The Value of Reliability Data – A Look Back… A View of the Future

S. A. Della Villa

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Performance of Generating Plant: Managing the Changes

"The evaluation of power plant performance is one of the most important tasks at any power station. Without its availability records, the plant staff can not determine ways to improve performance of the equipment and make the plant a profit-centre for the company. The causes of unavailability must be thoroughly analyzed to identify the areas for performance improvement"

– Executive Summary
World Energy Council - 2007

Let's Start With Some Benchmarks…

- In 2006…
  - ~ 15% of global energy demand filled by Nuclear power… ~ 19% in the US
  - 10 countries with highest reliance: France, Lithuania, Slovakia, Belgium, Sweden, Ukraine, Bulgaria, Armenia, Slovenia, Republic of Korea
  - Average Equivalent Availability = 83% (median = 86%)
  - "Nuclear plant operators are achieving high availability"
- In 1995…
  - Global installed wind power was 5,000 Mw
  - Ten years later…global capacity reached 59,000 Mw
  - In 2006 global capacity reached 72,600 Mw
  - "Their excellent technical availability is between 95% and 99%"

Source: Performance of Generating Plant: Managing the Changes (Executive Summary)

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Are you surprised with 83%…

Do you believe 99%?

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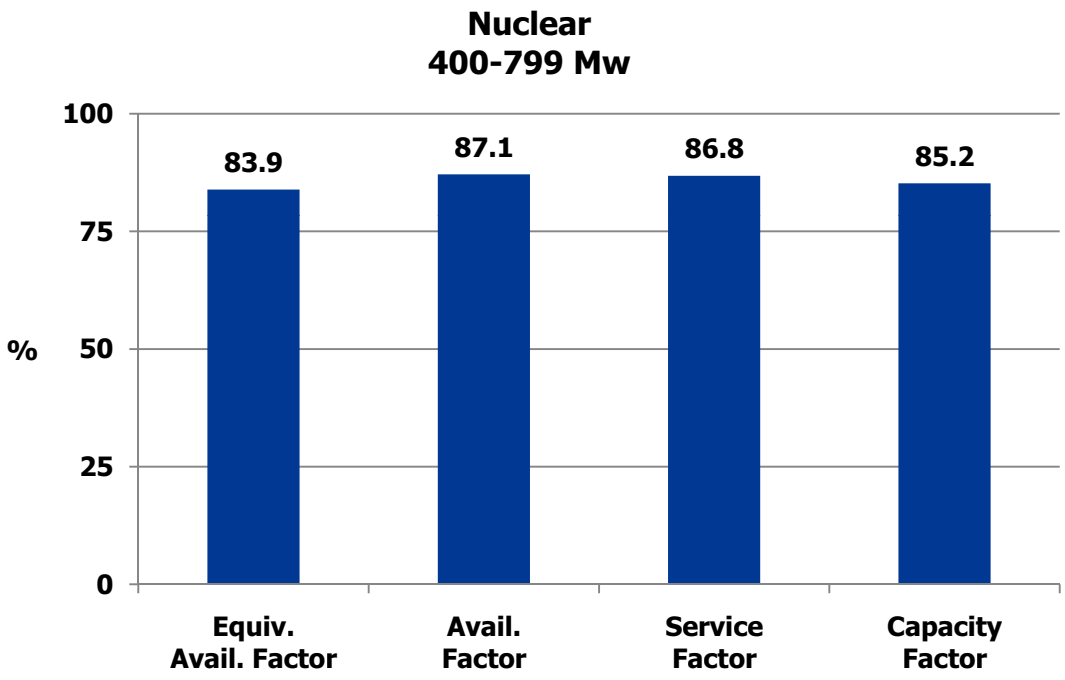
SPS - Incorporated in 1987

- Reliability Engineering and Information Technology Company
  - Initiated to meet industry need
  - Compile RAM data from global power plants through ORAP®
  - ISO 9001 Certified (LRQA)
- Gas and Steam Turbine Focus
  - Power generation
  - Oil and gas
  - Mechanical drive
- Industry Methodology
  - Common coding structure (EBS & KKS)…taxonomy to a component level
  - IEEE and ISO standards
  - NERC and WEC compliant
  - Strong support from EPRI and DOE
- Active In Industry
  - ASME, Electric Power Committee, Combined Cycle Users, ASQ

ORAP®

- RAM Database
  - All OEM gas and steam turbines (50 & 60 Hz)
  - Simple and Combined Cycle
  - All applications
  - Duty Cycles
- Benchmarking
  - Your unit vs. the Fleet and Best-in-Class
  - Market comparisons
- Close Relationship with OEM
  - ORAP supports design for reliability project efforts
- Third-Party… Unbiased
- Customer Focus
  - Value-added service supporting operators and OEMs

Let's Look At Some Data… NERC GADS (2003-2007)



