid Cooling Market Analytics to 2035
  - **5pm, 220C:**
    Liquid Cooling Market Update: Industry Dynamics- Adoption Signals- and the Road to Scale
- Liquid Cooling Bazaar, 5:20-6:00 pm

New Whitepaper: Thermal Boundaries in AI Infrastructure

- Full analysis of all liquid cooling technologies, adoption behaviors, industry segmentation and guidance for matching liquid cooling to compute through the power inflection

The question this project keeps getting

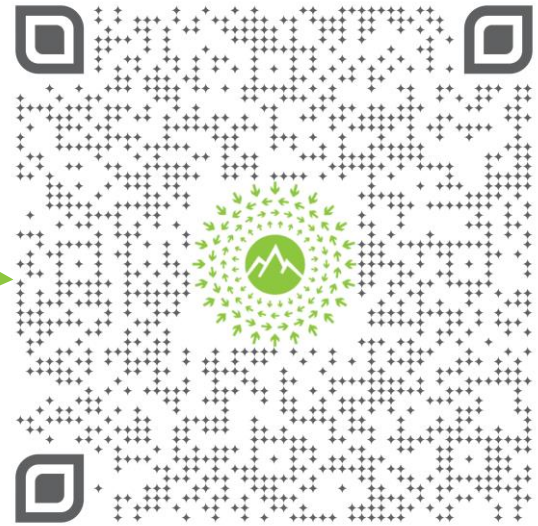
Immersion is the largest project community in OCP — and the IT OEM ecosystem is still not shipping immersion-native at scale.

So: why are the OEMs not committing?

They are. On their clock, not ours.

New OCP whitepaper, Thermal Boundaries in AI Infrastructure
By Rolf Brink, Mohan J. Kumar, Steve Mills, and Kelley Mullick

Scan to download



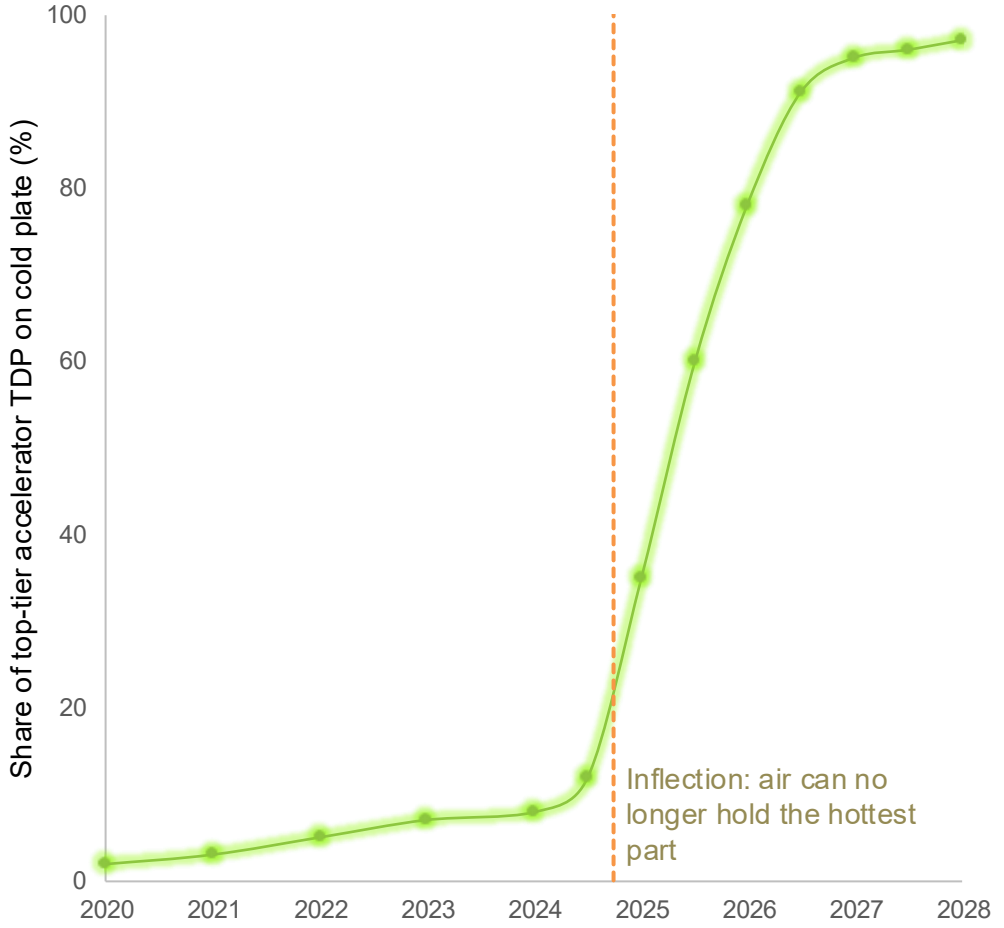
The clock has a law

“An ecosystem as a whole exhausts every option that preserves its current architecture before it accepts one that changes it.”

Strings. Every new method carries dependencies into parts of the system its adopter does not control.

Rational deferral. Waiting is individually sensible — so the whole ecosystem waits together.

Inflections. Transitions arrive forced, not chosen.



Under 10% → above 90% in ~24 months. Forced, not chosen.

