



Smart. Focused. Done Right.®



Fossil Fleet Performance Benchmarking

ScottMadden's Methodology for Achieving Results

Introduction to ScottMadden's Fossil Generation Benchmarking

- We believe performance benchmarking is a must have management tool.
 - Assess performance
 - Establish targets
 - Obtain competitive intelligence
- ScottMadden's fossil generation benchmarking allows generation operations to compare their generation units against peer units.
 - We work to build apples-to-apples comparisons.
 - We use relevant and up-to-date industry data.
- ScottMadden has been benchmarking fossil generation for more than 10 years. We know how to perform the analysis quickly and efficiently to allow you to focus on running your plants.



Why Is Fossil Generation Benchmarking Important?

Renewable Portfolio Standards

Regulatory Requirements and Increasing Oversight

Aging Workforce

Plant/Unit Decommissioning

The Fossil Fleet



To continue to compete, you need to increase operating efficiency and lower costs. Where do you begin?

Benchmarking:

- Specifically identifies areas for improvement and provides a basis for performance goals
- Provides clear link between specific actions and performance objectives
- Provides defensible analysis to support sound decision-making around budgets and staffing
- Clearly defines common vision

Why ScottMadden Benchmarking?

ScottMadden brings unique skillsets to fossil generation benchmarking.



Proprietary Methodology

We examine unit cost and reliability results at the unit level and staffing at the plant level. Our studies are designed to provide unique insights.



Expertise and Staffing

Our benchmarking staff have performed hundreds of studies. Our expertise is experience based in energy, not theoretical.



Report

You are not signing up to provide your data every month. We prepare a report that shows how your units compare to peers and information on the gaps.



Unbiased

We ask our clients to agree on the peer plants before performing the analysis. We report the facts without manipulation.



Energy Focused

We have deep energy experience from our 35 plus years of consulting with energy companies.

Our clients obtain specific benefits from ScottMadden's generation fleet benchmarking study:

- **Identify** areas of positive performance to be encouraged and reinforced
- **Pinpoint** areas of comparatively sub-par performance to set the stage for root cause analysis
- **Discover** top-performing plants at other utilities which could be studied for leading practices
- **Prioritize** improvement initiatives to focus efforts on achieving results

ScottMadden Provides Three Benchmarking Products

Cost

Typical cost metrics include:

- Operations Focused View
 - Total production cost/MW
 - Operating cost
 - Maintenance cost
 - Fuel cost
- Market Focused View
 - Variable O&M cost
 - Fixed O&M cost

Cost metrics are normalized depending on the type of unit and mission:

- Cost per installed MW
- Cost per MWh

Reliability and Performance

Typical reliability metrics include:

- Net Capacity Factor
- Eq. Forced Outage (or EFORD)
- Eq. Availability Factor
- Planned Outage Factor
- Forced Outage Factor
- Maintenance Outage Factor
- Eq. Unplanned Outage Factor
- Unit Derate Factor

Other metrics can include:

- Lost MWh by System/Component
- Unavailability by Outage Type
- Heat Rate (various)
- Ramp Rates
- Starting Reliability (CTs)

Staffing

Staffing metrics include:

- Total Staffing
- Operations
- Maintenance
- Plant Engineering
- General Management Admin and Support

