FALL2025

Glass Manufacturing Cold Tank Repair

Benchmarking Study

www.ap-networks.com

Study Objectives and Scope

AP-Networks is conducting a study into the Cold Tank Repair (CTR) performance of glass manufacturing plants. Invited study sponsors include plant owner-operator organizations. The study is being conducted by AP-Networks, Industry's premier independent capital project benchmarking and assessment firm. AP-Networks will facilitate the study, conduct analysis, and serve as the custodian of study data. Confidentiality agreements will protect sponsor data, and collected data will be evaluated and benchmarked using the AP-Networks Capital Project Database. This is the most comprehensive database of practices and outcomes available in Industry, containing data from more than 3,000 unique projects executed worldwide.

The study will provide sponsor organizations with a set of holistic project benchmarks for their plant type, along with insights into project cost performance trade-offs. The study will evaluate detailed cost components, as well as safety, scope, duration, interval between CTRs, and other performance measures.

AP-Networks will employ a standardized benchmarking data collection tool to collect sponsor data. Study sponsors will independently provide CTR performance data from their respective organizations, with key project representatives participating in data and practices validation. With this input, AP-Networks' analysis team will identify the effective cost-related practices utilized by high-performing project teams.

AP-Networks will facilitate the study design, ensure alignment with Industry standard definitions, collect and verify the data, and interface with each CTR organization. AP-Networks will then prepare and deliver a custom report to each study sponsor detailing the sponsor company's competitive position relative to Industry cost performance. Furthermore, each report will identify specific differences in cost components and practices and provide observations and actionable recommendations to drive improved performance.

Objectives

- Identify specific practices that owners can employ to reduce CTR costs.
- Rank CTR performance by quartile against industry competitors.
- Identify levers that drive cost efficiency and performance improvements, based on empirical data.

Study Workflow

1. AP-Networks will facilitate individual sponsor review of the study components.
2. AP-Networks will utilize our custom data collection instrument and study plan
3. Each study sponsor will provide their own set of data.
4. AP-Networks will analyze compiled data using statistical tools
5. AP-Networks will prepare and deliver custom reports for each study sponsor.

Process Units Included

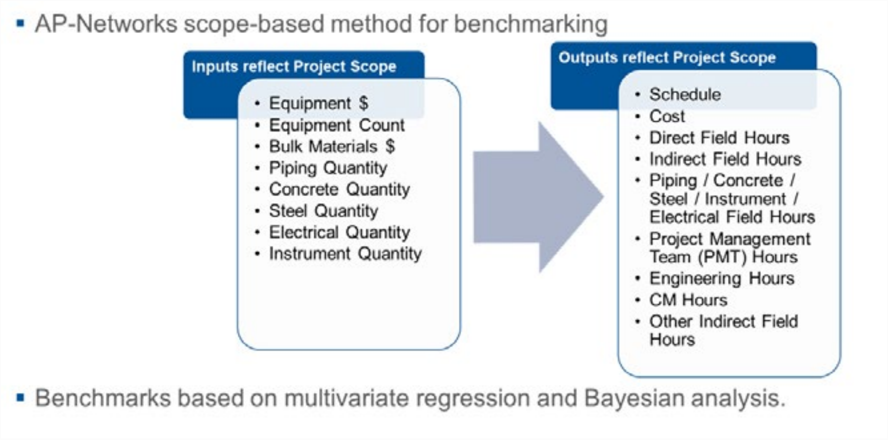
Units involved in the benchmarking study include, but are not limited to:

- Batch House
- Furnace
- Tin Bath
- Annealing Lehr
- Cutting and Capping Line
- Utilities
- Float Buildings

AP-Networks Capital Project Database and Study Design

Measuring and tracking CTR performance is essential for long-term operational success. AP-Networks' database of more than 3,000 Capital Projects containing information on planned and actual project outcomes, key characteristics, and planning and execution practices that are correlated with outcomes. Data analysis facilitates the insights into causal factors behind success and failure and allows capital projects to be benchmarked against Industry average and top quartile performance. It also allows for the identification of demonstrated practices that lead to successful outcomes.

