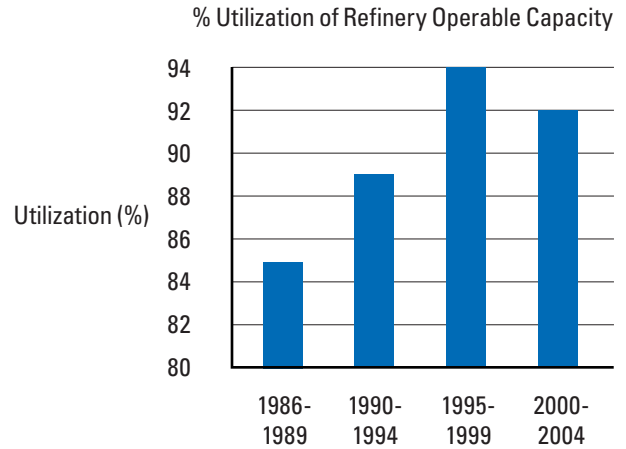


Availability in a Supply Constrained Environment is the #1 Issue for Refinery Executives

Historic Margin Opportunities

- **The 3-2-1 crack spread is at record levels** and are expected to remain well above historic averages
- **But Refinery utilization has hit a plateau** and many refineries are not taking advantage of the record margins
- **Refineries are investing in the current business cycle** to increase capacity and availability



Diagnosing Bottlenecks and Constraints Are Difficult

Diagnosing bottlenecks and emerging constraints can be particularly difficult because they can be either 1) a process or catalyst issue, 2) an equipment issue, or 3) the result of an abnormal process impact on equipment, e.g., hot gas expander turbine blade salting (Figure 1).

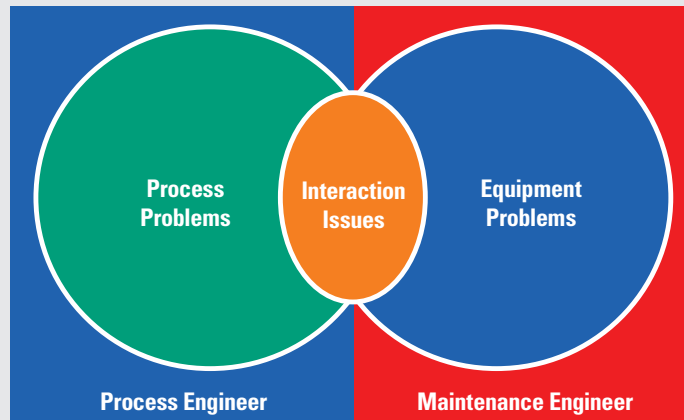
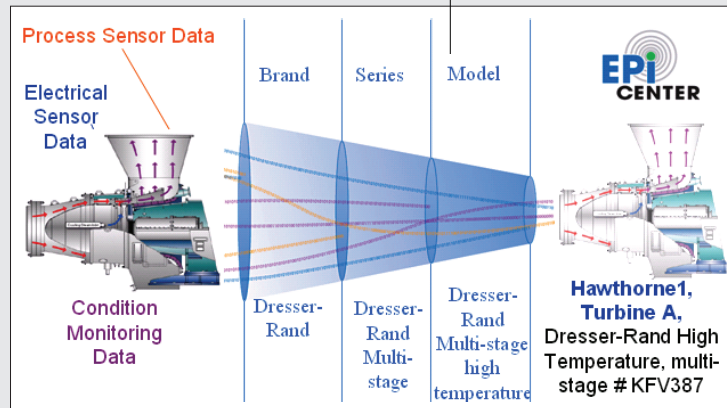


Figure 1 — SmartSignal’s EPI*Center software solution provides early warning of the toughest refinery problems including difficult to detect interactions between catalysts and equipment, e.g., Hot Gas Expander Turbine Blade Salting.

Condition monitoring solutions employ First Principles technology and treat all equipment of the same model # the same.



But all equipment is different – even equipment of the same model number. EPI*Center treats each piece of equipment as being unique because it is unique.

Figure 2 — EPI*Center uniquely models individual equipment and process performance for superior detection of emerging constraints.

EPI*Center Uniquely Identifies the Difficult-To-Detect Emerging Constraints that Current Tools Do Not Catch

- EPI*Center provides refineries with early warning of emerging using existing equipment data that traditional solutions do not catch.
- Based upon 40 patents, EPI*Center treats each piece of equipment as being unique because it is unique. (Figure 2)
- Importantly, EPI*Center does this for all equipment, OEMs and operating regimens.

EPI*Center Provides Early Warning of the Toughest Refinery Problems – Even Difficult-To-Detect FCC Issues

Examples of EPI*Center's early actionable warning of difficult FCC issues includes:

1. Two months early warning of catalyst fouling on an FCC Unit hot gas expander turbine
2. Five months early warning of wet gas compressor thrust bearing failure
3. 48 hours early warning of main fractionator flooding
4. One month early warning of an FCC Unit CO boiler tube leak

The Result is Substantial, Tangible Benefits

Financial Benefits

- Increased revenue and profits
- Decreased unnecessary maintenance expenses
- Improved return on capital deployed

Operational Benefits

- Increased availability
- Decreased EII
- Decreased EPA issues, environmental credit purchases
- Fewer OSHA Issues
- Better Solomon Report results

The Value of CO Boiler Leak Early Warning

- With early warning refineries can take mitigating actions
- Reducing lost operating hours. Decreasing gas oil inventory expenses and spot gas expenses
- **Just one incident can save refineries \$4.7M**