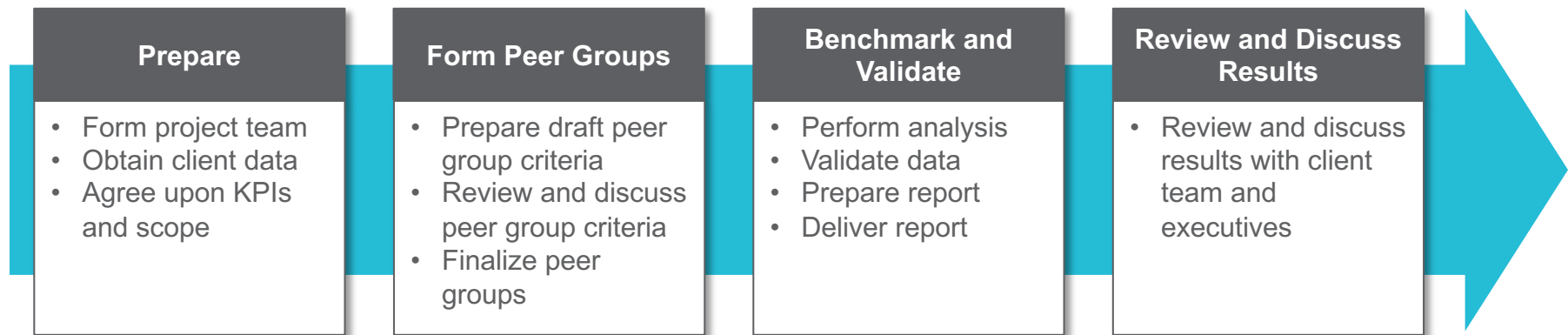
Metrics are normalized to enable appropriate comparison:

- Capacity
- # Blocks (Combined Cycle)
- # Units (Combustion Turbines)

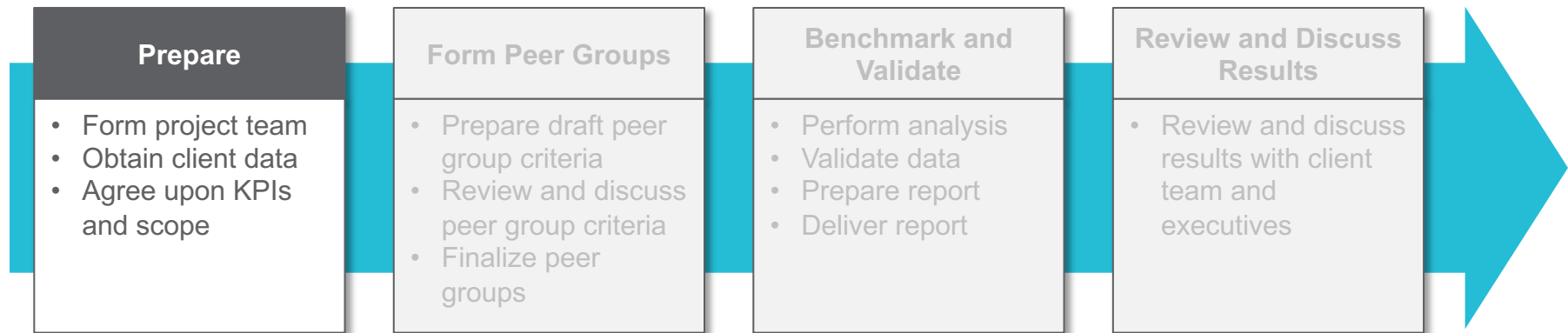
Note: ScottMadden's benchmarking methodology goes beyond the quantitative metrics listed above. We evaluate numerous qualitative factors, including each operator's approach to staffing (e.g., a regional approach to day-to-day maintenance and engineering may result in fewer dedicated plant staff), that are critical to understanding and interpretation of benchmarking results.

Overall Methodology

We conduct benchmarking studies using an efficient four-step methodology:

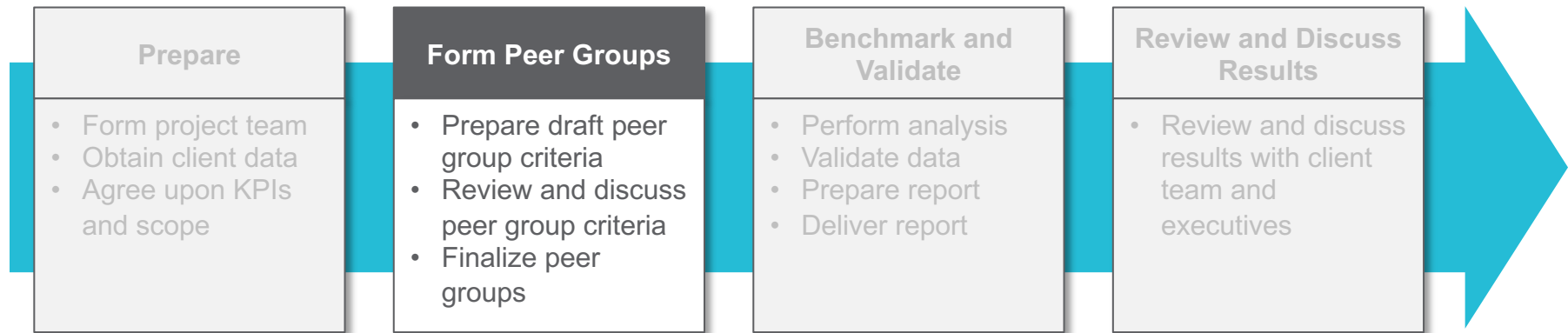


Methodology: Prepare



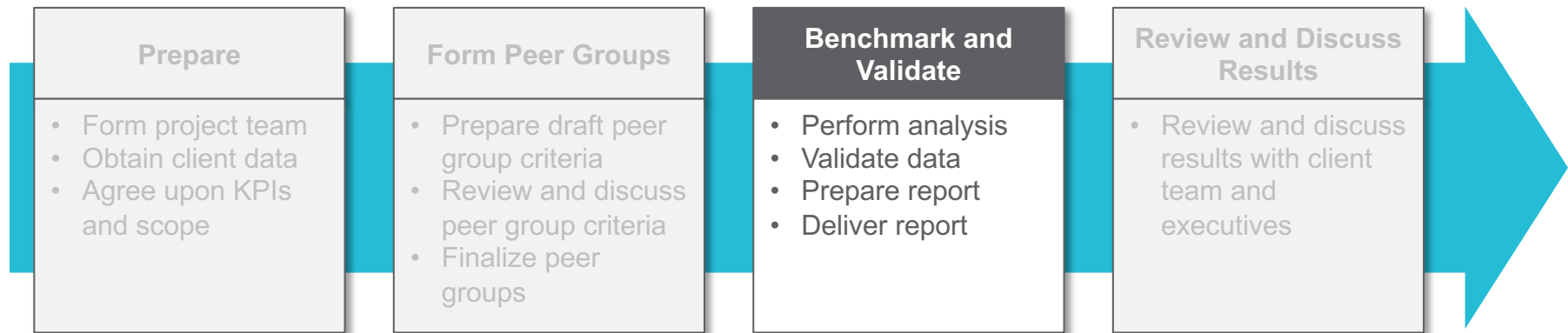
- Finalize the metrics that will be benchmarked
- Obtain your data
 - Cost data at the unit level (as available)
 - Staffing data for in-scope plants sorted by ScottMadden's provided functional buckets
- Identify your team participants and stakeholders who will review the peer group selection process
- Finalize project plan and set milestone reviews

Methodology: Form Peer Groups



- Develop peers based on like unit characteristics (e.g., vintage, equipment type, capacity, etc.)
- Multiple peer groups to match the fossil fleet makeup
- Key step in the benchmarking methodology because reliability and cost benchmarking can be correlated
- Peer groups must be signed off by the client prior to moving forward

