

Solomon Associates' Benchmarking

An Insight into Energy Performance and Gaps

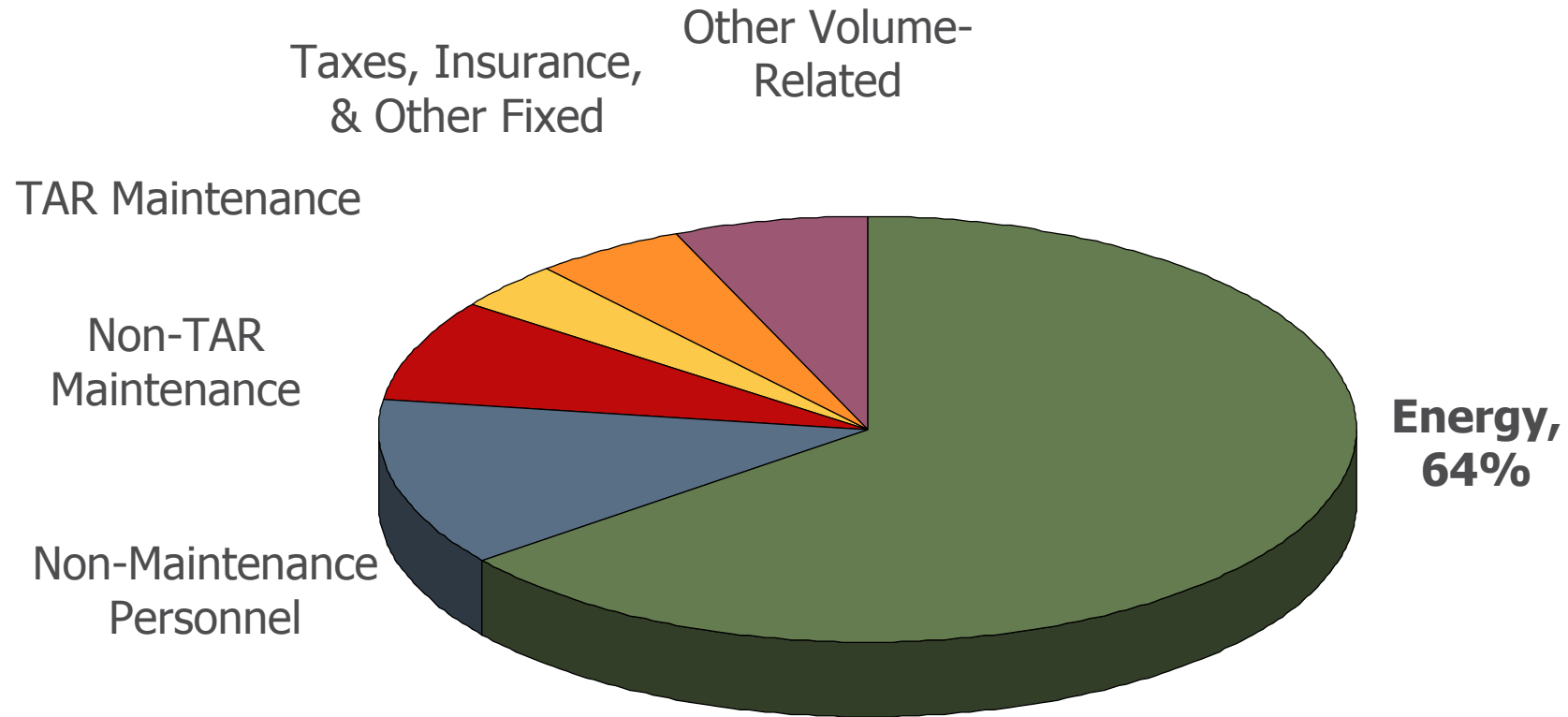
**Presented at: CEE Refining and Petrochemical Meeting,
Gdansk, October 2011**



Solomon Associates
M³ – Measure. Manage. Maximize.®

Operating Cost Distribution 2010

Central & Southern Europe



Average refinery energy valued close to €180m p.a.