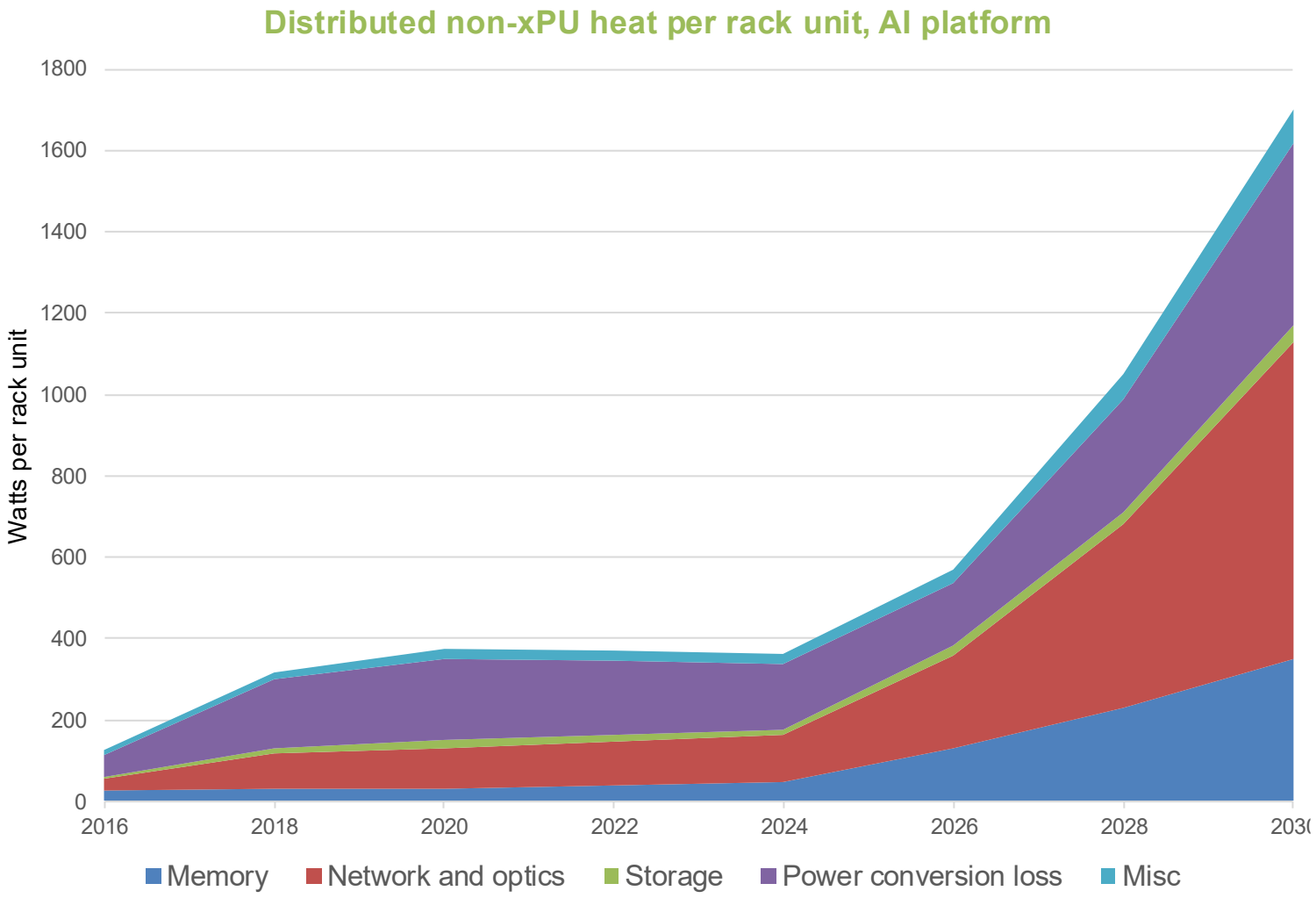
Pushed by a wall, pulled by economics

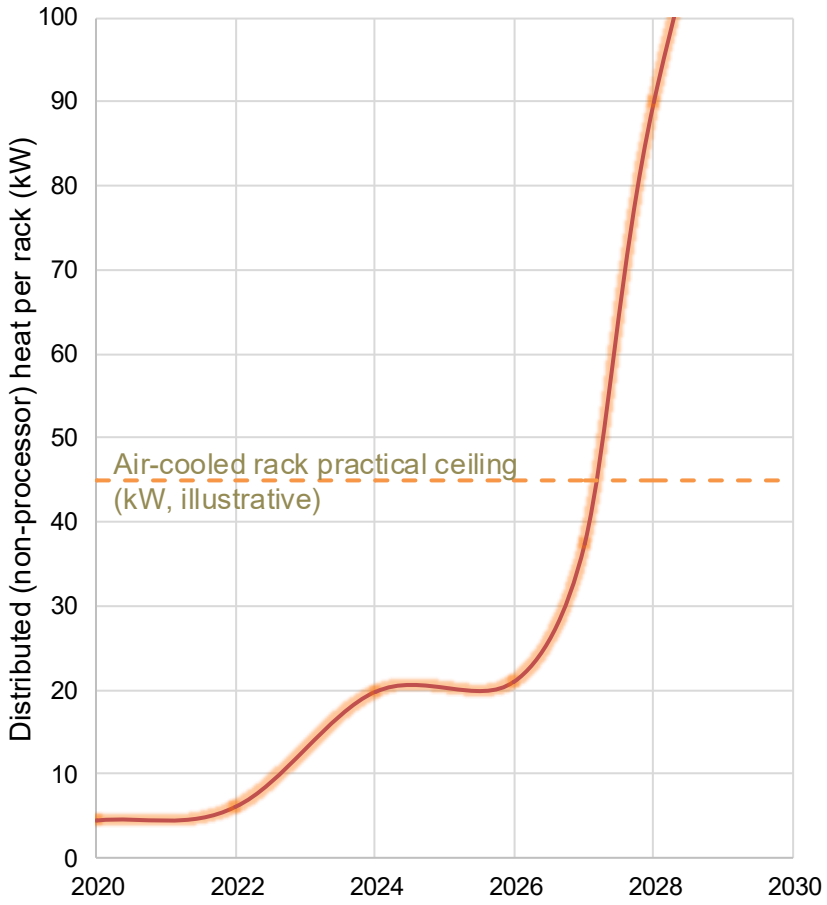
Cold plate was pushed	Immersion is pulled
Air hit its physics wall on the hottest devices — there was no choice. Overnight default; the scramble that followed is preparation debt, paid in public.	It answers the distributed load, reliability, and the facility's power and space scarcity. No wall forces a date; economics pull — and pulled transitions are gradual and uneven by nature.

A pulled transition does not announce a deadline. It arrives account by account, workload by workload.

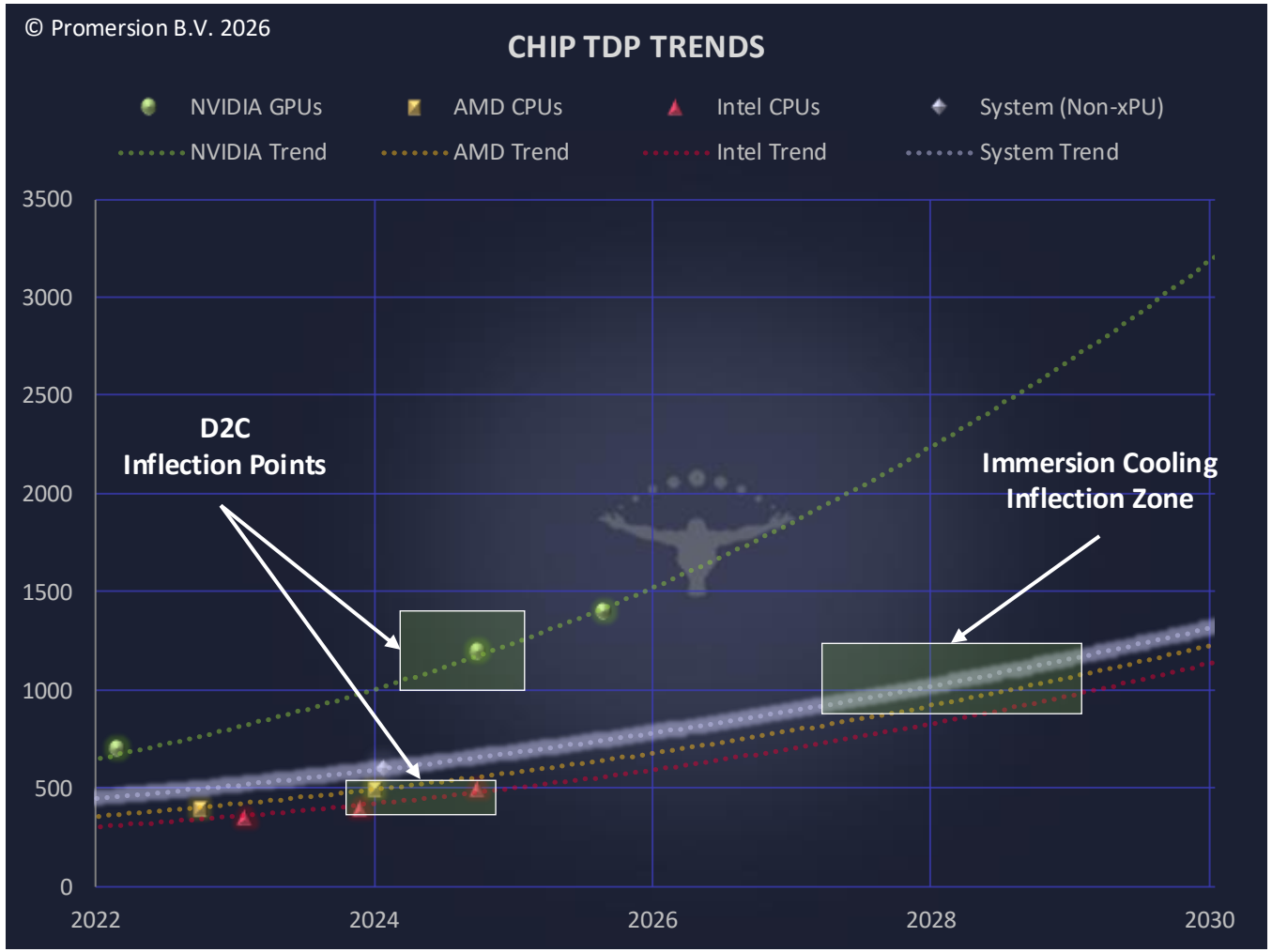
Same law, two forcing functions. The absence of a single visible commitment moment is what a pulled transition looks like from outside.