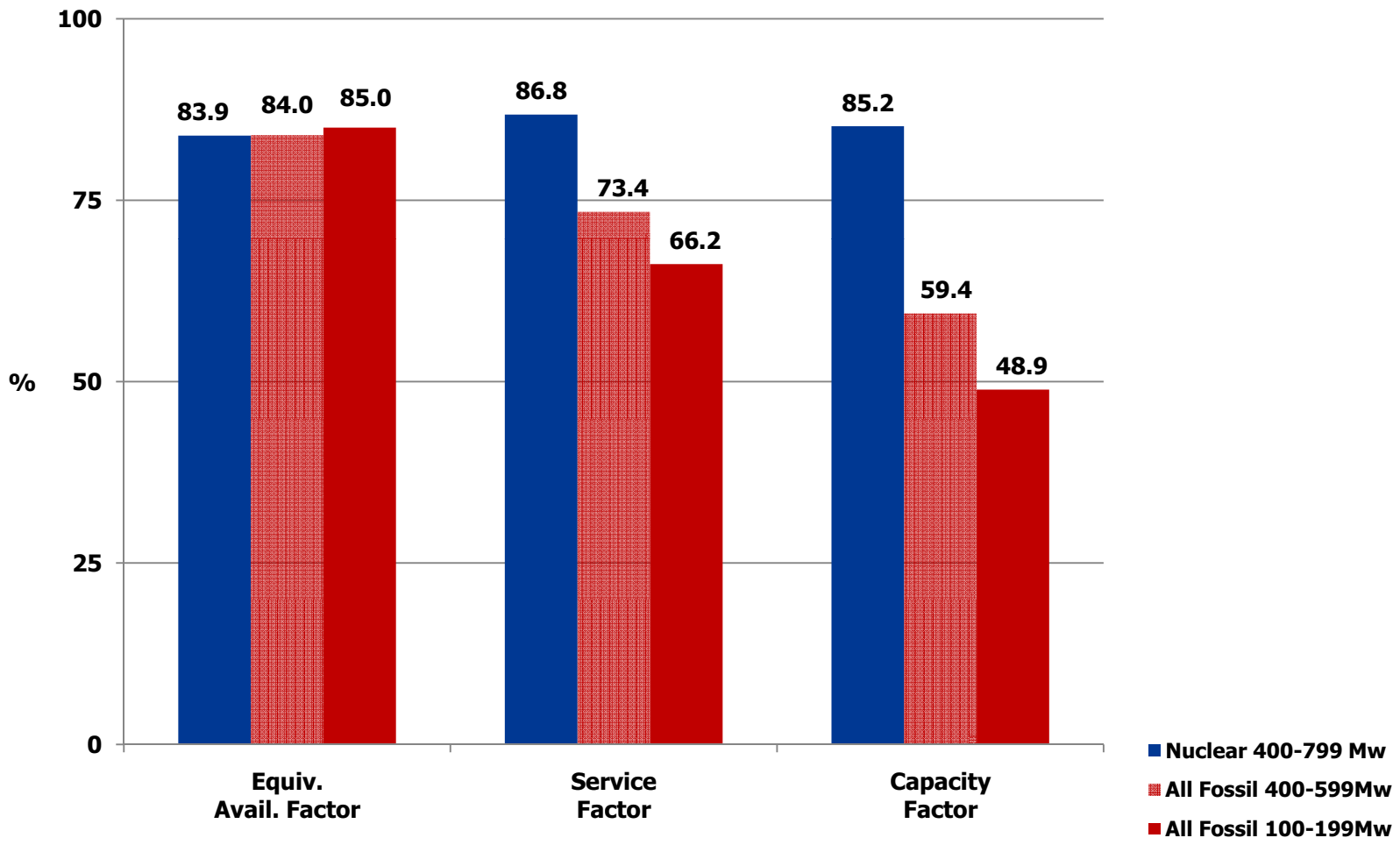
Some Standard Definitions… IEEE 762

Equivalent Availability - The percentage of available megawatt production over a given period of time. This represents the generation that could be provided if Limited only by outages and deratings. It is equal to 100% minus the Equivalent Unavailability, where the Equivalent Unavailability represents the percentage of production lost over a period due to all outages.

Service Factor – The percentage of time over a given period that a piece of Equipment has been in operation.

Capacity Factor - The percentage of megawatt production over a specified time period as a function of the total megawatts that could have been produced if the unit had been operated continuously at its nameplate rating over that time period.

Let's Expand Our View… NERC GADS (2003-2007)