This study will separate uncontrollable and controllable factors. AP-Networks will weigh their individual criticality by applying statistical analysis tools to the compiled data, focusing on critical factors, leading indicators, and best practices specific to glass manufacturing plants and their challenges.



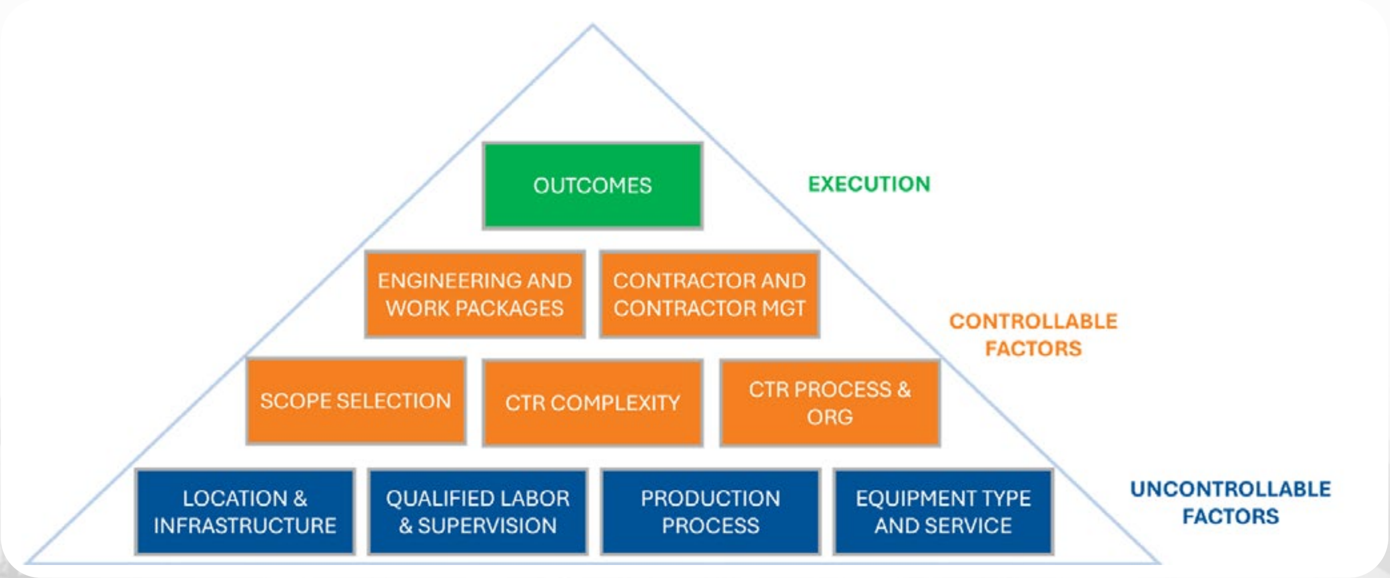
Study Factors

The Study will investigate and adjust for CTR indicators associated with uncontrollable factors such as:

- Location and Infrastructure.
- Availability of qualified labor and supervision.
- Production process, equipment size, and type of service.
- Process flow diagrams.

...and controllable factors such as:

- CTR interval and size.
- Scope characteristics and key ratios.
- CTR organization and staffing.
- CTR work process.
- Planning practices and standards.
- Budgeting and estimating practices and standards.
- Contracting and contractor management practices.
- Continuous improvement, performance management, and learning.