Key Performance Indicators

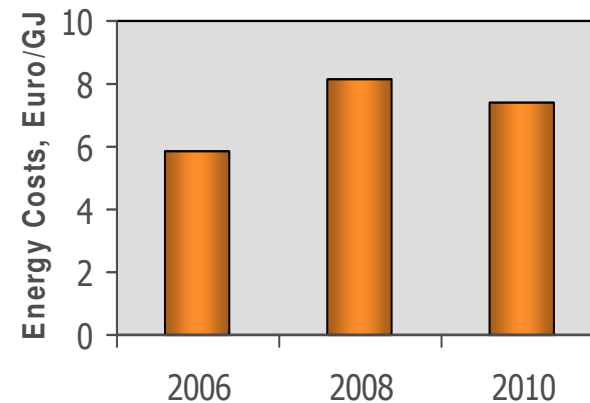
Energy Intensity Index (EII®)

Energy consumption as percent of Solomon Associates' standard energy for a given refinery's operations.
100 = world average value in 2004 study.

Important Because

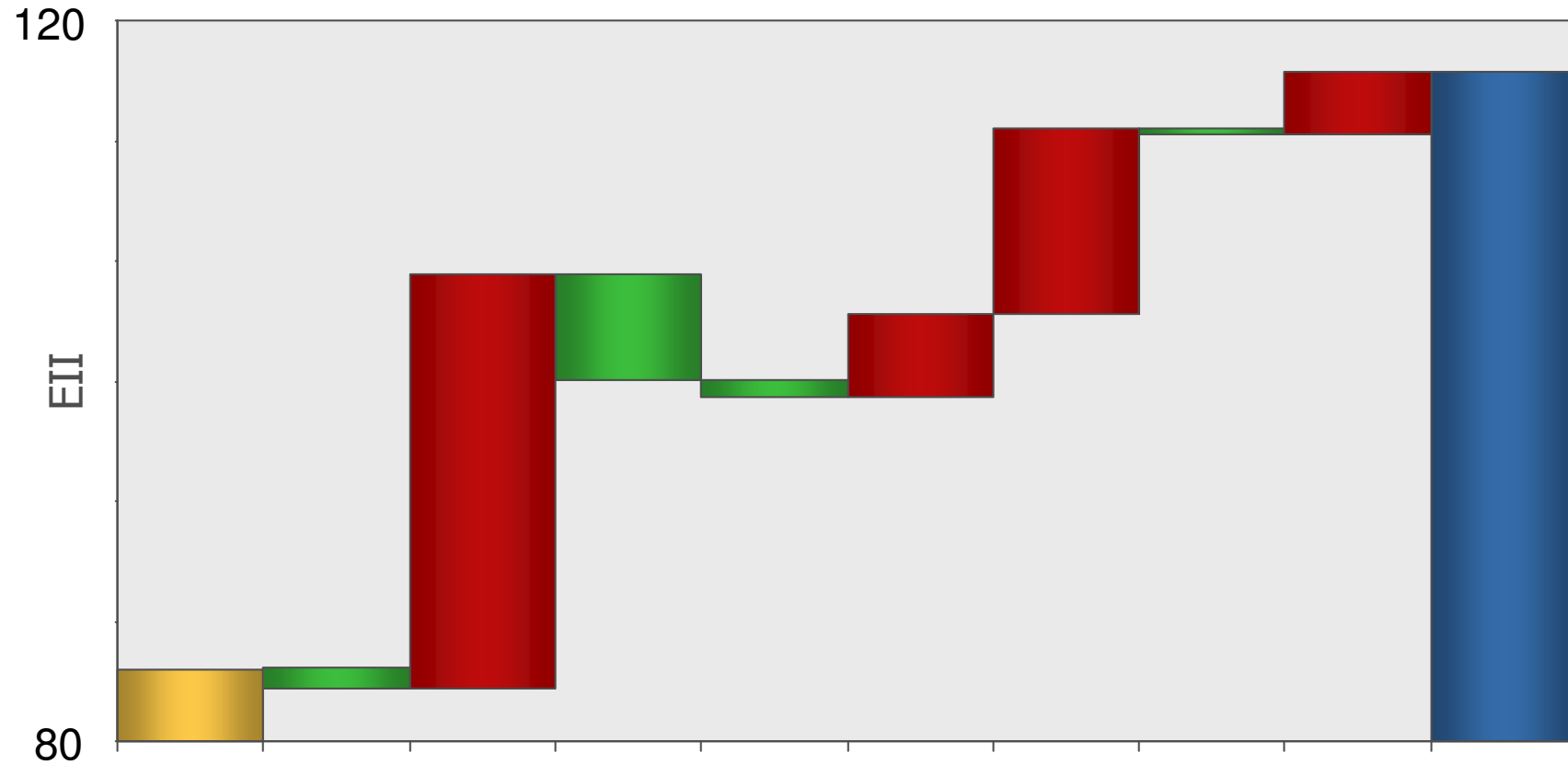
- Energy is typically the largest single refinery cost category
- Impacts CO₂ emissions/costs
- Energy management combines strategic and tactical decisions
- Requires ongoing commitment