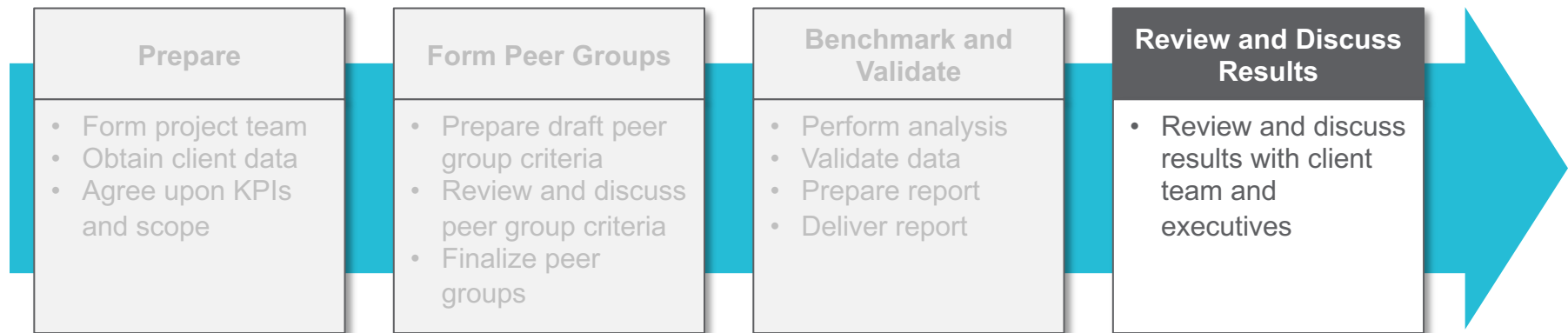
Methodology: Benchmark and Validate



Ensuring Data Credibility

Source	Analysis	Results
<ul style="list-style-type: none">■ Respected data partners■ Validated and scrubbed data■ Large samples■ Targeted peer group members	<ul style="list-style-type: none">■ Investigate anomalies■ Database audits and control totals	<ul style="list-style-type: none">■ Sanity check of results versus expectations■ Deep dive analysis into issue areas before finalizing■ Identify drivers for variations