The load left behind





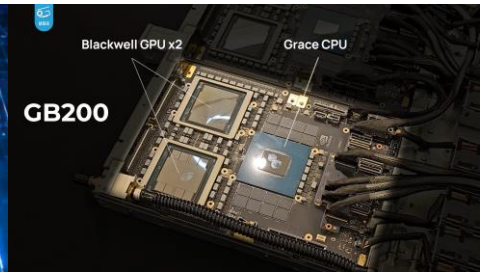
Inflection Points



D2C Drivers

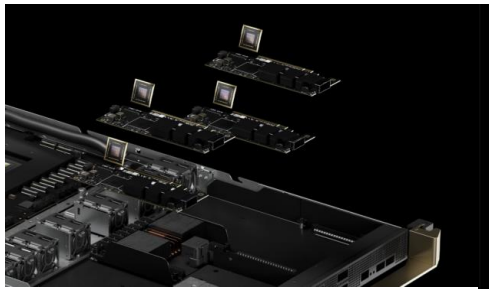


CPUs

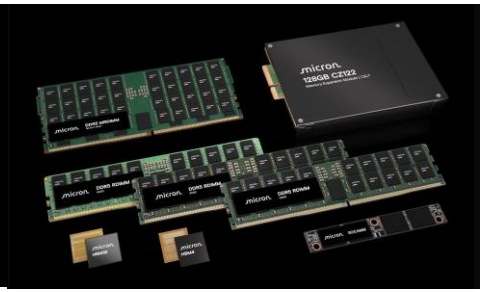


GPUs

Immersion Drivers



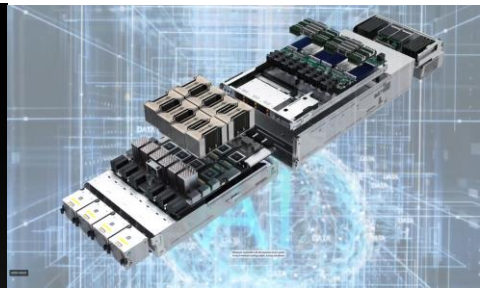
High Bandwidth NICs



Memory

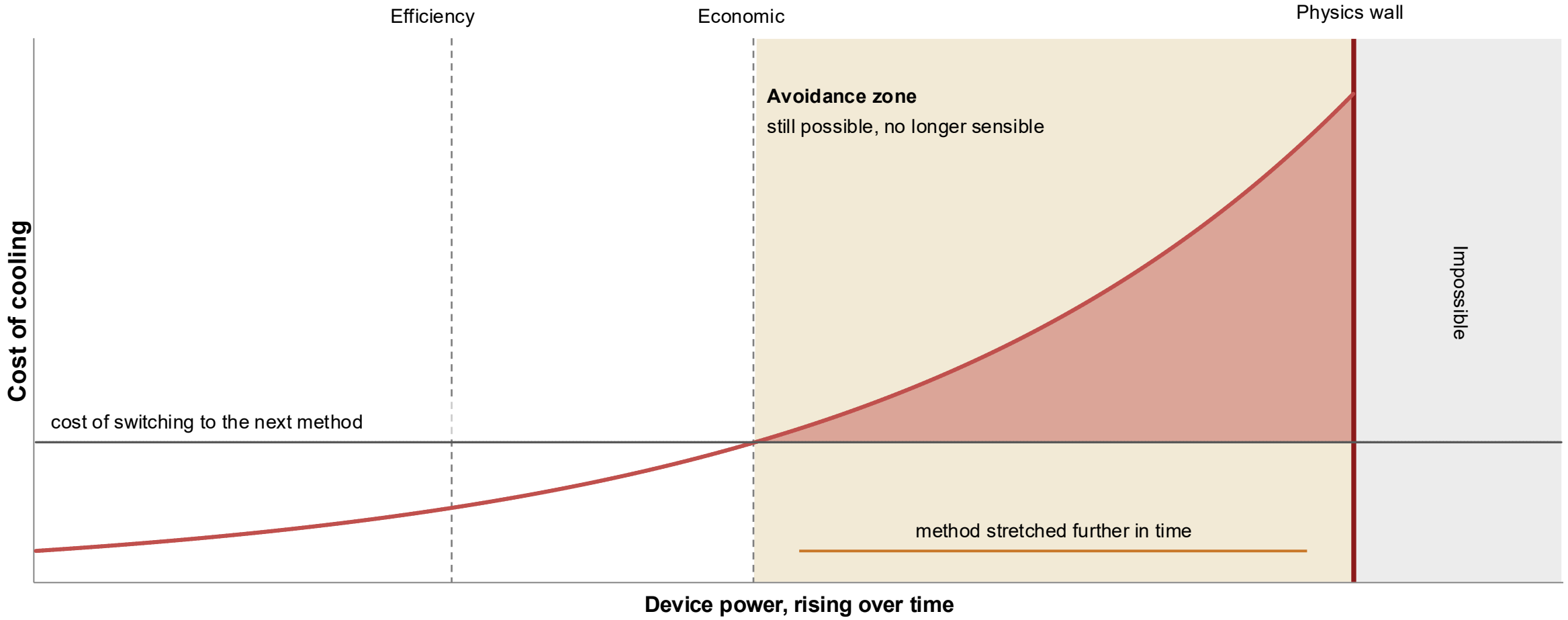


SSD Storage



Power Delivery

The avoidance debt



The avoidance debt accrues in five accounts

Reliability — the account the paper quantifies

1.45x

Yesterday: the design point

GPUs plated, six couplings per tray. The junction dividend outweighs the plumbing.

0.96x

The fully plumbed tray

Eleven assemblies against the eight the dividend buys. The advantage is spent.

0.72x

At field coupling rates

Two dozen couplings at stress rates: forty percent more failures than air.

The accounts every designer feels

Weight

Plates, manifolds and fluid add kilograms per tray — rack statics, shipping and handling inherit it.

Chassis real estate

Plumbing competes with IT for the same volume: space for hoses and fittings is space not spent on memory, network or airflow.

Serviceability

Every fitting is a touchpoint behind a disconnect. Access shrinks as coverage grows — the simple, serviceable argument erodes.

The fifth account is charged to the next method. Deferral denies immersion its organic maturation — design-for-purpose, reference chemistry and supply depth only come with adoption. That is the preparation debt, and it comes due all at once.

One stretch, five accounts: reliability, weight, space, serviceability — and the readiness of what comes next.

Immersion reliability: the headlines

3.4–5x

Model floor

the paper's mechanism-share model, conservatively read

up to 12x

Fleet observation

3,000+ immersion-cooled servers over 30 months — OCP EMEA 2025

1/8th

The Natick anchor

nitrogen atmosphere and no handling alone gave one-eighth land-based failures

Why the gain is different in kind: the bath removes failure mechanisms from every component at once — thermal cycling, vibration, dust, oxygen and moisture.

The pump and filtration skid is counted exactly like a CDU: the comparison is symmetric, the mechanisms are opposite.

The bracket is open on purpose. The gap from floor to ceiling is this community's data to close.

The strings an OEM actually sees

No reference fluid. Every program re-validates chemistry against fluid, polymers, metals and markings — pilot-stage cost per SKU.

The seam moves inside. The tank crosses acquisition into transport: one co-designed product, fewer standard interfaces — complexity where standards reach last.

The loop. Design-for-purpose comes with adoption; adoption waits while cold plate can still stretch; the deferral holds back the very maturity it waits for.

Plugging into what is already there is rational. Cold plates on SSDs and NICs became routine for exactly that reason.

The fundamentals are moving anyway

3–5x floor · up to 12x

Relative MTBF vs air: the paper's modelled floor — and this community's 3,000+ server fleet observation.

Lowest cost per year

Worked 200 MW AI case: immersion's total annual cost is lowest — and reliability is half the advantage.

One PO vs a 15-year clock

Immersion's cost sits on one visible purchase order; its savings sit in someone else's facility budget.

250 kW → 600 kW

Rack power shipping → announced. Power and space scarcity pull the volume method.

Our job is not to argue the ecosystem onto immersion. It is to have the ecosystem ready when the economics force the question. That is the roadmap.

Roadmap to 2030

Phase 1: Standardization and Interoperability (2025-2027)

Accelerating the standardization of immersion cooling to avoid fragmentation and reduce operational risks.	Interoperability between cooling solutions and IT equipment is key, as lack of compatibility will hinder scaling.

Phase 2: Industrialization and Supply Chain Readiness (2027-2028)

Immersion technologies must be readily available, cost-competitive, and supported by the ecosystem of suppliers and service providers.	Data center operators must begin integrating liquid-ready designs into new facilities and retrofitting existing spaces where possible.

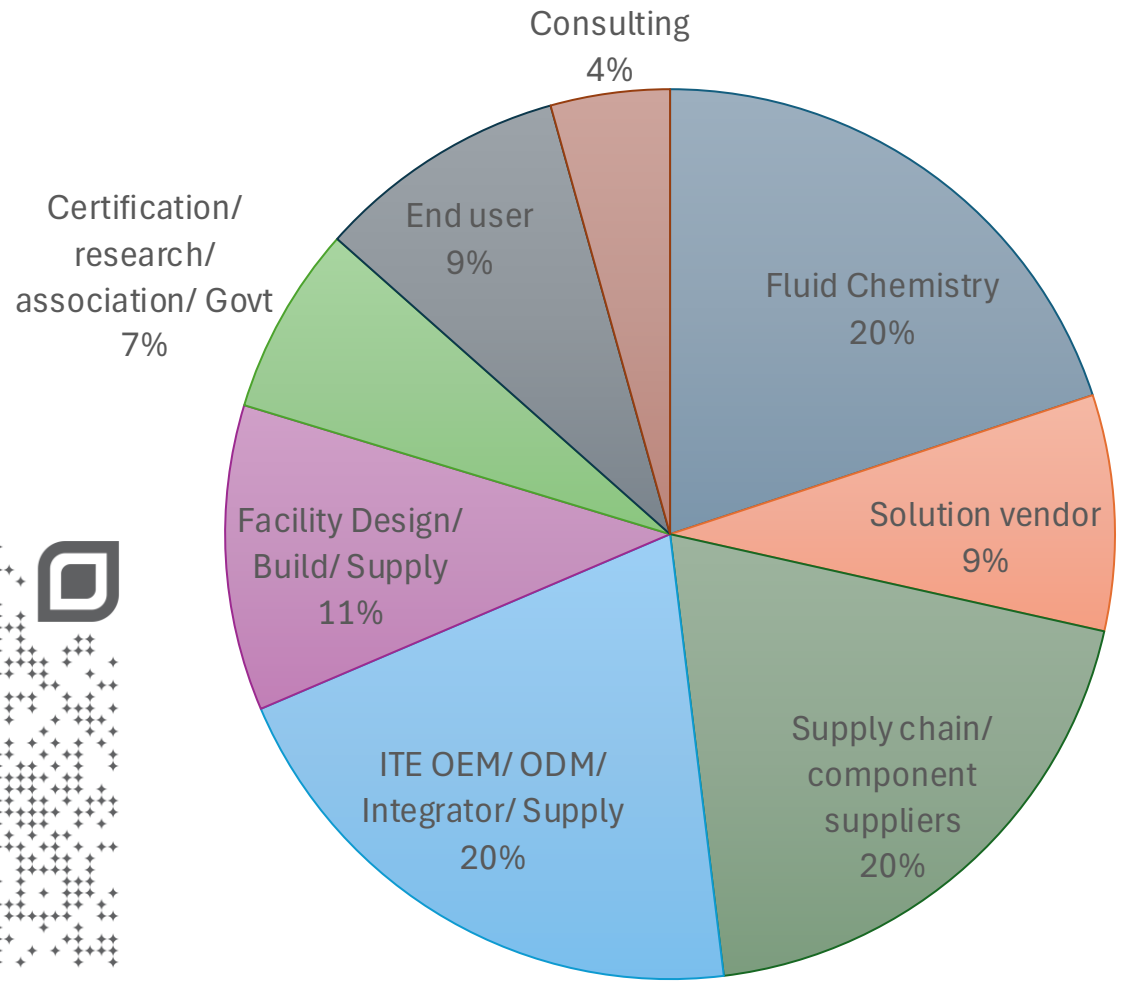
Large-Scale Deployment and Market Shift (2029-2030)

