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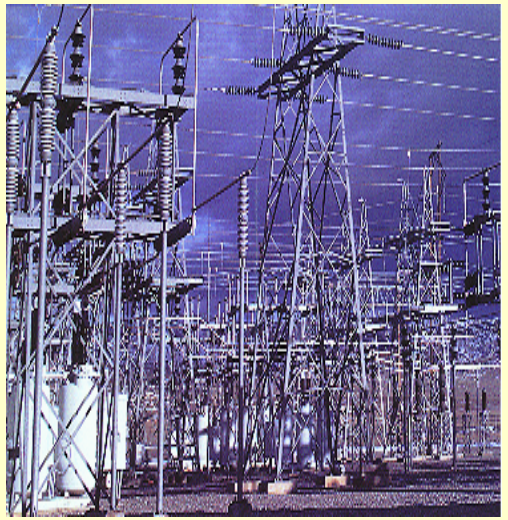
# Integrated Energy Management for Power Plant & Distribution Network of Industrial Plant



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Head - North

24th September, 2008

# Challenges…

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How will I ensure 100% uptime for my critical loads

Should I make, buy, or trade?

How can I reduce dependence on few skilled people

How do I reduce penalties on account of excess power drawl?

How do I minimize operator error, production loss?

How do I handle complexity of multiple sources of power (CPP/Grid)

How do I keep pace with changing requirements of power sector reforms (ABT)

How will I train/enable a new generation of staff in a fraction of time it took before?

How will I manage all of this new data I receive?

How do I improve equipment safety?

*New people…must respond faster, handle more complex processes & networks, make better decisions, with bigger consequences*