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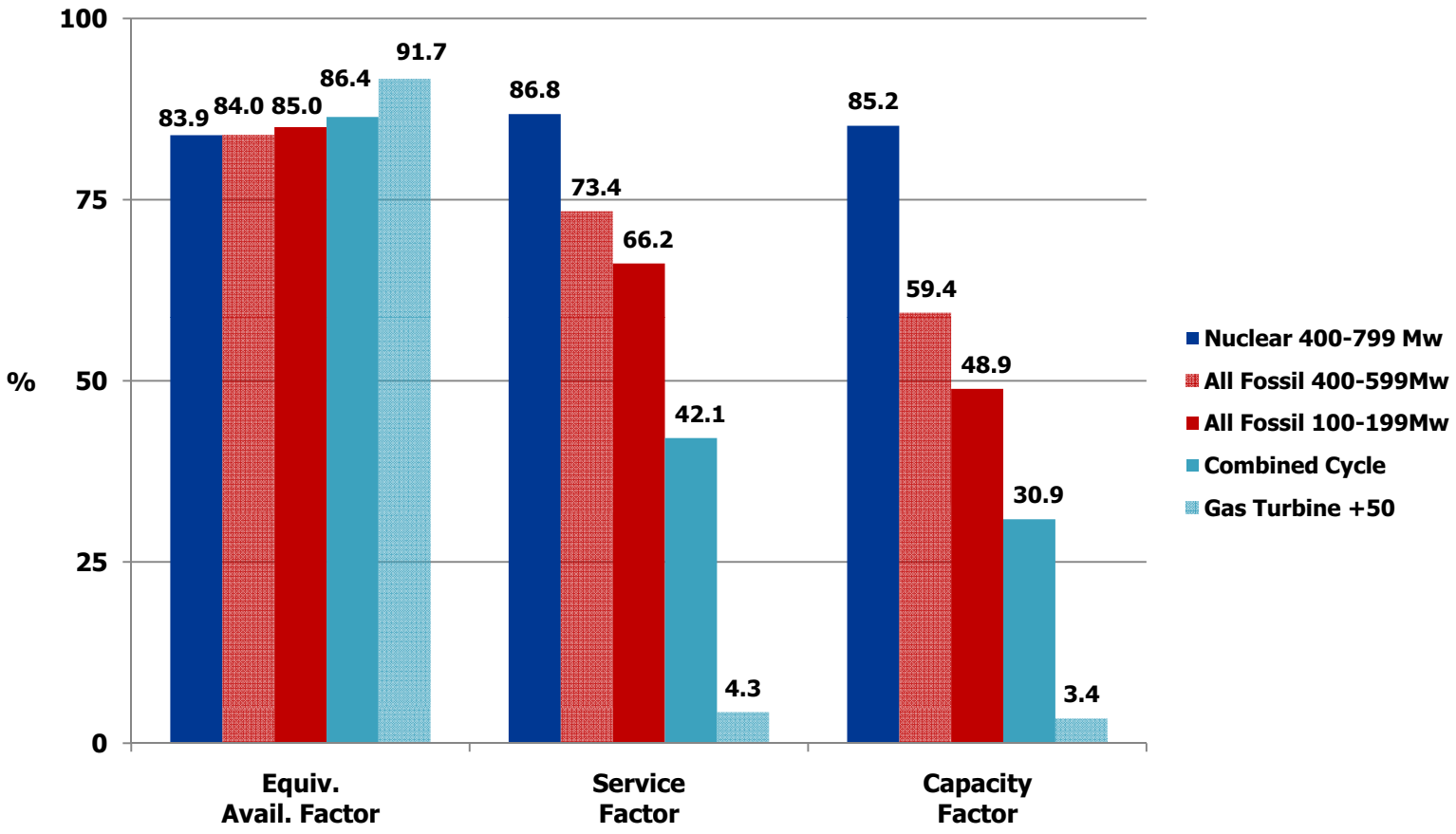

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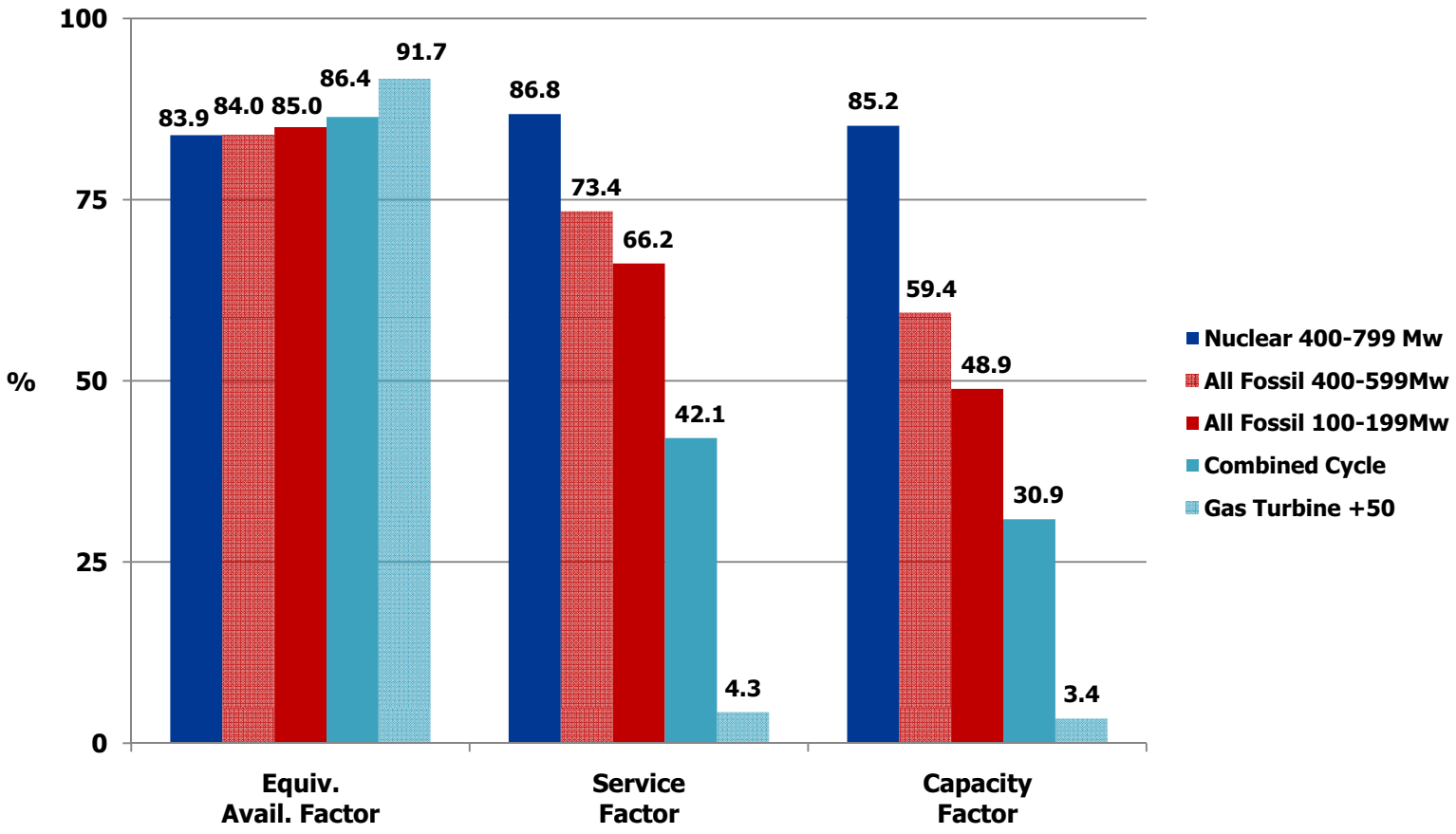


Putting the Generating Mix on a Level Playing Field

Let's Take a Look Back

- Prior to 1970's Combustion Turbines Not Viewed As Capable of Providing Reliable Service Regardless of Duty
- Had to Structure and Adapt Strategy For Market Acceptance
- Combustion Turbines Needed to Play More Significant Role in Utility "Generation Mix"
  - Dependence on equipment's operational reliability and availability

A Focus on Availability and Reliability

- 1980's Electric Power Research Institute (EPRI)

  "Availability is affected by both the inherent design as well as the individual utility's operational and maintenance practices."