Immersion forced to move beyond early adopters and become mainstream solution for AI, HPC, and high-power-density applications	Hybrid solutions play a key role with a mix of air, liquid, and immersion technologies

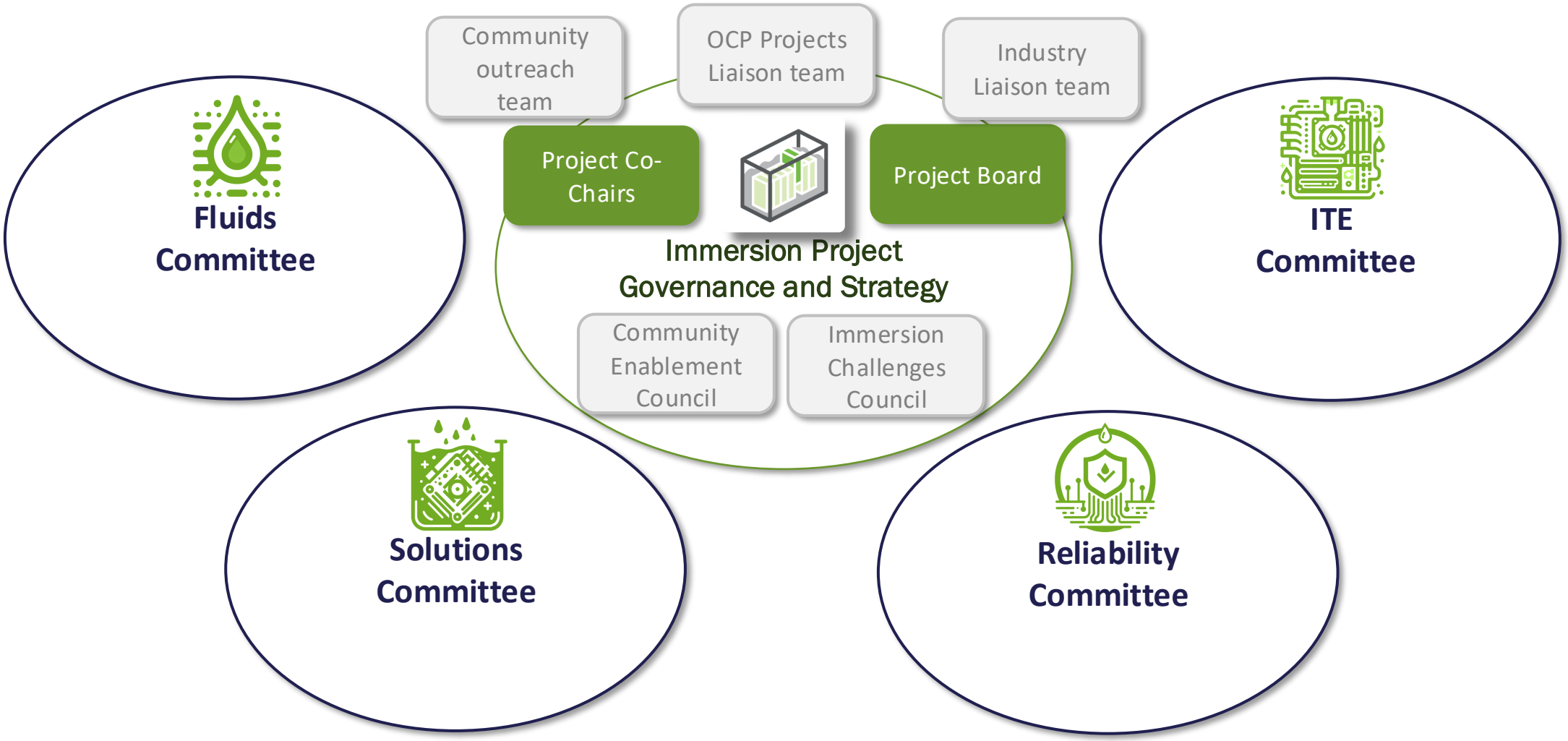
Immersion Project: Updated Quick Stats

- **15** active parallel workstreams
- **4** technical committees providing support and oversight
- **3** active support teams
- **35** active volunteer leaders
- **1342 unique participants**
- 1014 LinkedIn Group Members





Immersion Governance Model



Project Board Role

Project Board

Strategic Leadership: Provide strategic guidance and leadership to ensure that the project's activities and goals are aligned with the overarching objectives of OCP **and the needs of the industry**.

Oversight and Coordination: Oversee the project's operations, ensuring effective coordination between different committees and teams to **maximize efficiency and impact**.

Decision Making: Make key decisions regarding project direction, resource allocation, and priorities based on input from technical committees and **feedback from the community**.

Quality and Standards Assurance: The committee is responsible for approving all materials intended for publication and ensuring that the outputs of the project, such as standards, best practices, and research, meet high-quality standards and are **relevant to industry needs**.

Project Board

Project Board

Project Leadership

Project Chairs
Rolf Brink (Promersion)
Jessica Gullbrand (Eaton)

Support Teams

CE Representation
Steve Mills (Meta)
CE Leadership Team

Community Outreach
Allison Boen (Alcatex)
Rachel Bielstein (BAC)

Technical Committee Chairs

Community Enablement
Gemma Reeves (Alfa Laval)

Industry Liaison
Kelley Mullick (Avayla)
Maryam Mohagheghi (HF Sinclair)

Technical Committees

ITE
Austin Hipes (Unicom)

Fluids
Kris Fletcher (Analog Devices)
Spencer Kerns (CPChem)

Solutions
Amy Short (Denvr Dataworks)
Kevin Gero (Murata)

Reliability
Samantha Yates (Intel)
Brian Kinkade (Fuchs)

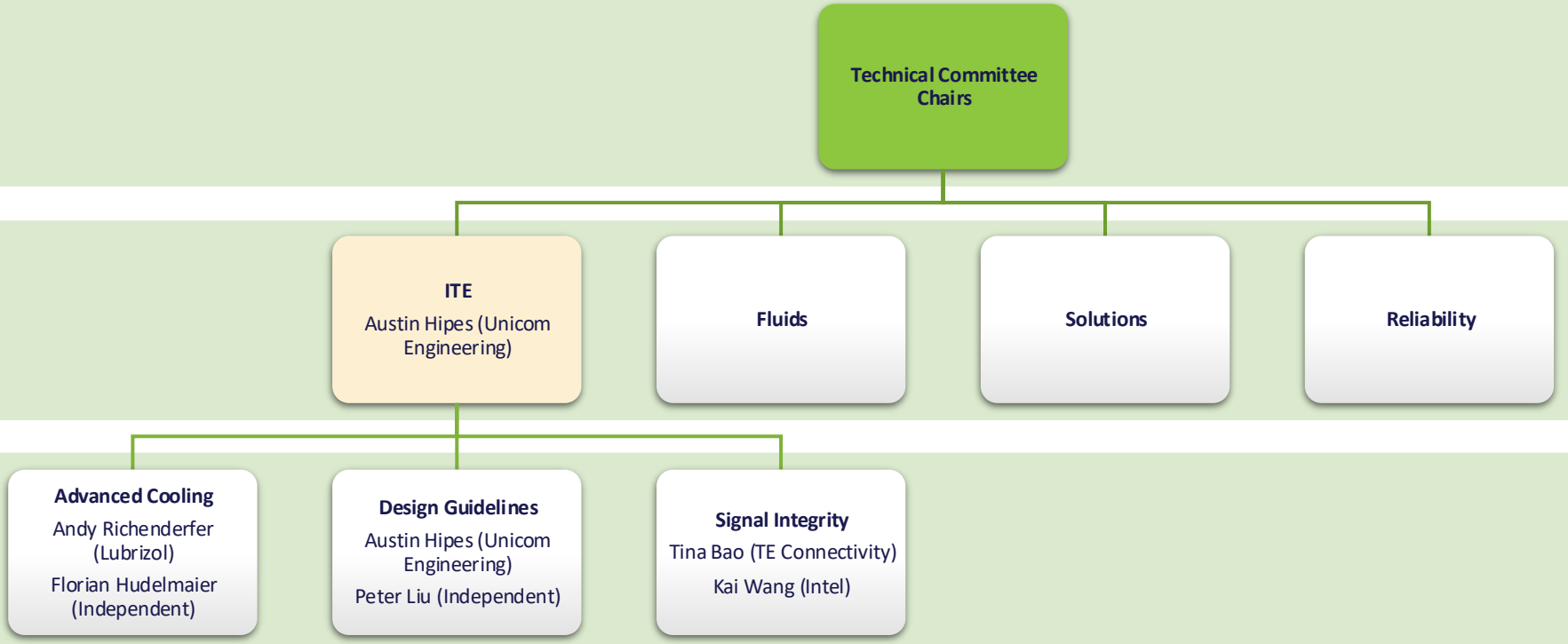
Workstreams

Project Board

Project Board

Technical Committees

Workstreams



Workstreams

Project Board

Project Board

Technical Committee Chairs

Technical Committees

ITE

Fluids
Kris Fletcher (Analog Devices)
Spencer Kerns (CPChem)