Energy Cost Trends €/GJ



Energy Intensity Index

Central Europe Region is Improving, but from Higher Base

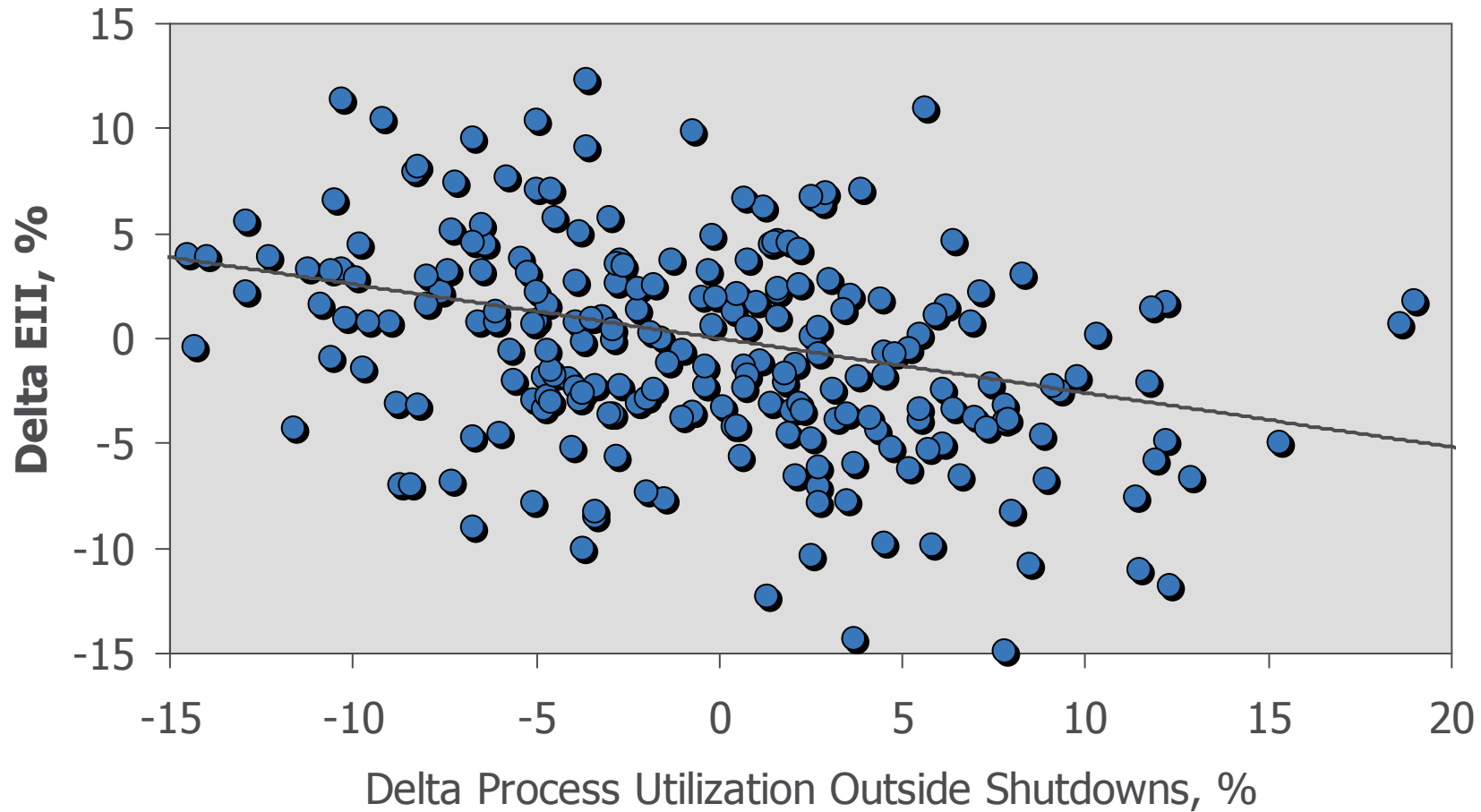


What has brought about improvements?