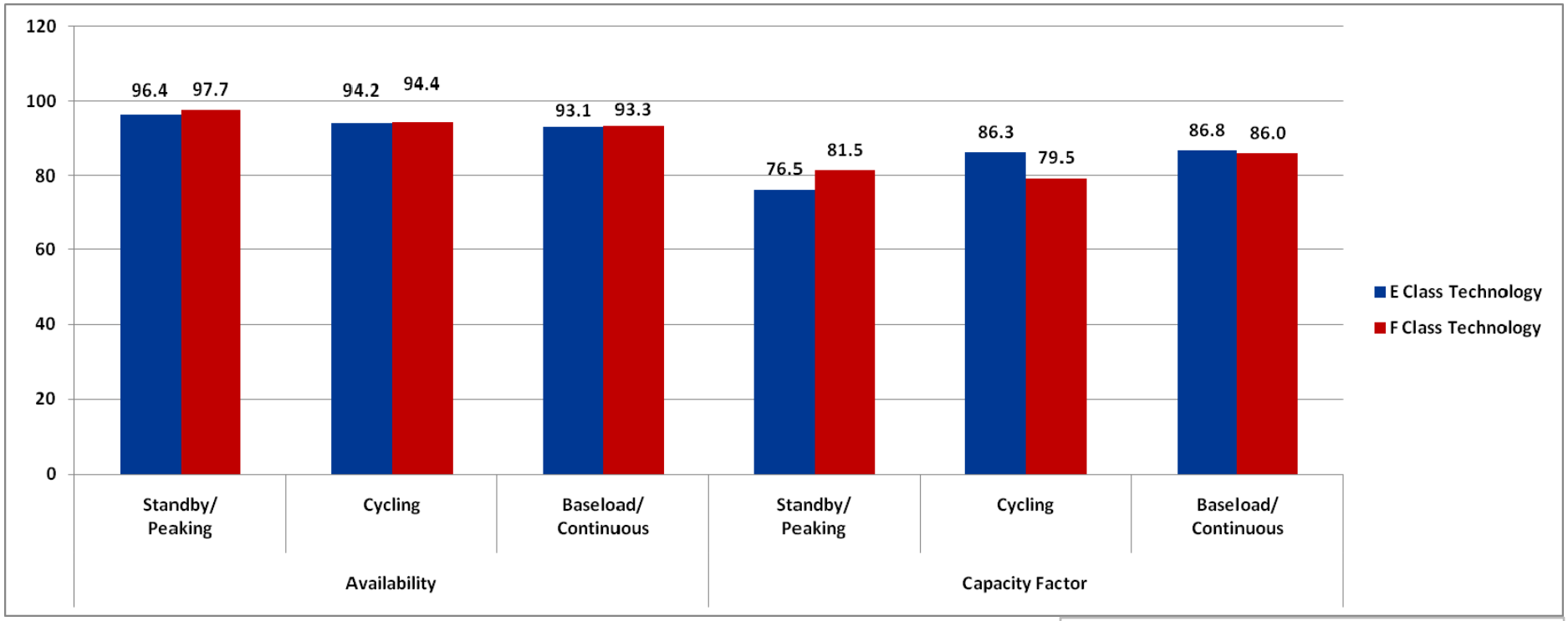
  - Focused on direct participation with Turbine Manufacturers to influence reliability based design improvements
  - High-Reliability Gas Turbine Combined-Cycle Development Program: Phase I (December 1980)
  - Reliability and Availability Assessments of Selected Domestic Combined-Cycle Power-Generating Plants (August 1982)
  - Design of High-Reliability Gas Turbine Controls and Accessories (June 1988)

- DOE Focused on Advanced Turbine System Design (1992)
  - Maintaining high reliability
  - Increase Output & Improve efficiency

Where We Are Today…

- Industry Methodology Developed and Maintained
  - IEEE and ISO Standards
- Continued Partnership with Original Equipment Manufacturers & Owner/Operators
  - Information sharing for "reliability based design improvements"
- Industry Focus on Data Interpretation and Understanding
  - Governmental and private organizations established
- Owner/Operator Cooperation and Transparency

Gas Turbines
ORAP® - (2004 – 2008)