Solutions

Reliability

Workstreams

Fluid Cleaning Guidelines
Roma Suris (Submer)
JanElsa Carty (Shell)

Fluid Lifecycle Management
Alex McManis (Eneos)

Oxidation Methodology
Spencer Kerns (CPChem)
Vanja Boyd (ExxonMobil)

Specifications
Kris Fletcher (Analog Devices)
Peter Cooper (Promersion)

Workstreams

Project Board

Project Board

Technical Committee Chairs

Technical Committees

- **ITE**
- **Fluids**
- **Solutions**
  - Amy Short (Denvr Dataworks)
  - Kevin Gero (Murata)
- **Reliability**

Workstreams

- **FMEA**
  - Nicholas Beardsley (GRCooling)
  - Khaled Morsy (Independent)
- **Hardware Management**
  - Mick Jones (Vertiv)
- **Immersion Requirements**
  - Amy Short (Denvr Dataworks)
  - Peter Cooper (Promersion)
- **Power Distribution**
  - Oriol Chavanel (Hypertec)
  - Kevin Gero (Murata)
- **TCO**
  - Andy Young (Asperitas)
  - Eduard Roytman (Microsoft)

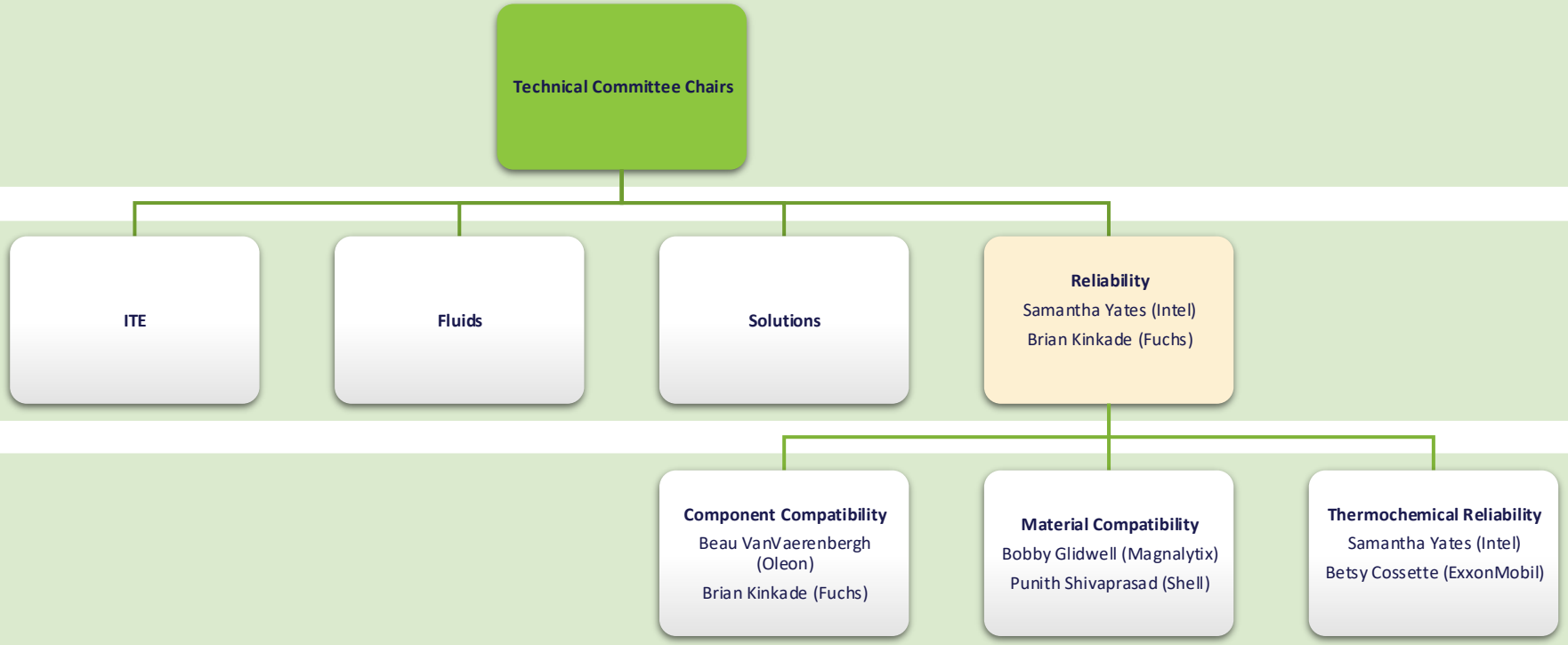
Workstreams

Project Board

Project Board

Technical Committees

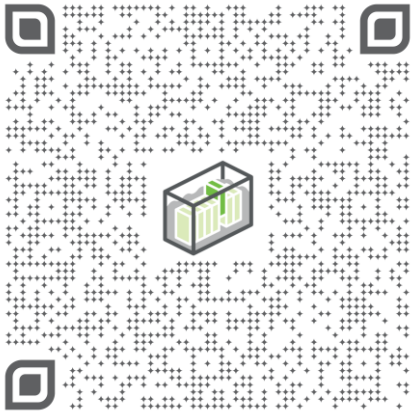
Workstreams



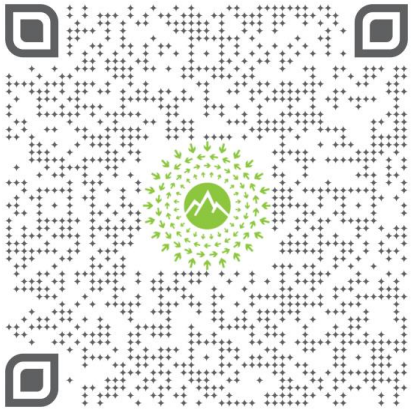
2026 Immersion New Contributions

Project Board

- Released:
  - Server Component Immersion Material Compatibility Testing
  - Thermal Boundaries in AI Infrastructure
- In Approval Process
  - Safe Handling Guidelines for Immersion Fluids
  - High-Speed Interconnect Signal Integrity in Immersion Cooling
- Open Source Material Compatibility Database
  - Open access interactive database
  - Progressed and maintained by the Reliability Committee Workstreams
  - Community provided data set, open for additional inputs! (self-certified)



Server Component Immersion Material Compatibility Testing



Thermal Boundaries in AI Infrastructure

OCP Material Compatibility Database BETA

Open source wetted material interactions for dielectric immersion cooling.

Database | Heatmap | Compare | Build Advisor | Insights | Reference

Beta — Community-Sourced Information. For informational screening only: risk levels are a starting point for engineering judgment, not a pass/fail verdict.

Search: Material or keyword | Application Category: All applications | Material Class: All classes | Fluid family: All fluids | Compatibility: All risk levels | Failure Mechanism: All mechanisms

570 records | Material A–Z | Reset sort | Compact | Comfy

Material	Class / Sub-type	Fluid Family	Compatibility	Properties	Mechanisms
ABS Connectors, Housings & Rigid Parts	Thermoplastic ABS	Biobased Renewable Hydrocarbon Single-Phase	✓ Low Risk	Not specified	—
ABS Connectors, Housings & Rigid Parts	Thermoplastic ABS	Natural Esters Single-Phase	✓ Low Risk	Not specified	—
ABS Connectors, Housings & Rigid Parts	Thermoplastic ABS	Perfluorocarbons (PFCs) Two-Phase	✓ Low Risk	Not specified	—
ABS Connectors, Housings & Rigid Parts	Thermoplastic ABS	Synthetic Esters Single-Phase	▲ Elevated Risk Environmental Stress Cracking	Not specified	Environment
ABS Connectors, Housings & Rigid Parts	Thermoplastic ABS	Synthetic Hydrocarbons (GTL) Single-Phase	✓ Low Risk Not tested; based on the experience	Dimensional change, weight change, shore hardness, fluid properties	—
ABS Connectors, Housings & Rigid Parts	Thermoplastic ABS	Synthetic Hydrocarbons (PAO) Single-Phase	— Not Tested Not tested	Not specified	—
Acetal Copolymer (Ertacetal C) Connectors, Housings & Rigid Parts	Thermoplastic POM-C	Biobased Renewable Hydrocarbon Single-Phase	✓ Low Risk Not bench tested; based on the experience and literature data	Not specified	—
Acetal Copolymer (Ertacetal C) Connectors, Housings & Rigid Parts	Thermoplastic POM-C	Natural Esters Single-Phase	✓ Low Risk	Not specified	—
Acetal Copolymer (Ertacetal C) Connectors, Housings & Rigid Parts	Thermoplastic POM-C	Perfluorocarbons (PFCs) Two-Phase	✓ Low Risk	Not specified	—
Acetal Copolymer (Ertacetal C) Connectors, Housings & Rigid Parts	Thermoplastic POM-C	Synthetic Esters Single-Phase	✓ Low Risk	Not specified	—
Acetal Copolymer (Ertacetal C) Connectors, Housings & Rigid Parts	Thermoplastic POM-C	Synthetic Hydrocarbons (GTL) Single-Phase	✓ Low Risk Not tested	Dimensional change, weight change, shore hardness, fluid properties	—