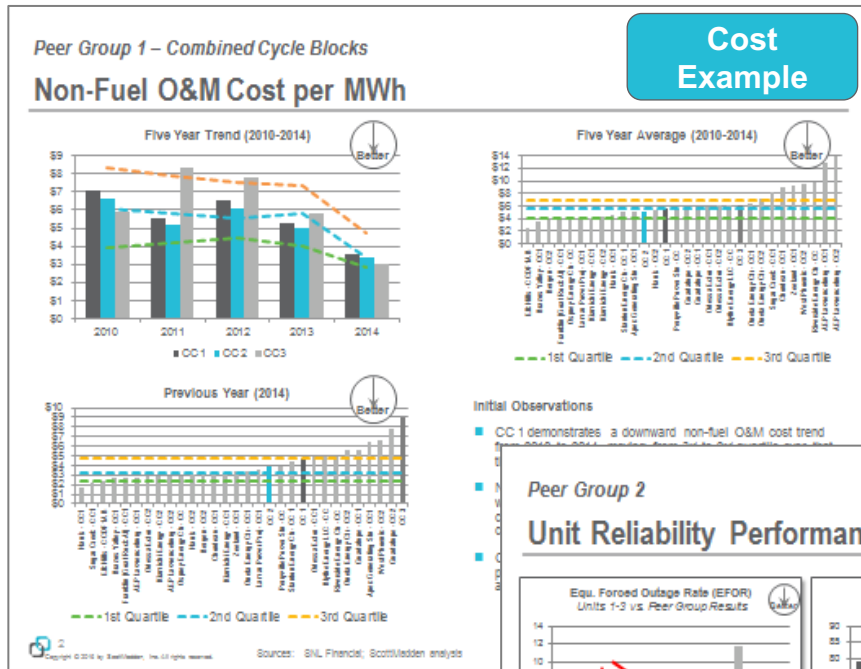
Methodology: Review and Discuss Results



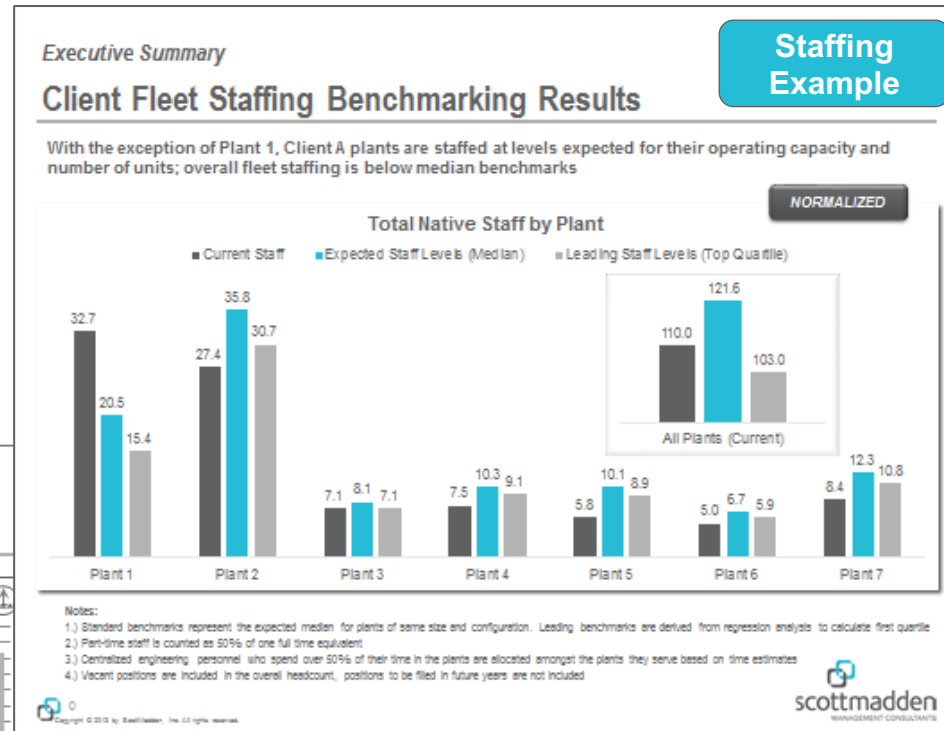
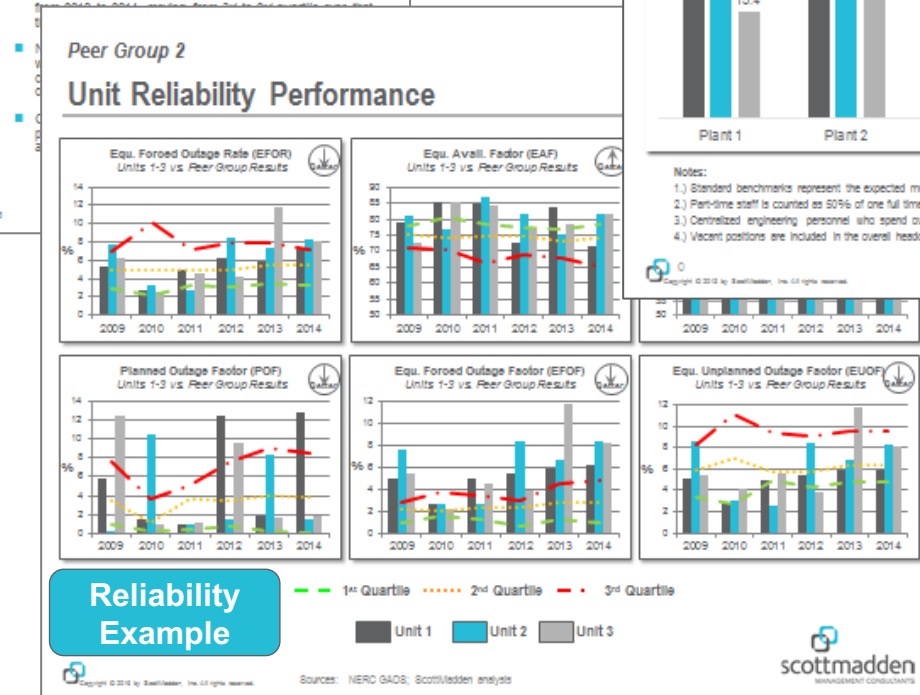
- Identify cost and reliability improvement areas for discussion with owner-operators.
- Conduct progress reviews with you as the project sponsors.
- Conduct presentations with key leadership to present findings and gather input.
- Work collaboratively with your team to discuss implications and potential causes for certain topics of interest based on the results of the benchmarking.
- May even perform some hypothetical modeling; for example, if event X had not happened last year, your results would have improved, and you would be in the top quartile.
- These are important discussions to have as they help us to frame the results of the benchmarking. Please note that benchmarking tells you where you stand versus your competitors; it does not answer the question of “why.”
 - Our studies and interactive discussions with your team attempt to narrow down the possible answers to the “why.”