**"Energy Management to Improved Business Performance: Solve A Bigger Problem"**

# Power Plant Challenges

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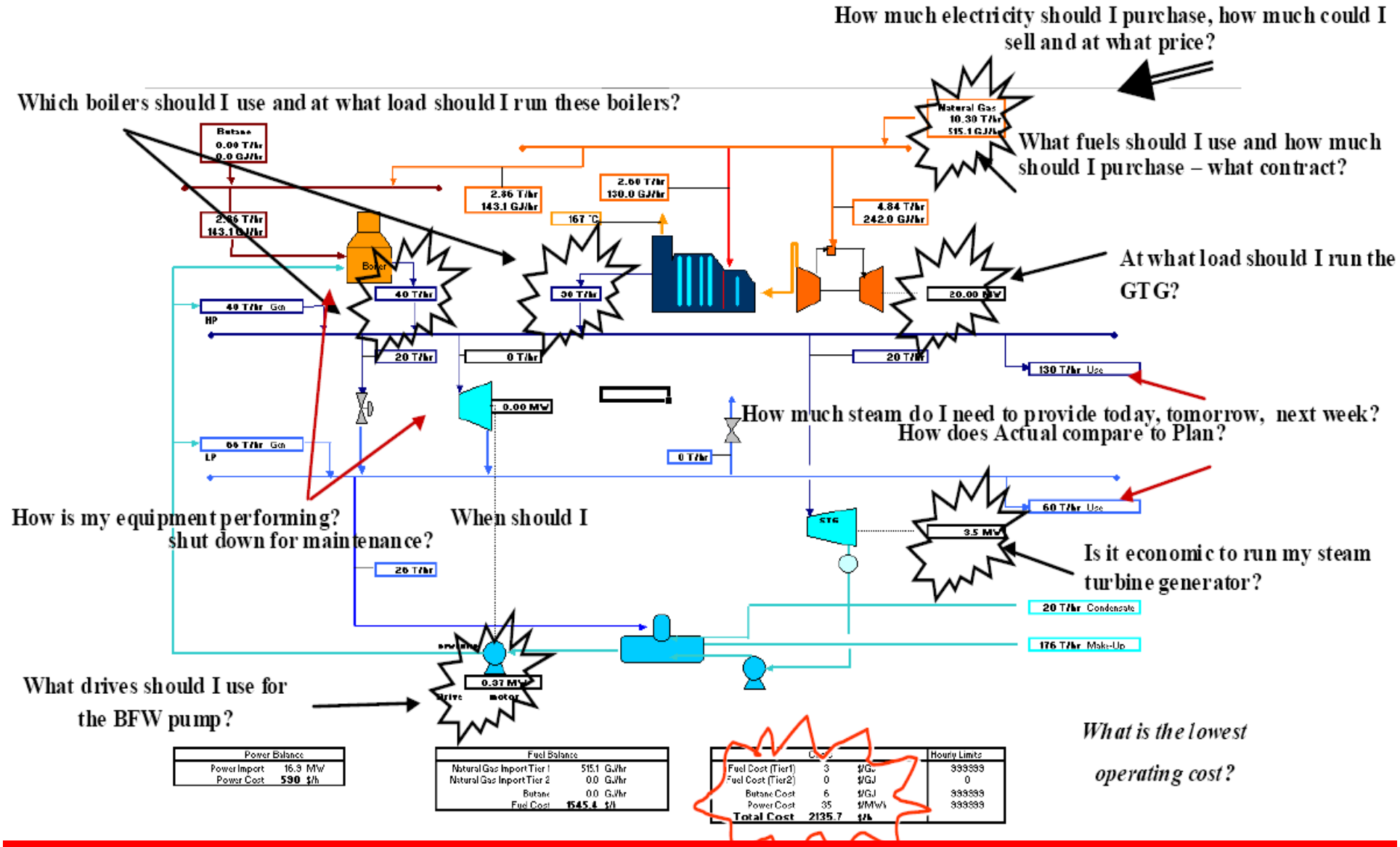
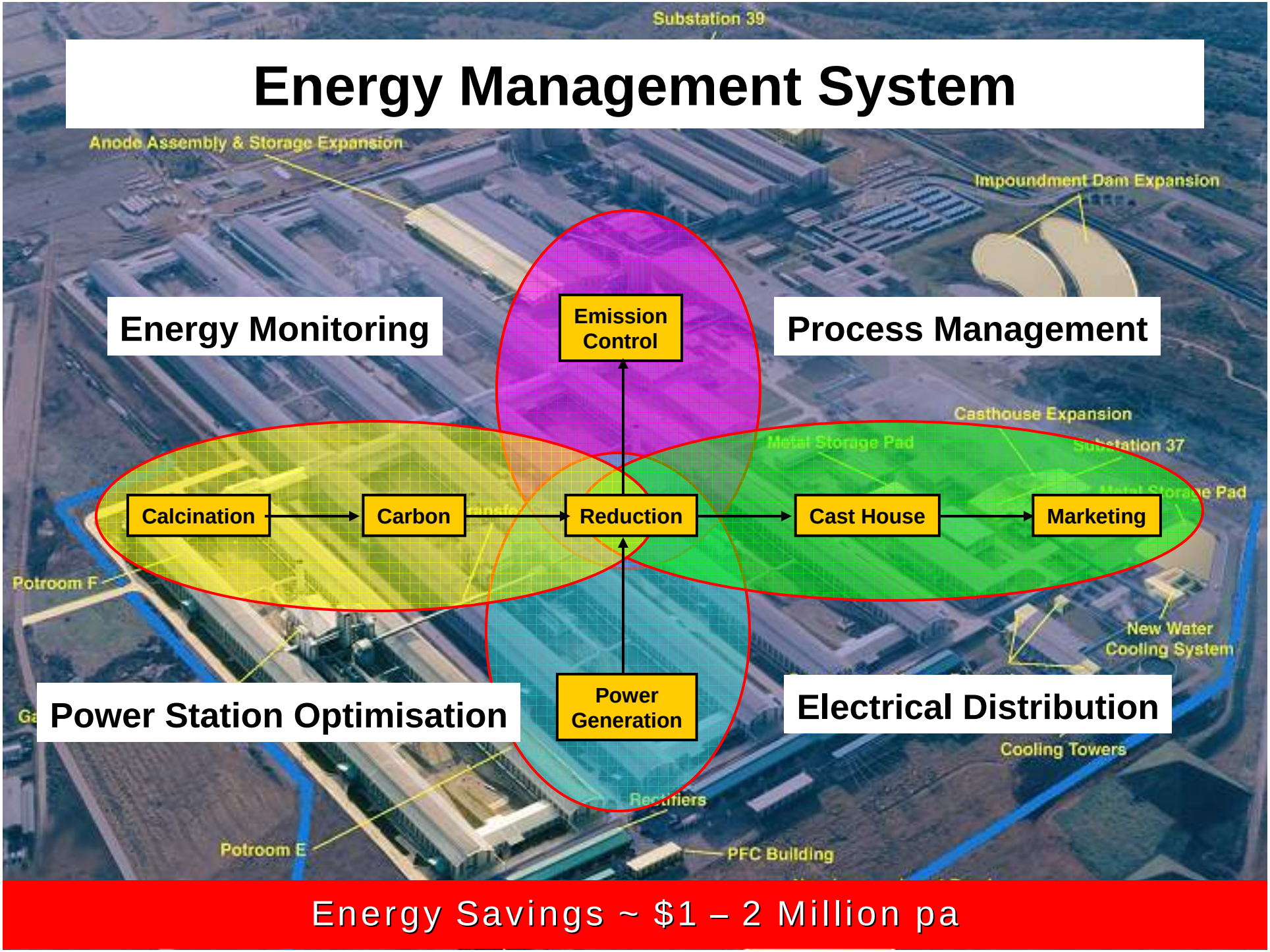