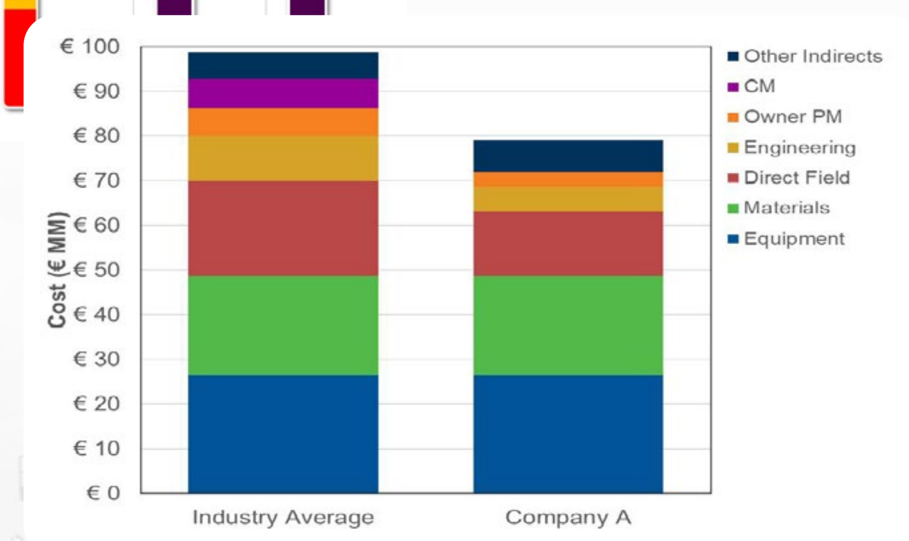


What is Involved?

Sponsor organizations will be required to provide CTR performance data to AP-Networks for analysis. AP-Networks will validate this data to ensure compliance with the study's standardized definitions. Required sponsor steps include:

- Review the benchmarking code of conduct and complete an agreement that ensures confidentiality of all study data.
- To participate, each sponsor must complete the standardized data collection survey for each CTR in the study. All sponsors must contribute data to ensure equitable participation in the study.
- Make key CTR representatives available for the submission and validation of CTR performance and practice data.

Confidential reports will be customized for each sponsor. Each report will provide an "apples-to-apples" comparison of component cost performance for the sponsor group and Industry. All individual sponsor data is blinded and cannot be viewed by any other sponsor organizations.



Study Deliverables

- Complete list of study sponsors and CTRs included in the study and the statistical sample.
- Customized benchmarking data collection tool designed for the study.
- Industry mean, average, and standard deviation values for each benchmark for the sponsor group sample of CTRs (blinded for confidentiality). List of metrics can be found at the end of this document.
- Detailed cost gap analysis: Your CTR's detailed cost performance compared to the rest of industry.
- Identified best practices and any observed association between practices and CTR performance outcomes.
- Individualized conclusions, observations, and recommendations.

Report Structure and Table of Contents

The final report will provide benchmarks for both practices and outcomes relative to the studied CTRs. The report is proposed to consist of the following sections:

Executive Summary

Key Findings

- Data Sample and Project Overview
- Insight from the AP-Networks Project Database
- Benchmarking Results: Performance Outcomes
- Cost Performance Relative to Company and CTR Averages

Cost Competitiveness

- Cost Component Breakdown
- Cost per Direct Labor Hour
- Cost Per Piece of Equipment Worked
- Cost Predictability
- Cost Predictability and Complexity
- Contingency and Discovery Allowances

Schedule

- Schedule Performance
- Schedule Competitiveness
- Schedule Component Breakdown
- Schedule Predictability

Labor Hours

- Labor Hour Growth by CTR
- Labor Hours Per Piece of Equipment Worked

Safety, Environmental & Operability

- Safety Performance
- Environmental Performance
- Operability

Benchmarking Results: Practices & Leading Indicators

- Practices and Leading Indicators
- Issuance of Engineering Packages
- Scope Freeze
- Changes to Scope
- Planned Versus Actual Equipment Count
- Scope Control Process
- Field Productivity
- Pre-CTR Work Slippage
- Adequate Resource Selection
- Timing of Awarded Contracts
- Contractor Capabilities
- Risk Management
- CTR Readiness (as available)

Summary of Findings:

- Identified Best Practices and Recommendations

Benefits to Study Participants

Each study sponsor will receive a customized performance benchmarking report comparing the sponsor's CTR performance measures to that of the aggregate sponsor group. The report will:

- Identify specific practices that owners can employ to reduce CTR costs.
- Provide a quartile ranking of CTR performance against industry competitors. This will be done at both the CTR level and the company level across a wide range of metrics.
- Identify levers that drive cost and schedule efficiencies and performance improvements, based on empirical data.