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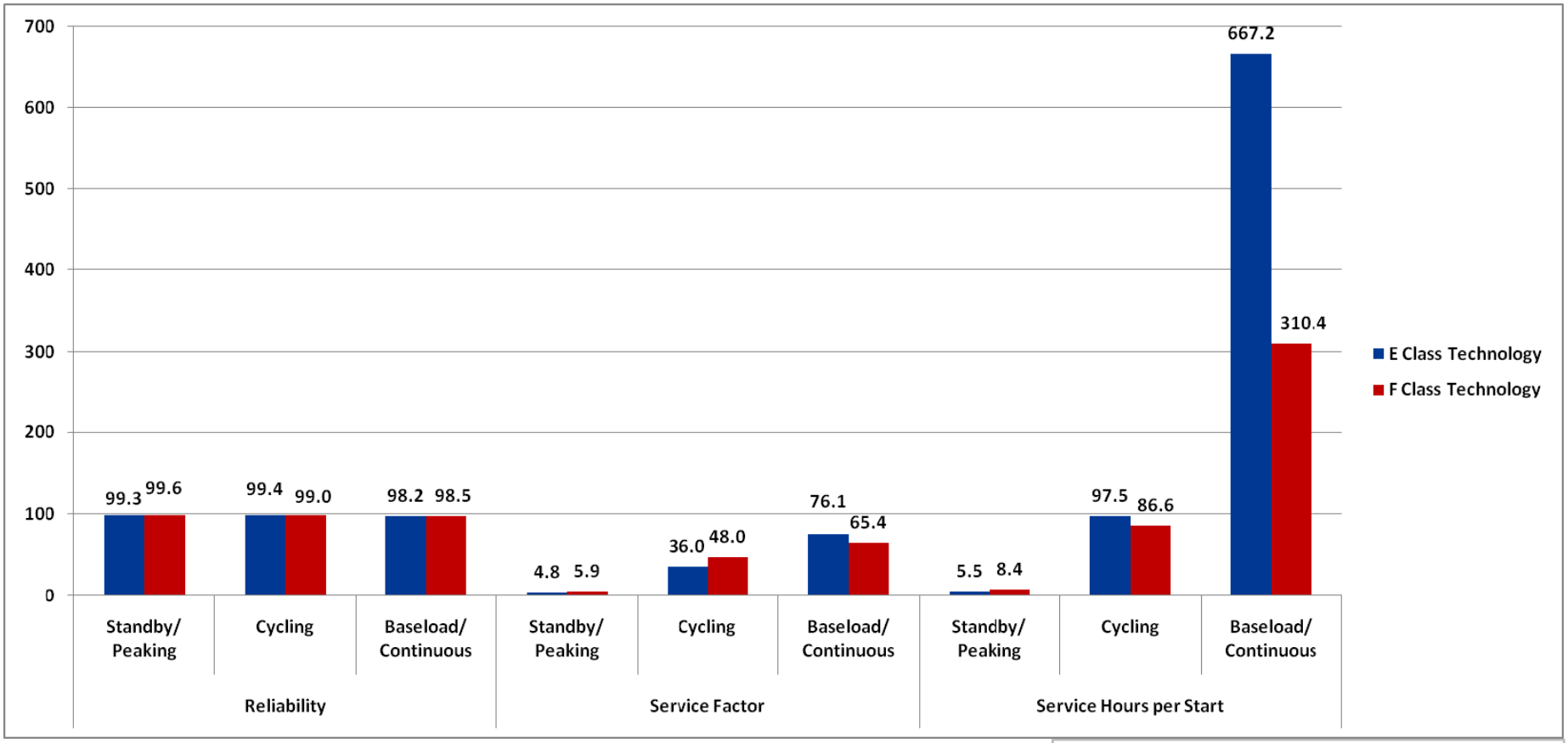

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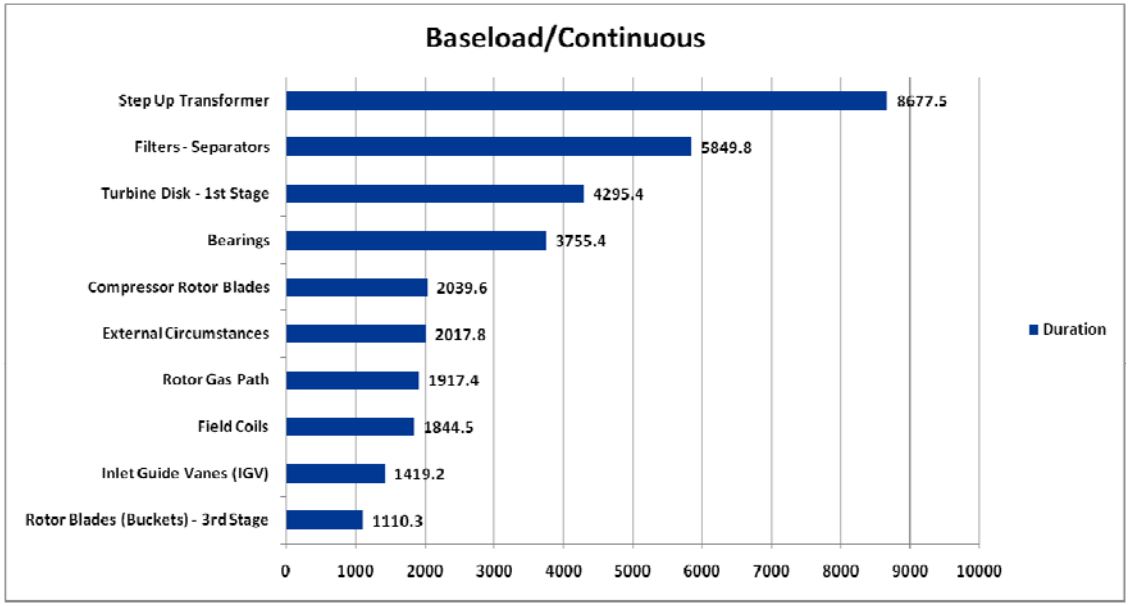
F Class - Top Contributors to Downtime Forced Outage Duration & Frequency