Distributed Control System required for optimization of Power Plant

# Energy Management System




Energy Savings ~ $1 – 2 Million pa

# Energy Management Task

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- Improve economic performance
  - Real time information from Gen./Distr.
  - Cogeneration –combined heat and power generation
  - Trigeneration –combined heat, power and cooling
- Optimization Objectives
  - Determine optimal schedule
    - **set-points for each unit several days ahead**
  - Provide an analytic and planning tool for What-if analysis
    - **evaluation of any thinkable/future situation**
  - Provide a tool for real-time optimization

# Energy Management Task (...cont.)

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- Integrated Energy System Equipment
  - Typical IES units
    - **gas turbines, steam turbines, steam boilers, hot water boilers, compressor chillers, absorption chillers**
  - Unit parameters
    - **maximal/minimal output levels**
    - **overhead costs**
    - **startup/shutdown costs**
    - **energy conversion efficiency curves**
- Optimization inputs
  - real-time prices of purchased energy
    - **electric power, natural gas, other fuels**
  - energy demand of the consumer
    - **power, heat, steam, cooling**
  - demand needs to be forecast

# Power Station Optimisation

# Overview - SIS



## Supervisory Information System

An advanced information system that manages, monitors, and optimises the performance of the power plant.

## Features:

- Open and compatible hardware and software platform
- Reliable industrial real-time database platform
- Distributed data retrieval mechanism
- Embedded advanced control technology
- Modularised application solutions