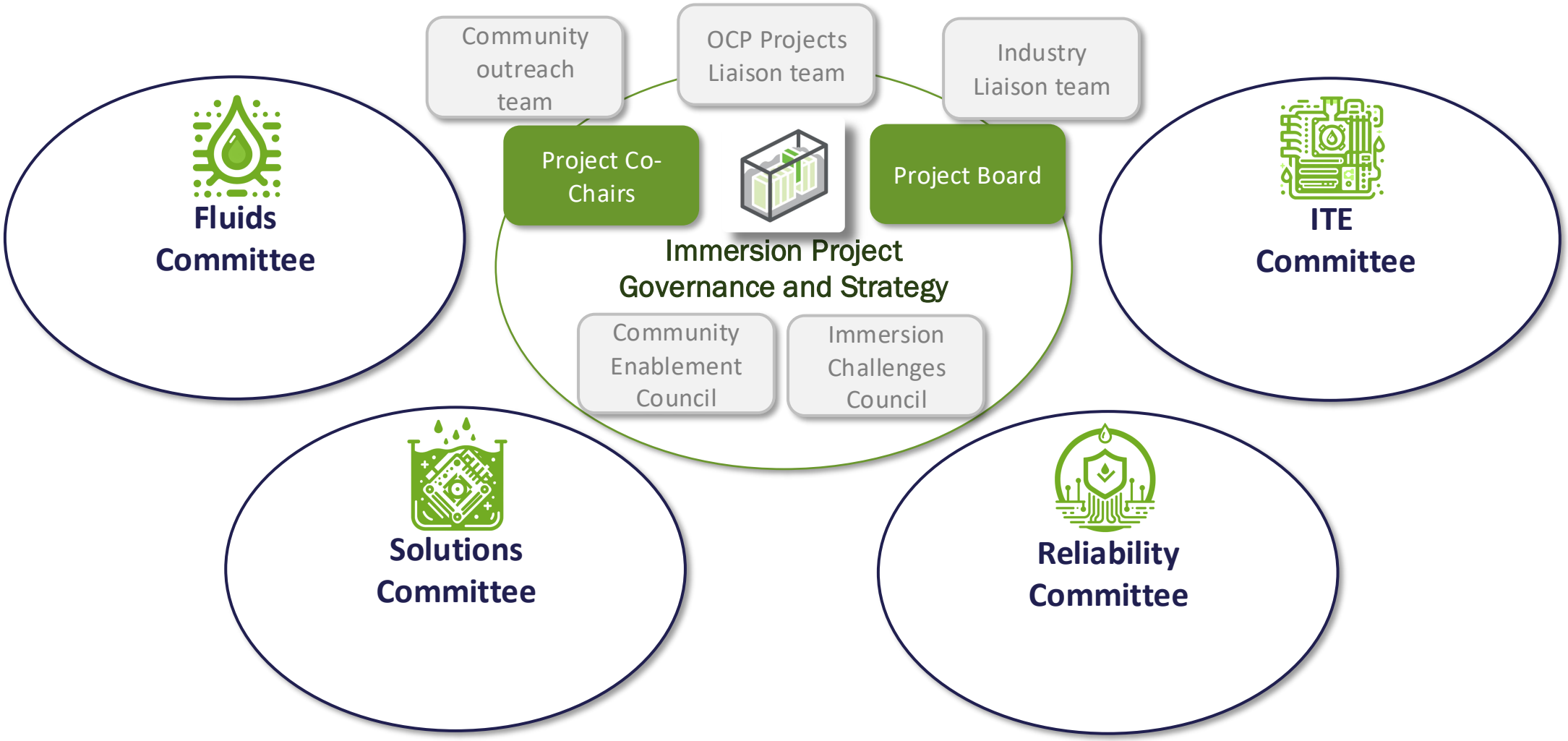
Project Board

Open Source Material Compatibility Database

https://ocp-material-compatibility-tool.sintex.workers.dev/

SCAN ME

Immersion Governance Model





Community outreach team

RSVP NOW!

https://dcoffsiteevents.com/forever-fluid-ocp

Invited by:
"LIVE during OCP"

OCP GLOBAL SUMMIT | 2026

Scaling Innovation for the AI Era.

Community outreach team

THE VENUE

Scott's Ballroom at the *Rotary Summit Center.*

88 S 4th St, 7th Floor
San Jose, CA 95112

Please use the North side elevator to the 7th floor.

GET DIRECTIONS →

DATE	TIME	EVENING
Wednesday, October 14, 2026	7:30 - 10:30 PM	Drinks, light bites, conversation

GOLD

SUPPORTING SPONSORS

Shell

As AI and high-performance computing drive unprecedented growth in data centers, cooling has become mission critical. At Shell, we offer a full portfolio of cooling fluids designed to support next-generation data centers, from immersion cooling to direct liquid cooling and supporting services solutions. Our portfolio helps customers reduce water usage, lower noise, improve reliability, and unlock higher computing performance for data centers of tomorrow.

VISIT SITE →

Unicom Engineering

Purpose-built application platforms, appliances, and lifecycle deployment services for edge, AI, and data center builds.

VISIT SITE →

Castrol

Castrol ON liquid cooling fluids for both direct-to-chip and immersion applications, tuned for thermal efficiency and reliability.

VISIT SITE →

Shield by Guardian

A complete liquid cooling fluid management program: testing, preventative maintenance, leak detection, commissioning, and 24/7 monitoring.

VISIT SITE →

2CRSI x NVIDIA

High-density server platforms for AI and HPC workloads, including immersion-ready systems built around NVIDIA accelerators.

VISIT SITE →

PLATINUM

Johnson Controls

A global leader in thermal management and mission-critical building systems, with cooling, efficiency and reliability engineered from chip to chiller.

VISIT SITE →

Airsys

Engineered, sustainable cooling for mission-critical environments. Its PowerOne line is built for the ultra high-density IT loads that AI and HPC demand.

VISIT SITE →

SILVER

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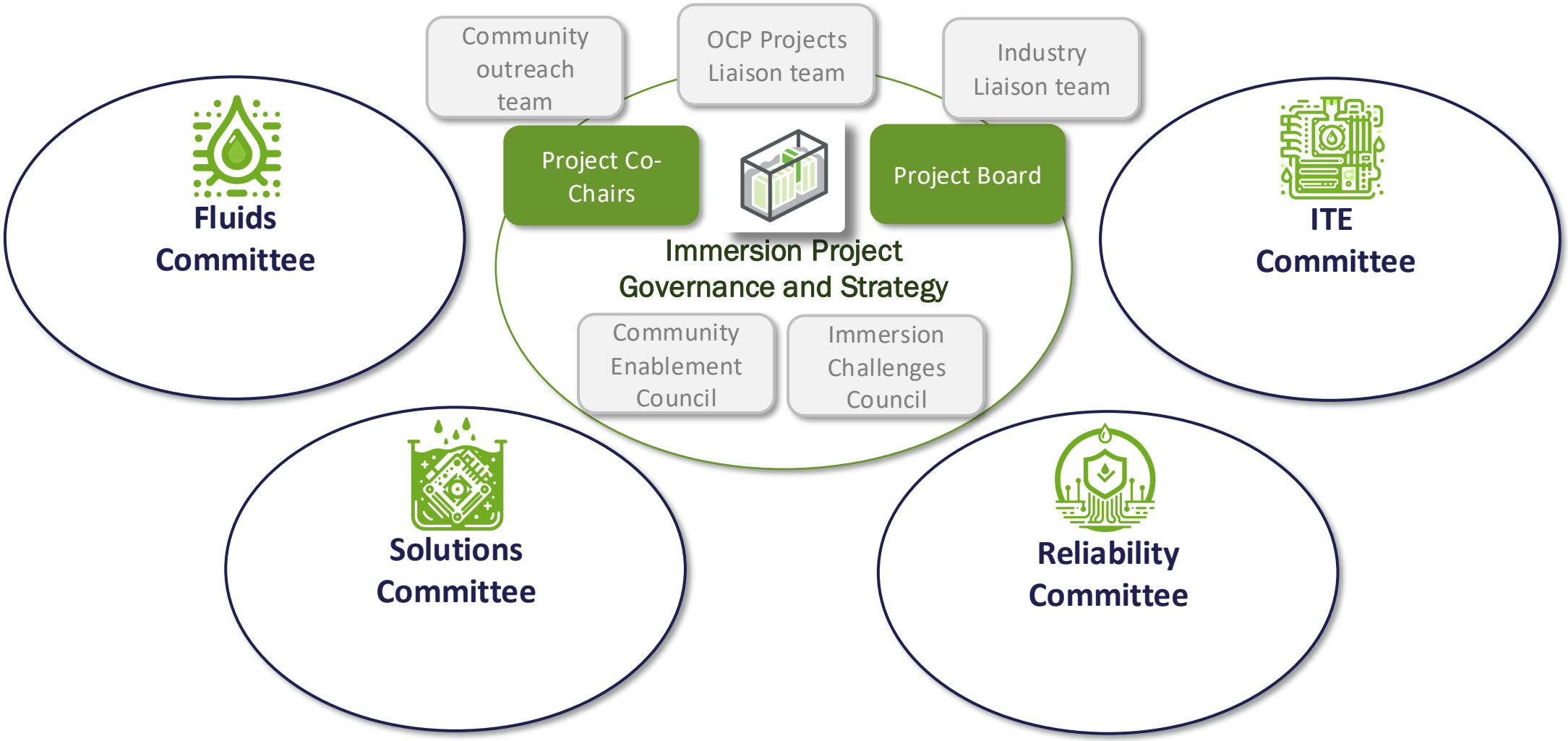
Community outreach team