2004 - 2008



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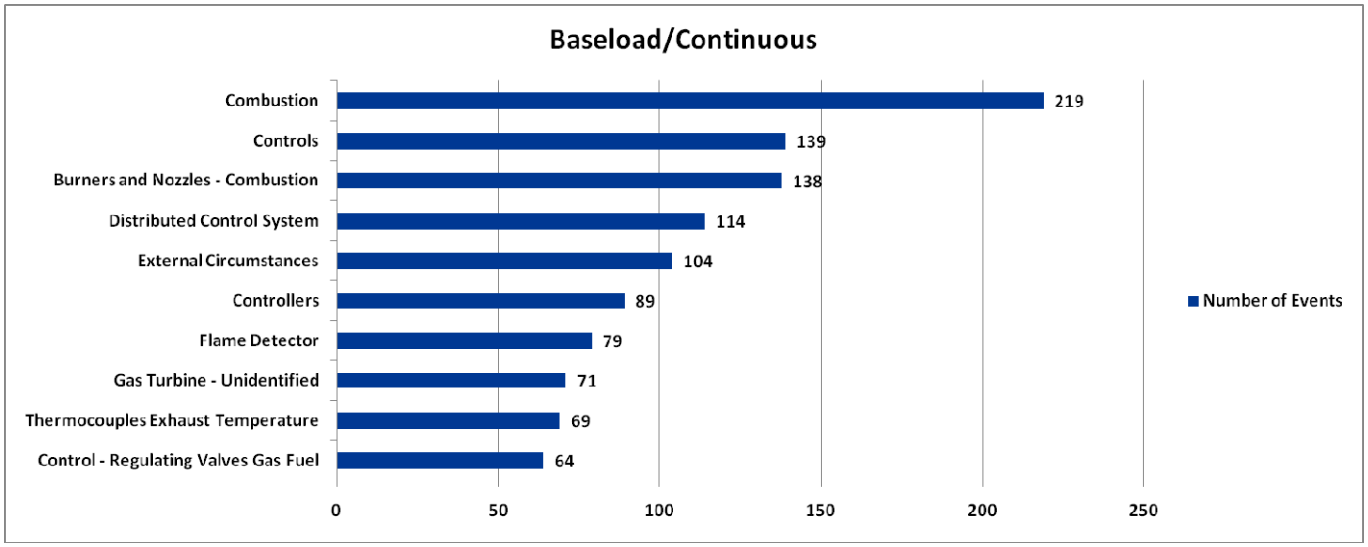

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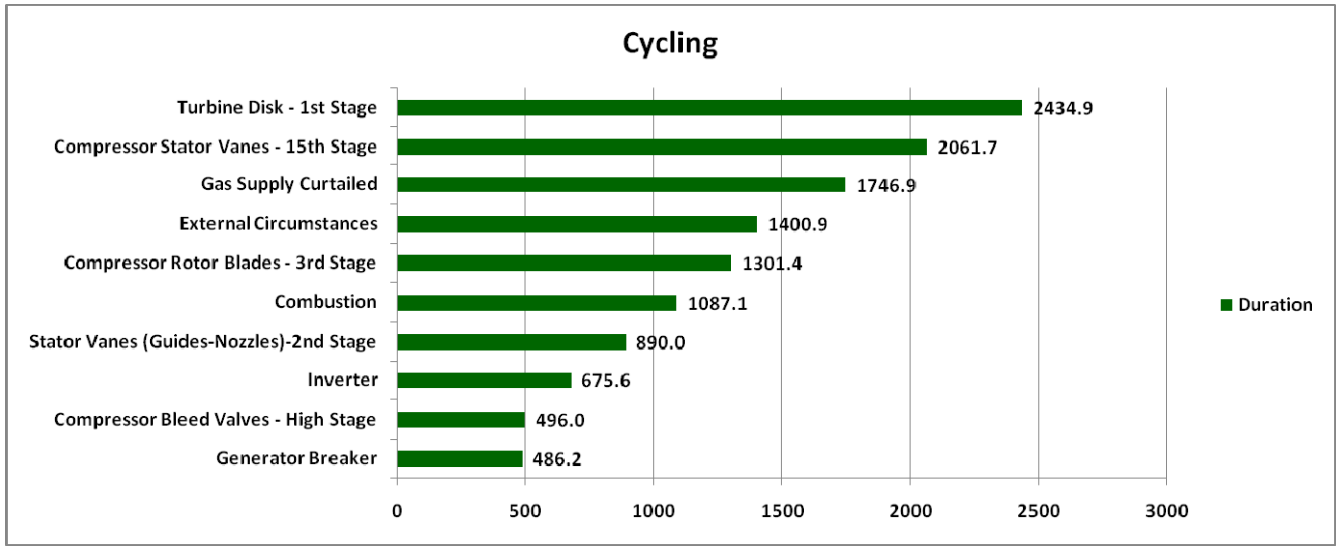