Study Pricing[1]

The study sponsorship cost is established on a per-CTR basis (as far back as 5 years) for each operating site in the study.

Company Sponsorship, one CTR Includes a customized company report	$33,000
Each additional CTR at a company (2-3)	$25,000
Each additional CTR at a company (+3)	$20,000
Each additional company CTR that has previously submitted data to AP-Networks	$15,000

Site sponsorship requires the signing of a Study Terms, Conditions, and Confidentiality agreement in order to confirm participation.

Study Schedule[2]

Study Kickoff	November, 2025
All Agreements Signed	February, 2026
Data Collection/Site Visits	March/April, 2026
All Data Submitted and Validated	May, 2026
Conclusion and Report Delivery	July, 2026

Benchmarking Case Study: Prior Consortium

Asset Performance Networks has conducted numerous consortium benchmarking studies in our history. One Consortium of a niche Industry believed their costs were not analogous to models being provided. AP-Networks' analysis showed that for regional benchmarking, there was a $40 per construction labor hour cost gap with this industry when compared to the rest of the industry in this region. But that paled in comparison to the 80 percent cost gap identified between the members of the consortium and the U.S. Gulf Coast, where a number of the corporate headquarters were located and analogs were developed.

AP-Networks' Benchmarking Study identified several factors that impact Projects to a greater degree than Projects in other regions: Reduced labor productivity, increased labor rates, high owner costs, and increased logistical costs. However, a significant portion of these factors were identified as being manageable, meaning that prudent preparation and management of field execution could have significant, positive impacts on these cost components.

The insights and recommendations provided by the Study provided sponsors with the necessary information to chart a path forward in this challenging environment.

[1] Minimum fee for study sponsorship is $33,000. Payment terms: 50 percent of total cost will be invoiced at sponsorship commitment and 50 percent at study conclusion. Any related travel costs are additional and will be billed at actual cost.

[2] Minimum requirements for the study to take place:
- Minimum Companies: 4
- Minimum CTRs 10

About Us

Asset Performance Networks (AP-Networks) is Industry's premier turnaround benchmarking and assessment firm. We aim to advance the state of Industry knowledge, and to drive continuous improvement.

For more than a decade, our company has worked to understand and improve turnaround and capital project performance in a multitude of different industries. We have developed CTR work processed and executed several ready for construction reviews, as well as multiple CTR closeouts. We work to help owner companies achieve their goals in executing CTRs and other schedule driven projects.
By combining our detailed project knowledge with the insight gained from our Industry-sponsored studies, we offer our clients access to the most insightful project database in the World.

AP-Networks and AP-Canada have built a database of more than 2,800 unique turnarounds and over 3,000 capital projects from Industry. The database contains:

- Estimated/Planned and actual turnaround outcomes.
- Characteristics of turnarounds (e.g., total field labor hours, types and numbers of modifications, new procedures, etc.) are correlated with outcomes.
- Turnaround practices (e.g., scope freeze, logistics planning, team alignment, etc.) are quantified and correlated with outcomes.

The AP-Networks Turnaround Database is used to facilitate better understanding of the causal factors behind success and failure and the practices that drive superior outcomes.

For More Information:

Asset Performance Networks

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Benchmarking Code of Conduct

AP-Networks benchmarking studies are governed by a strict code of conduct. Principles that our studies adhere to include the following:

- **Legality** – Adhere to all laws and regulations.
- **Exchange** – Provide fellow sponsors with the same level of information that you request.
- **Confidentiality –** Information exchanged is confidential to individuals and organizations.
- **Use** – Benchmarking information is used only for its intended purpose.
- **Contact** – Follow study procedures and respect corporate cultures.
- **Preparation** – Commit to the study objectives and timelines by being prepared and providing information in a timely manner.
- **Completion** – Follow through with study commitments.
- **Understanding and Action** – Treat fellow sponsors with respect and meet expectations.

The Benchmarking Code of Conduct document may be downloaded at:

http://www.apqc.org/knowledge-base/documents/benchmarking-code-conduct

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