UNTITLED SUPPER CLUB

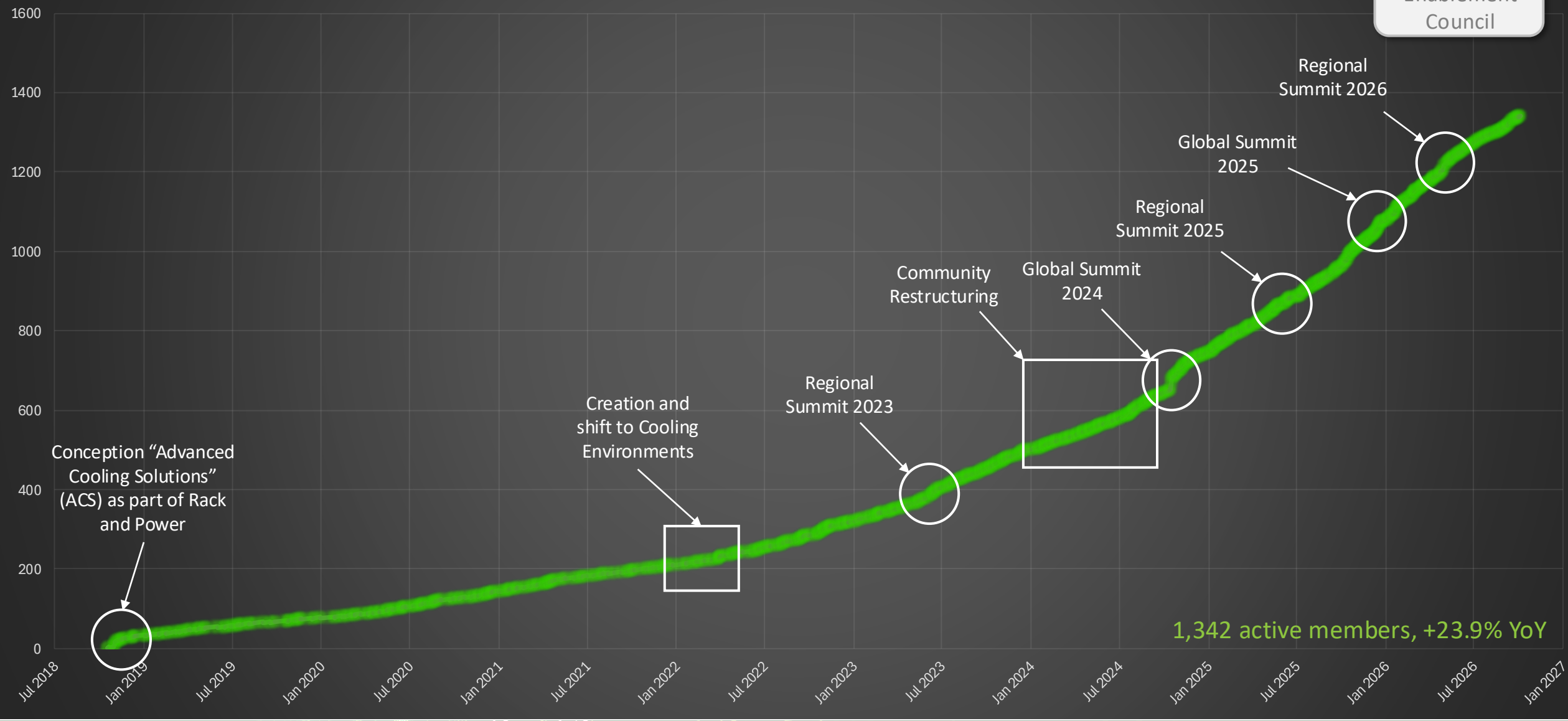
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Immersion Governance Model