# TotalPlant ® Performance Monitor

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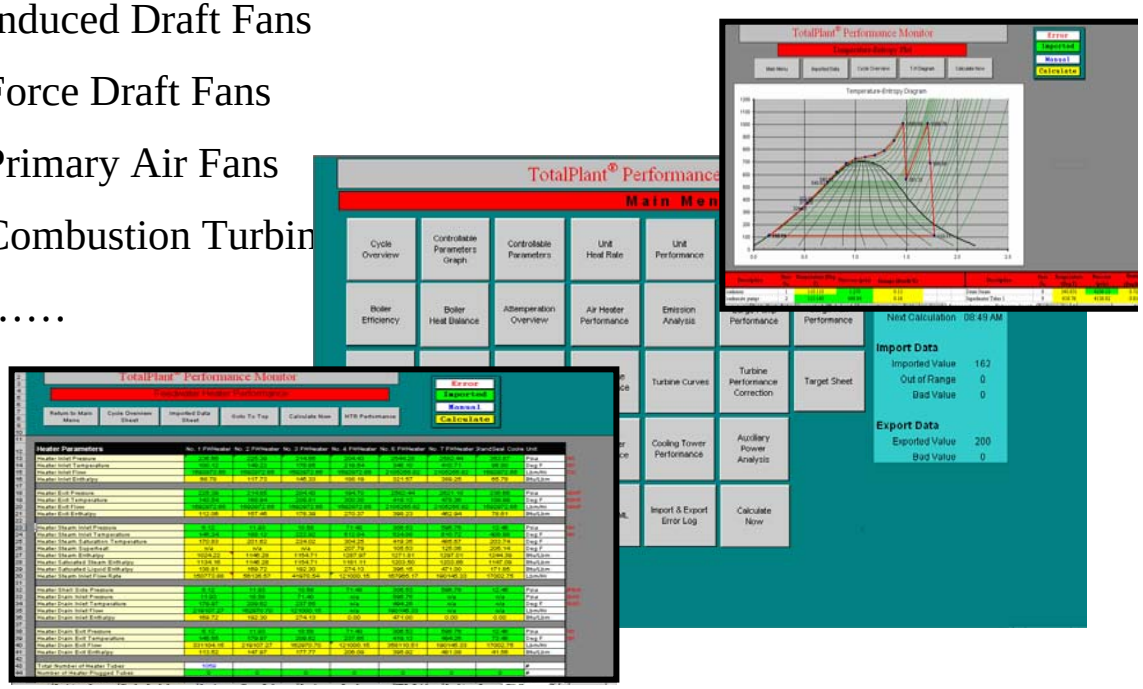
*access* any of the information stored to the plant data historian, *conduct* an entire suite of thermodynamic and heat balance calculations that help monitor the day-to-day plant operations, then *historize* the results.

- Plant Performance
- Unit Performance
- Mass & Energy Balance
- Boiler
- Turbine
- Feedwater Heater
- Condenser
- Cooling Tower
- Air Preheater
- Feedwater Pump
- Condensing Pump
- Circulating Pump
- Induced Draft Fans
- Force Draft Fans
- Primary Air Fans
- Combustion Turbin
- ……



# Load Economic Dispatch

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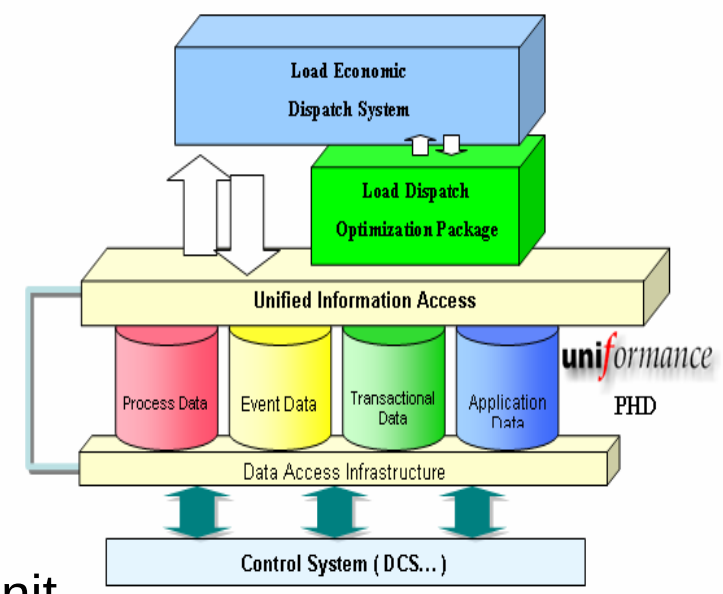
- Determines the optimal schedule of online generating outputs so as to meet the load demand at the minimum operating cost under various system and operating conditions.
- **Constraints**:
  - Fuel cost function
  - Availability of generating unit
  - Upper/lower bound of unit output
  - Prohibited working zones
  - Up/Down ramp limit of generating unit




- **Fuel cost function** of each unit can be estimated from historical data
- All calculations are done in **Load Dispatch Optimization Package**