- **Investments**
 - But energy efficiency often a “side effect” of upgrading projects
- **More improvement opportunities**
 - Equipment efficiency often worse
 - Centralized utilities
- **Smaller drop in Utilisation than Western Europe**
 - Refinery Utilisation impacts EII

Process Utilization Impacts EII

Weak correlation, but regular observable effect



More Rigorous Energy Analysis

Cost and CO₂ Legislation Drive Refiners

Solomon 2010 study includes:

- More and improved checks of fired heater data.
- Steam consumption data.
- Revised EII gap analysis
 - Fired Heaters
 - Added gap for FCC coke contribution
 - Electrical generation efficiency
 - Electricity consumed
 - Steam balance for refinery consumers & generators

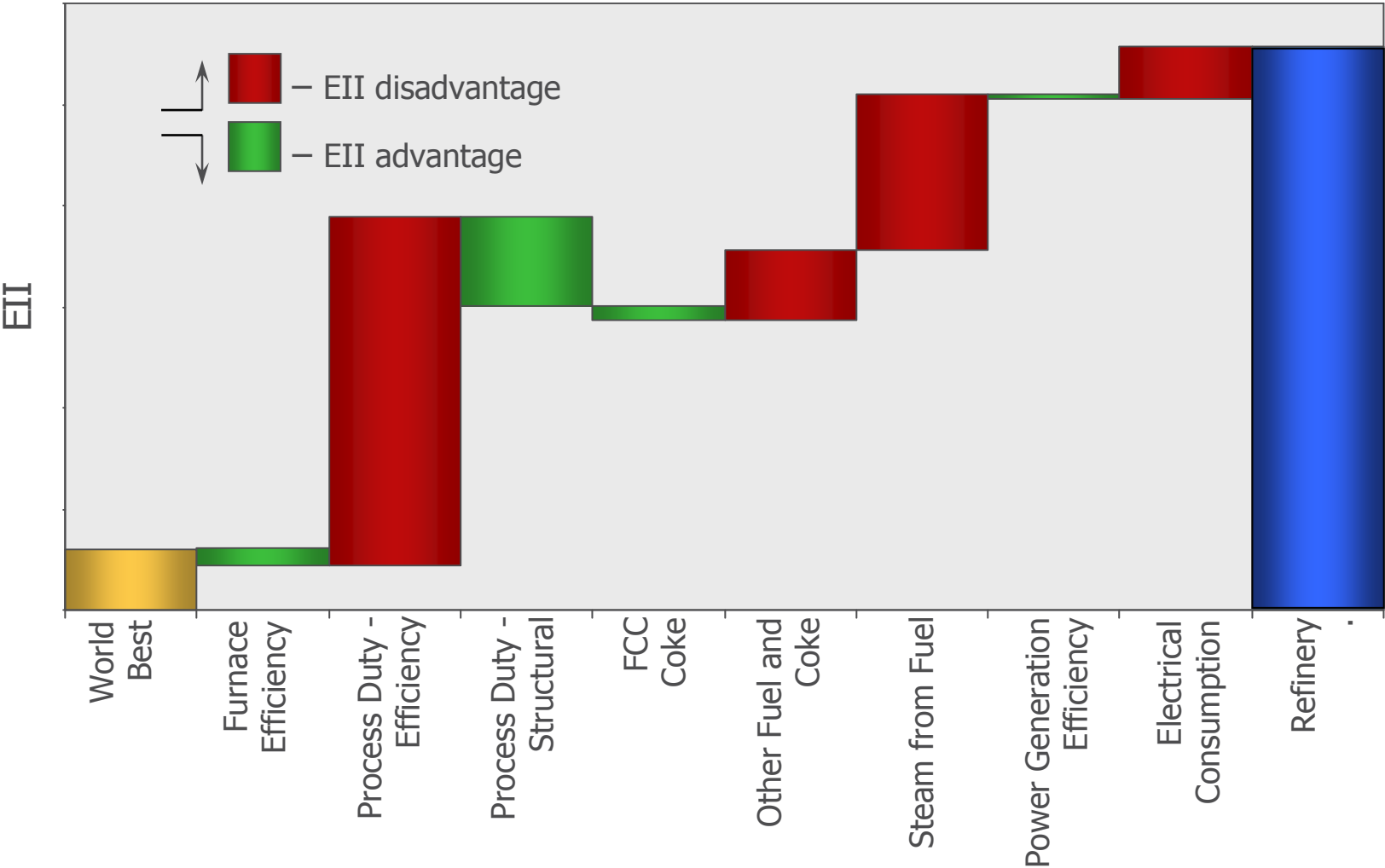
EII Gap Analysis Methodology

Study Participants Receive Gap Analysis

- Compares refinery consumption to “World Best”
 - Six efficient refineries – two from each major study region
 - Gap is expressed as percent of Solomon Associates’ standard energy
 - Shows energy consumed by category
- Aims to help participants find economically attractive EII improvements