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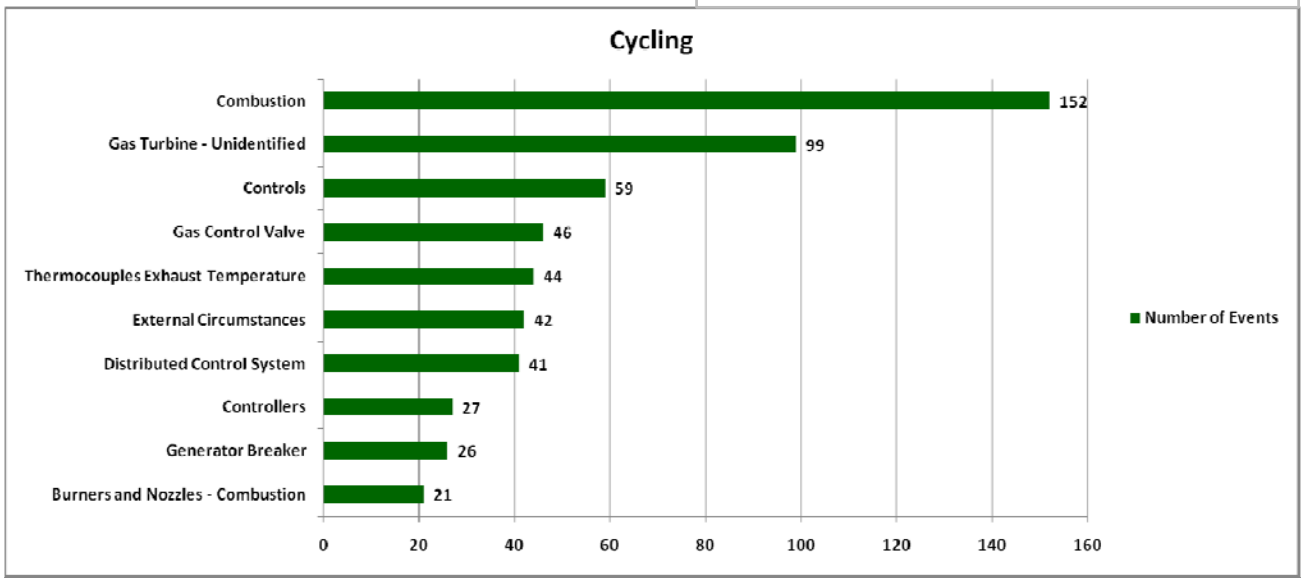

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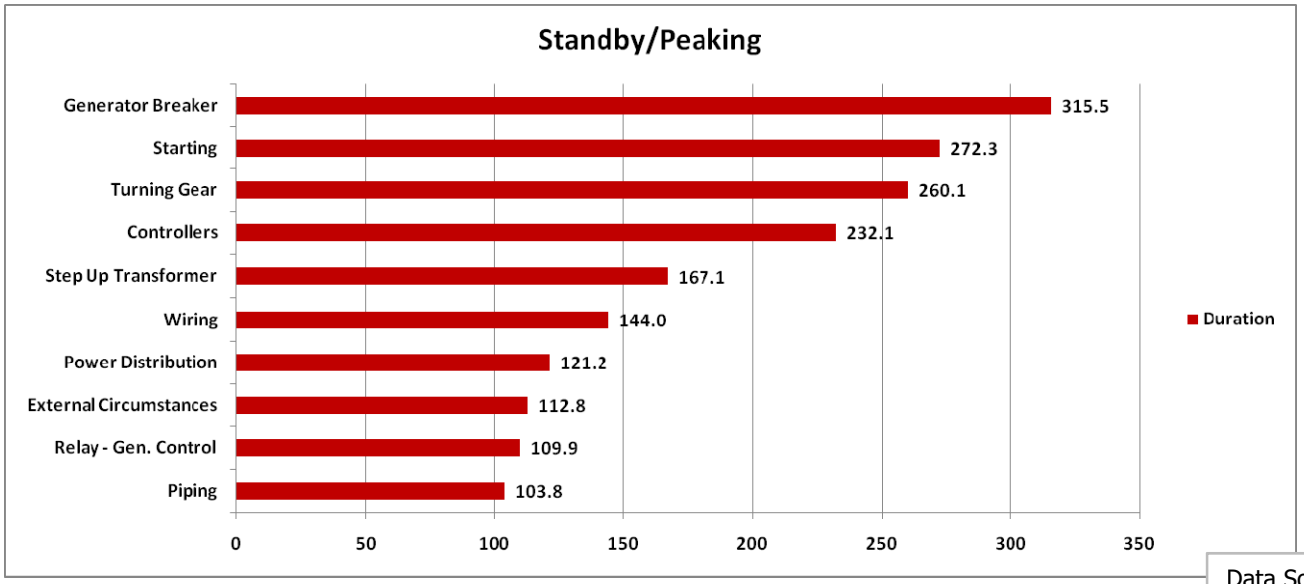