# Sootblowing Optimization

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- Ash deposition on heat transfer surfaces can reduce operating efficiency and availability.
- Excessive buildup can cause forced outages and boiler damage

## Conventional solution

**Operators DO NOT know whether the surfaces are clean or not?**

↓

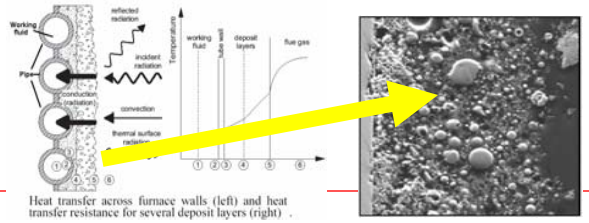
**Start sootblowers on a fixed schedule**

↓

**Energy wasted**
**Boiler life Reduced**

↓

**Contribution of Sootblow system is limited**



Heat transfer across furnace walls (left) and heat transfer resistance for several deposit layers (right) .

## Intelligent solution

**Estimate cleanliness factor**

↓

**Start sootblowers when it is necessary and economical**

↓

**Energy efficiency improved**
**Boiler life prolonged**

↓

**Contribution of Sootblow system is Maximized**

# Advanced Combustion Control

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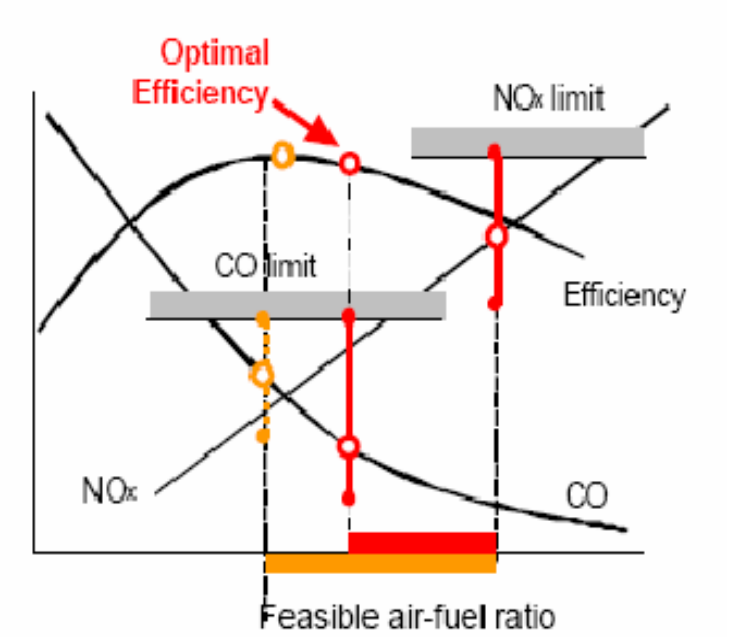
- **Target:**

  Optimize excess amounts of air in the combustion process to decrease CO emission.

- **Principle:**

  Establish a combustion model based on connectionist modeling, calculate the best relationship between oxygen, air flow, coal supply, main steam flow and so on.



# On-line Performance Test

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- Boiler Performance Test
- Turbine Performance Test
- Condenser Performance Test
- Air Preheater Leakage Test
- Vacuum Leakage Test