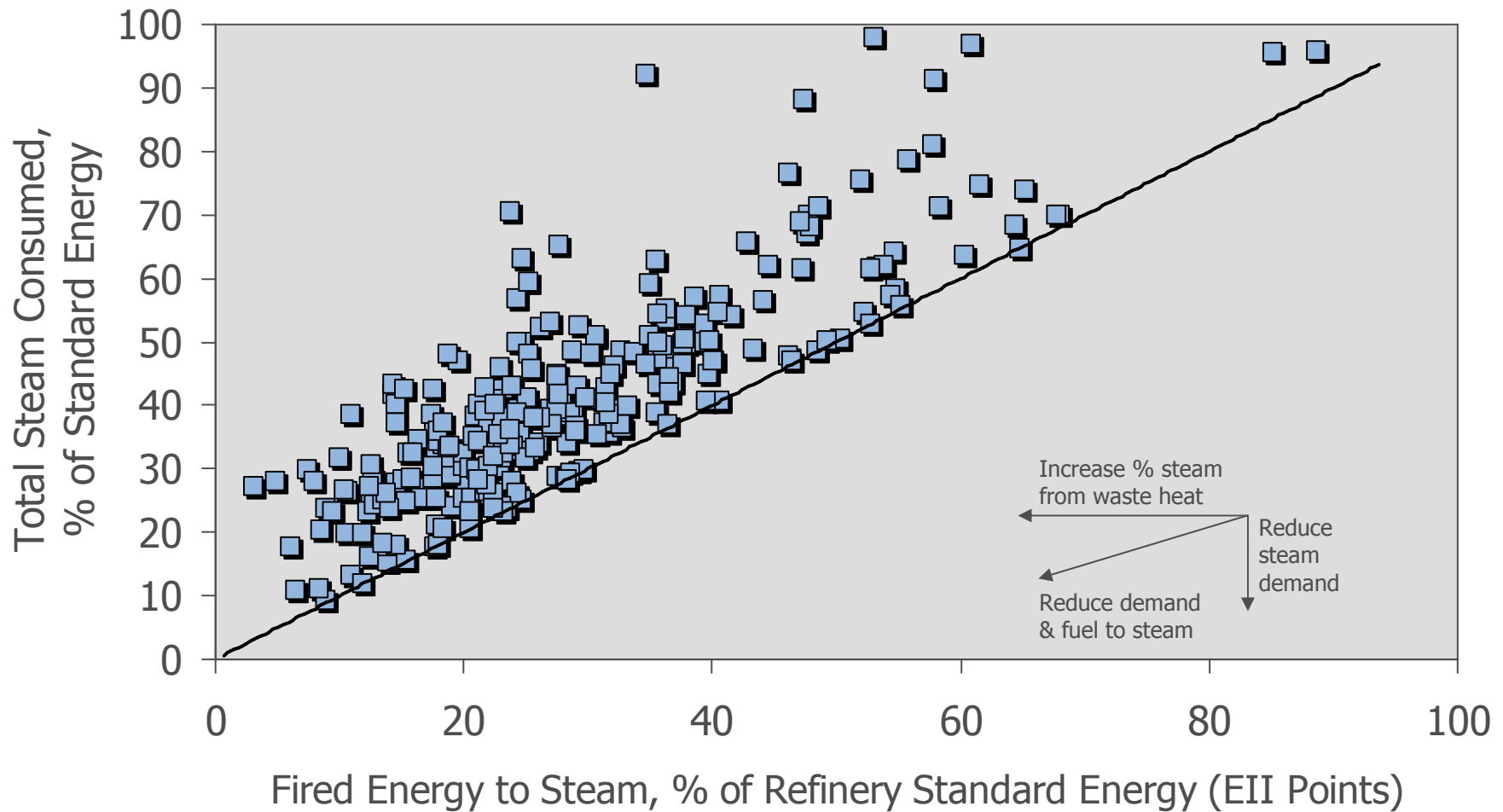
EII Gaps

Illustrative Example of Technique



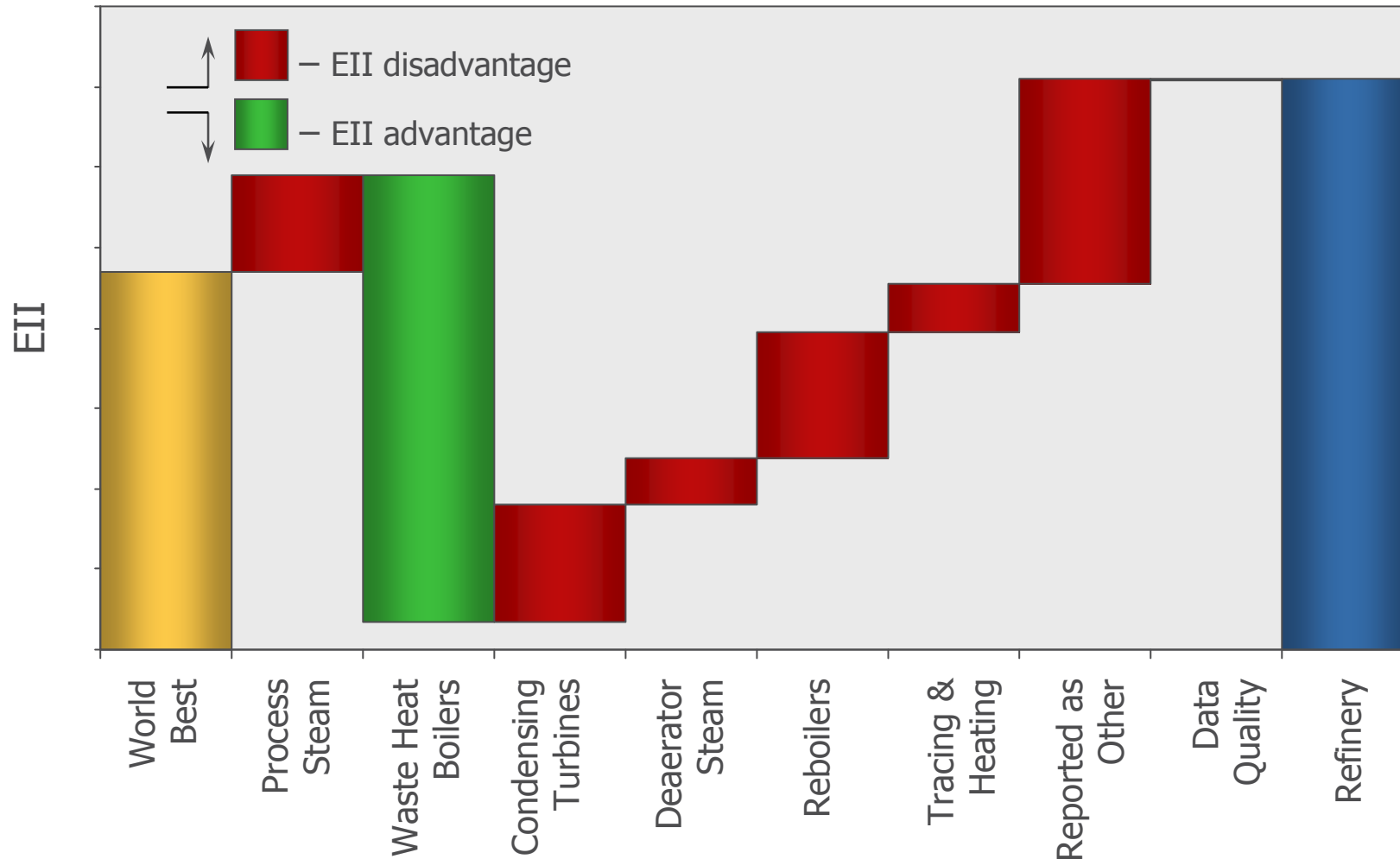
Steam system size

Worldwide Study Participants



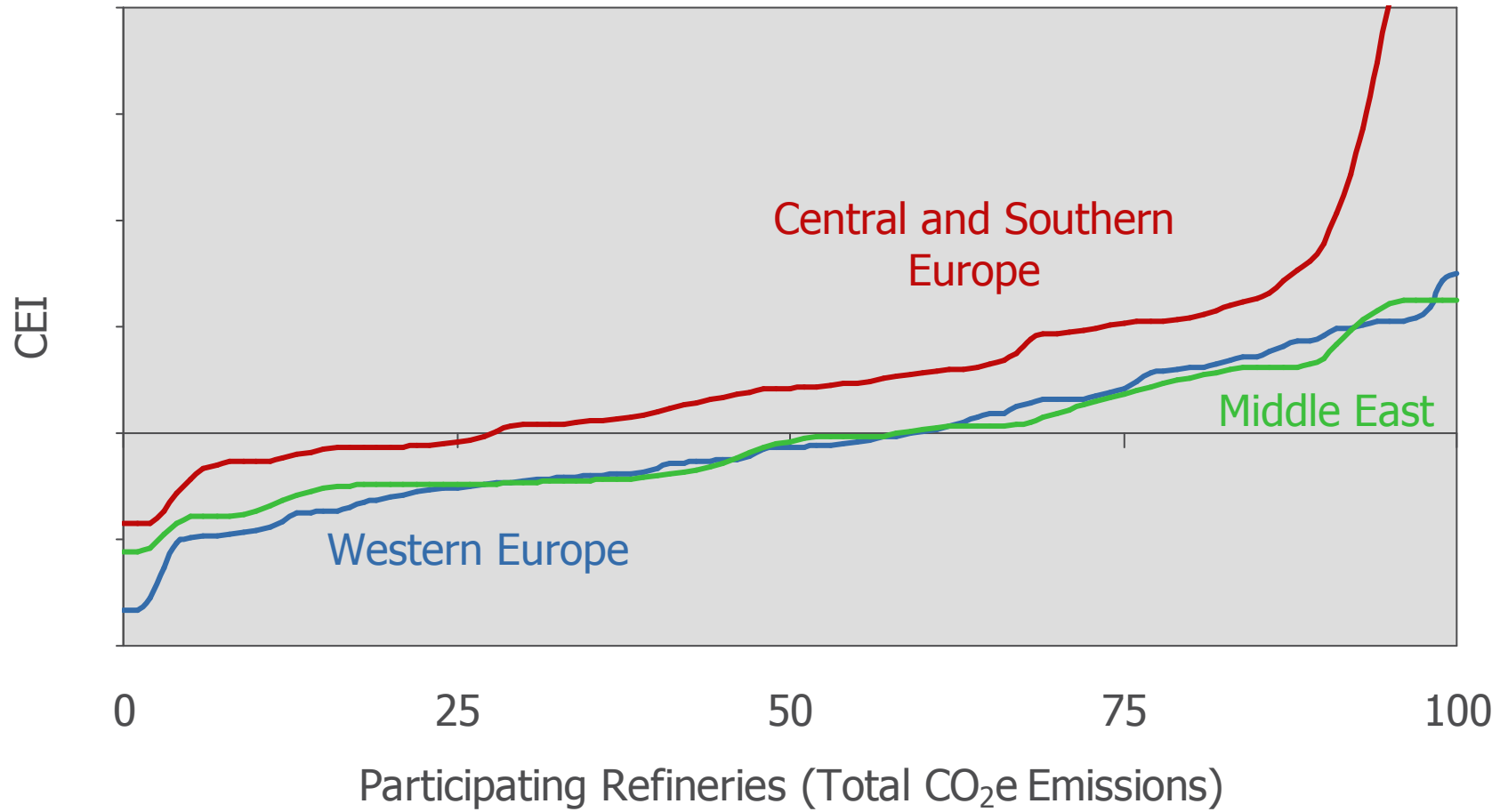
Steam represents ~25% of Average EII Gap

Illustrative Technique for further Drill-Down



Carbon Emission Index

Europe Study Participants



Refinery Performance Improvement



Benchmarking is critical – but only the first step in driving refinery performance improvement

Performance Improvement Process Steps

Identify the gaps

1

Pinpoint what is causing the gaps

2

Implement best practices

3

Sustain the improvements

4





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