Deliverables Overview

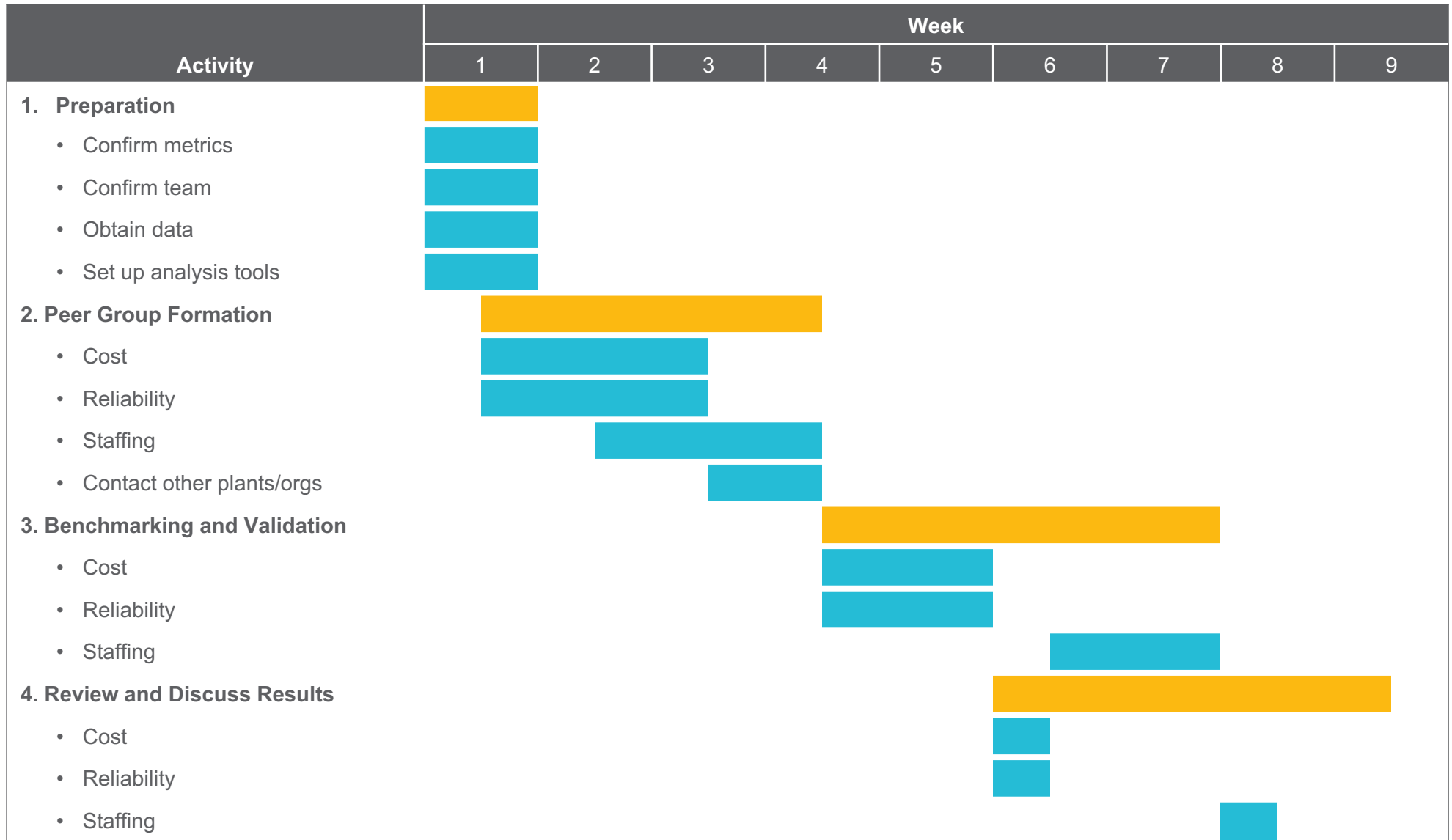
The primary deliverable is a comprehensive report comparing your unit's results to peer group results.