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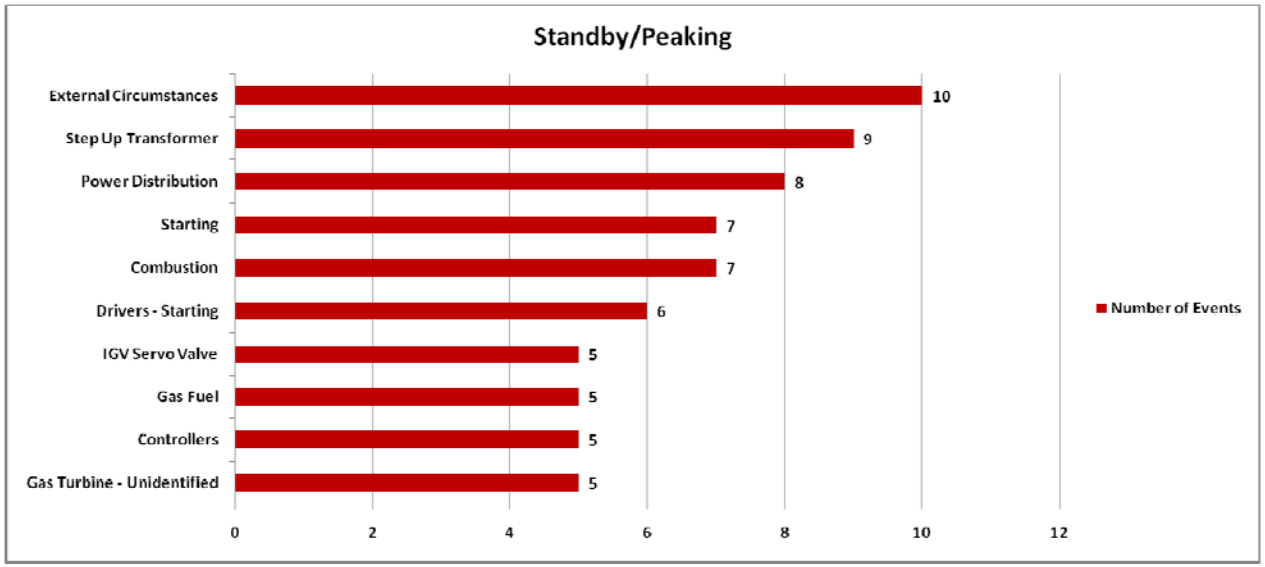
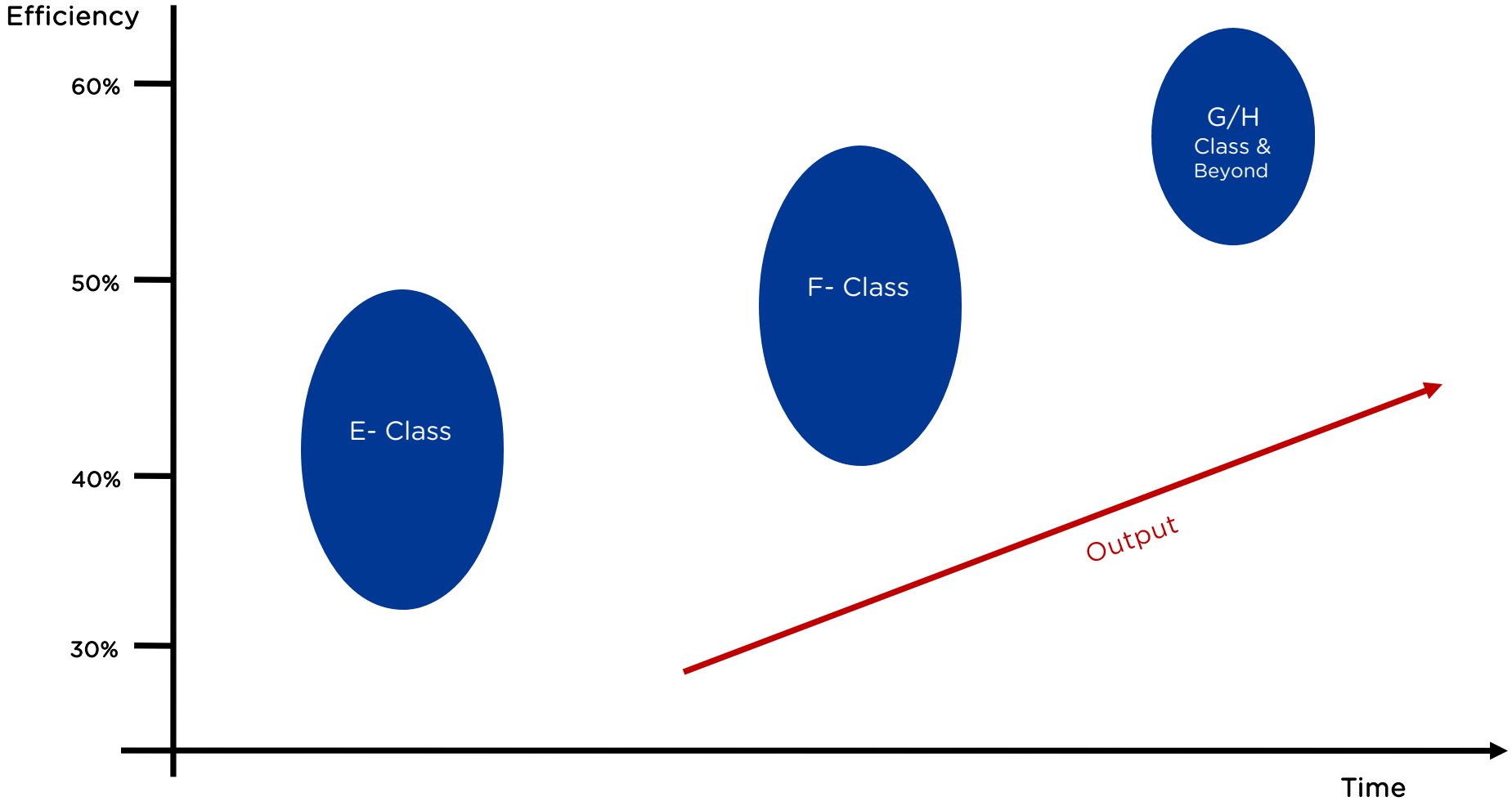


Product Evolution



Level Playing Field

Combined Cycle Plant

Wind Farm

A Unit by Unit Focus… A Strong Equipment Taxonomy

20% Wind by 2030: Overcoming the Challenges

- Historical Combustion Turbine Experience
  - Taught us data is essential for long-term growth and improvements
  - This process must be extended to Wind
    - Industry Needs Transparency
- Wind Turbines Must Fit Into Generating Mix
  - Learn from combustion turbine experience
- Technology has to be seen on a "level playing field"
  - Consistent means and metrics
- DOE/SNL Approach is Right Focus

20% Wind by 2030: Overcoming the Challenges

- The Time is Now
- Young but Rapidly Maturing Industry
  - However, infrastructure exists for value and payback
- Leveraging ORAP® for Wind: A Collaborative Effort Building the National Reliability Database

Thank You

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