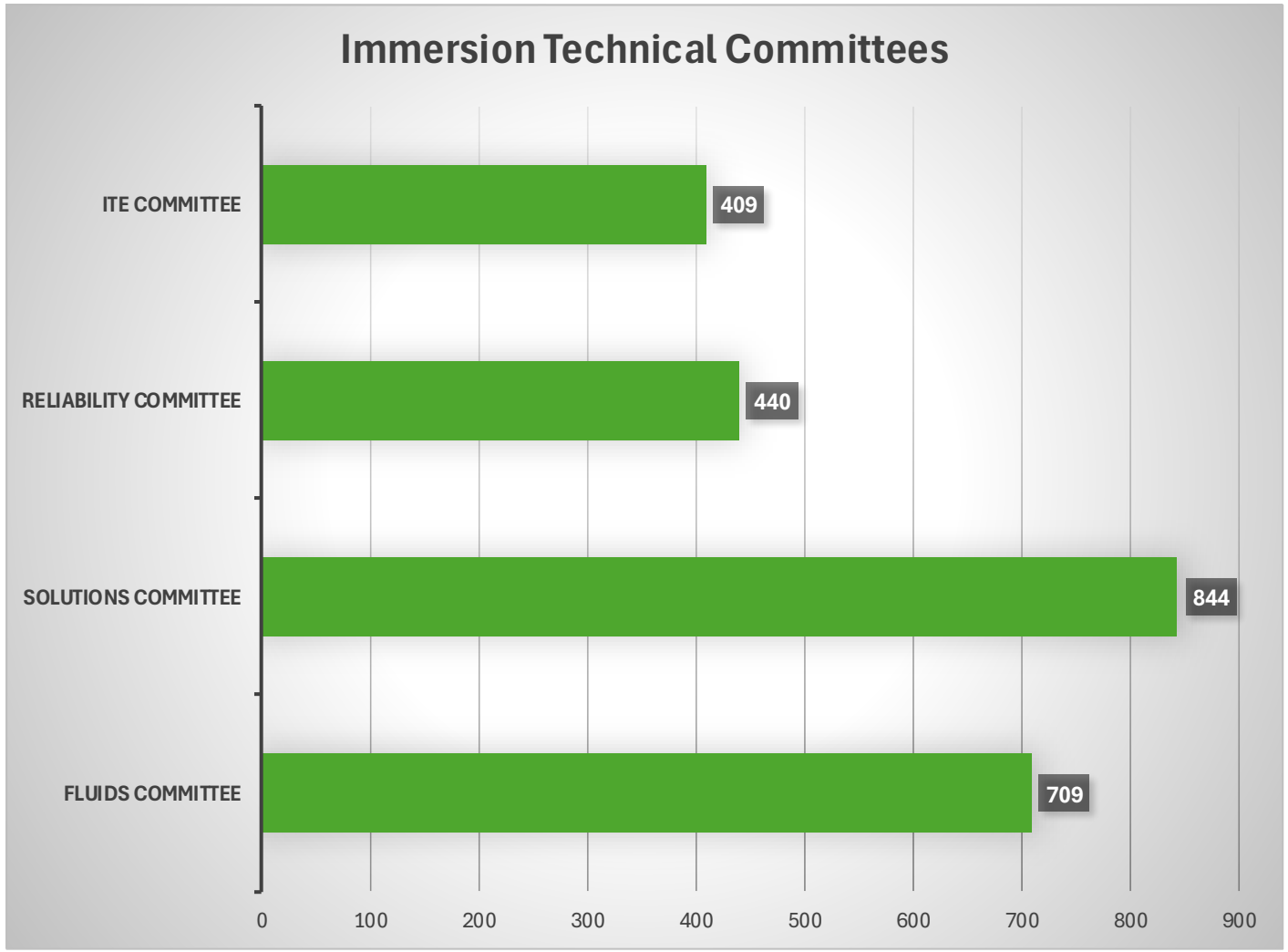
IMMERSION COMMUNITY MEMBERSHIP GROWTH

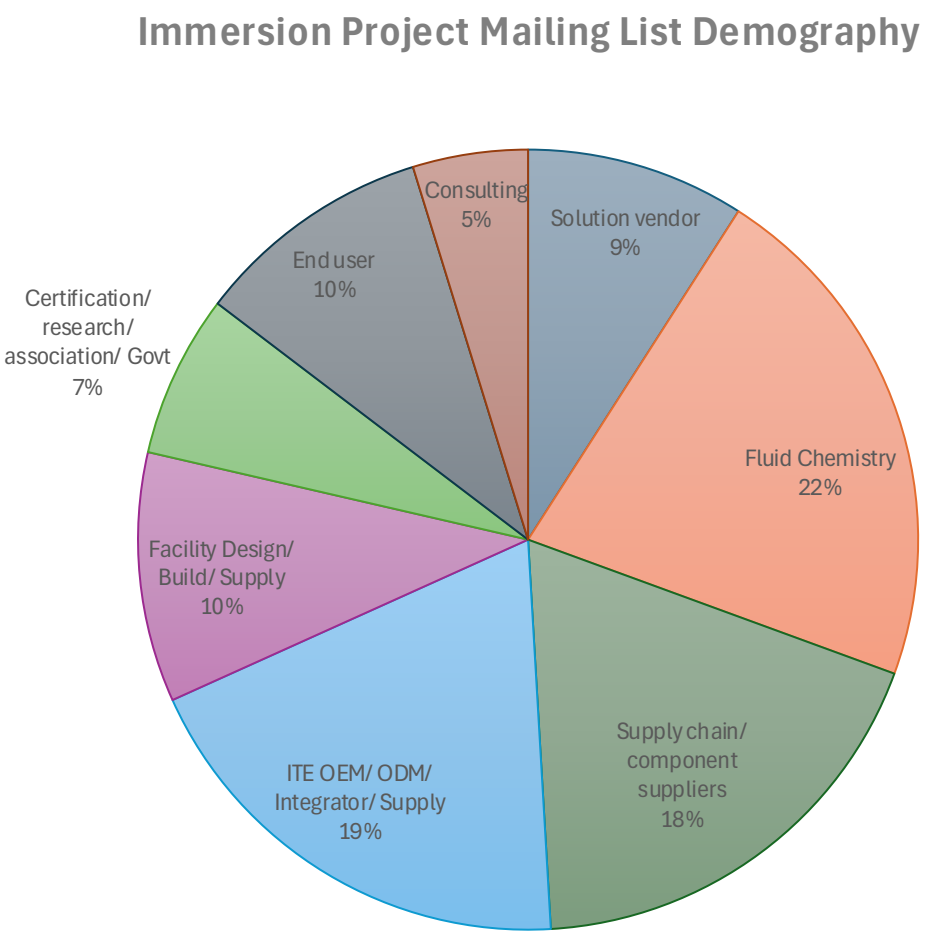
Community Enablement Council



OCP Immersion Project Quick-stats March

Community Enablement Council





Community Enablement

Community Enablement Council

GS-year	Total reach	Net growth	First-time joiners	Drop-offs	Growth %
GS 2021	288	—	—	—	—
GS 2022	364	+76	102	26	+26.4%
GS 2023	559	+195	232	37	+53.6%
GS 2024	787	+228	264	36	+40.8%
GS 2025	1,101	+314	422	108	+39.9%
GS 2026	**1,342**	**+241**	**427**	**186**	**+21.9%**

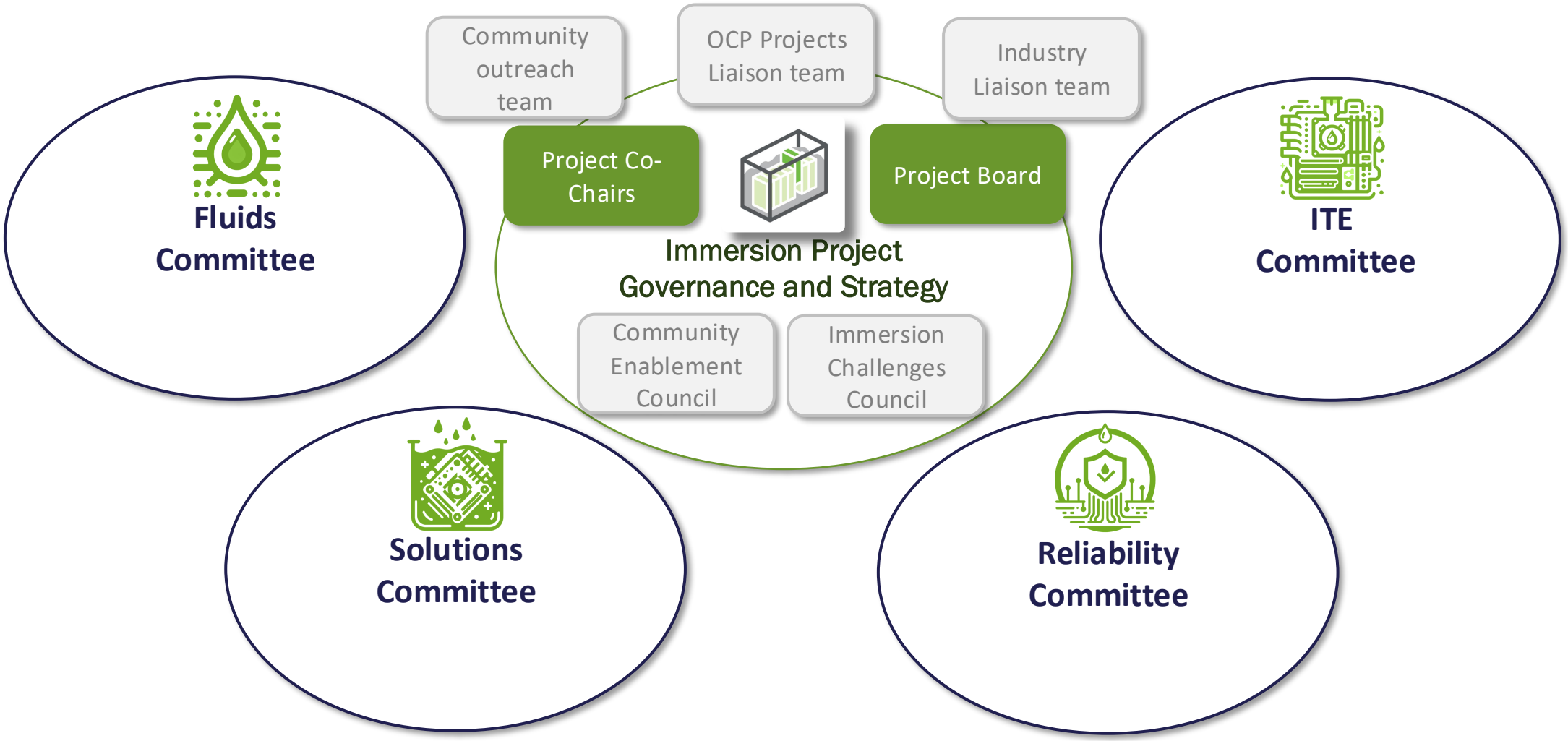
Come and speak to me in person about the OCP Immersion community and how to get involved;

- Supercompute Chicago : 15th-20th November
- Data Centre Forum Stockholm: 3rd December
- Others TBC



Gemma.Reeves@ocproject.net

Immersion Governance Model



Call to Action

- Join the Immersion project
  - Subscribe to the mailing list
  - Join the project, workstreams, and engage with the community
    - Project community call monthly every 3rd Tuesday of the month
    - Check the wiki page for all workstreams and activities
- Do you have any questions?
  - Reach out to Rolf and Jessica for any enquiries
  - How to participate and contribute: Gemma Reeves
  - Driving standards with industry liaisons: Kelley and Maryam
  - Helping to promote with community outreach: Allison and Rachel

mailing list

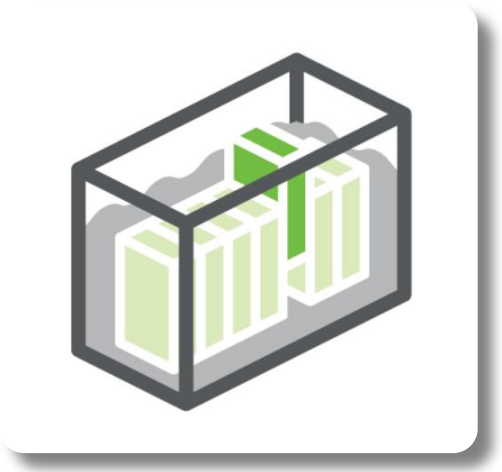
WIKI

Participate by Subscribing to the Mailing Lists

Immersion Project

Fluids Committee

ITE Committee



Reliability Committee

Solutions Committee

Challenges

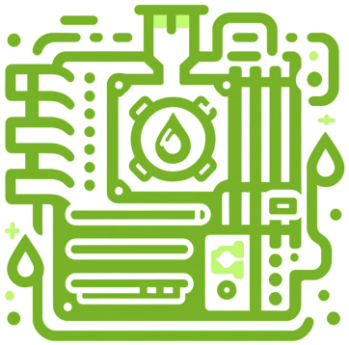
Industry Liaison Team

Immersion Mailing Lists: Fluids & ITE

Fluids-Cleaning Guidelines

Fluids-Lifecycle Management

Fluids-Oxidation Methodology



ITE-Advanced Cooling Techniques

ITE-Design Guidelines

ITE-Signal Integrity

Immersion Mailing Lists: Solutions

Solutions-FMEA



Solutions-Hardware Management

Solutions-Immersion Requirements

Solutions-Power Distribution

Solutions-TCO

Immersion Mailing Lists: Reliability

Reliability-Component Compatibility

Reliability-Thermochemical Reliability

Reliability-Material Compatibility

Thank You!