- An executive summary is prepared to summarize results for senior leadership and/or boards.



Typical Timing Is 8 to 9 Weeks for 4 to 6 Peer Groups



Recent Examples of ScottMadden's Work

ScottMadden performs comprehensive analyses of cost and reliability for fossil fleets in North America.

Utility in the Midwest/Cost and Efficiency

- ScottMadden helped a large investor-owned utility (IOU) in the Midwest identify plants which were higher cost and lower reliability compared to similar peer plants.
 - Significant new and incremental variable renewable generation in the region was forcing base load coal plants to be cycled in new and unprecedented ways, which was causing unplanned and unexpected outages.
 - Subsequent collaboration between the plant operators and the trading and marketing group resulted in a more holistic and constructive process for dispatching units as “a portfolio.”
 - Plants more suited to cycling were identified and targeted for accommodating curtailment required by the market, and those which were more prone to failures were allowed to run unabated.

Investor-Owned Utility in the Southwest/Reliability

- ScottMadden conducted a study to help a large fossil fleet operator in the Southwest identify specific components that were failing at disproportionally higher rates than peers, resulting in disproportionately higher lost MWhs.
 - Because transparent peer groups were developed collaboratively, plant managers had faith in the results.
 - This set the stage for the plant managers to conduct root cause analyses, develop improvement initiatives, and set reasonable goals for future improvement.
 - A task force comprised of cross-functional subject matter experts was chartered to address a handful of high-priority issues, which were identified as themes across multiple plants.
 - Benchmarking was embraced and institutionalized, and a procedure was developed to update ScottMadden's analysis once a year in the process of business planning and budgeting.

Recent Examples of ScottMadden's Work (Cont'd)

Public Power Generator in the Southeast – Cost and Staffing

- ScottMadden benchmarked the cost and staffing levels of a fossil generation fleet at the request of the company's board of directors.

Large Fossil Generator in the Southeast – Fossil Operations Restructuring

- ScottMadden assisted a client in developing a business case for implementation of performance improvement opportunities in fossil operations through use of a playbook structure.
 - Preliminary work to support the business case was a cost benchmarking study for the fossil operations coal fleet and a dialogue on workforce management.

Large Utility Environmental Department – Organization and Process Performance Assessment

- ScottMadden conducted an assessment of the Air Quality Group of an IOU environmental department.
 - The objective was to assess organizational structure, staffing levels, process quality, and quality of work in the areas of air policy development, compliance planning, and compliance reporting.
 - The project was implemented through a detailed benchmarking and best practices assessment and resulted in an organizational design and succession planning process development.
 - An ISO 14001 based methodology was employed.

Large Fossil Utilities and Unregulated Generators – Fossil Organization Development

- ScottMadden assisted clients in developing organizational structures and reporting relationship changes for multiple fossil organizations, applying benchmarking to inform the analysis.
 - These included multi-phased projects requiring organizational assessment, functional mapping, organizational design, staffing and selection method, and implementation.

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