Generate and save the test report automatically

According to the National Regulation and Standard

# Power Distribution

# Solution to Power Distribution

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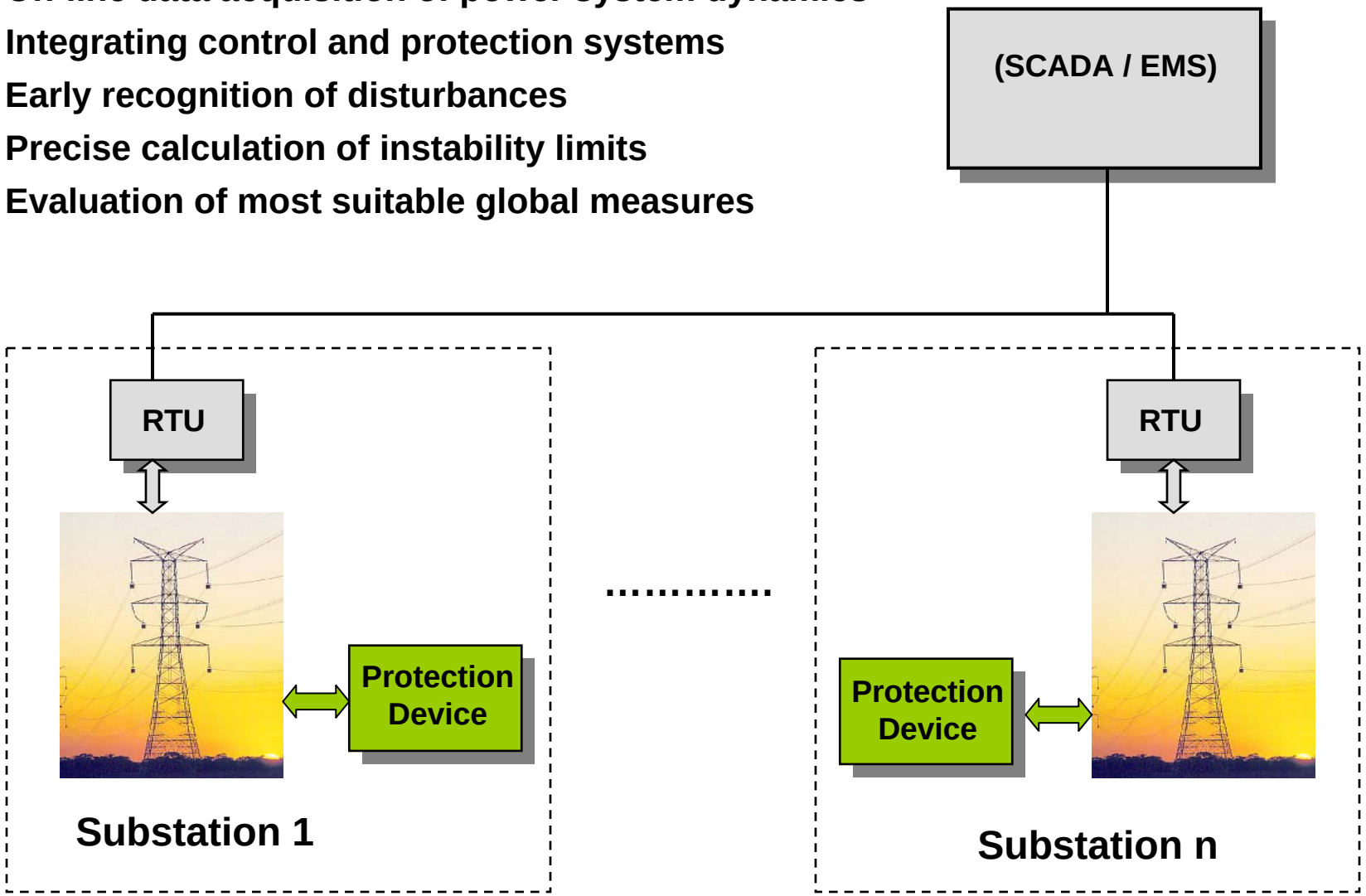
- Real-time data processing
- On-line data acquisition of power system dynamics
- Integrating control and protection systems
- Early recognition of disturbances
- Precise calculation of instability limits
- Evaluation of most suitable global measures



# Solutions for Industrial Energy Management System

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## Basic Requirement –

- Supervision, Control and Data Acquisition (SCADA)
- Load Shedding
- Active and Reactive Power Control
- Mode Control
- Remote Synchronisation

## Offline Decision Making Tools –

- Power Network Analysis
- Load Forecasting
- Contingency Analysis ( What if )
- Load Flow Analysis
- Relay Coordination Study
- Availability Based Tariff
- Asset Management

# Business Processes for Energy Management

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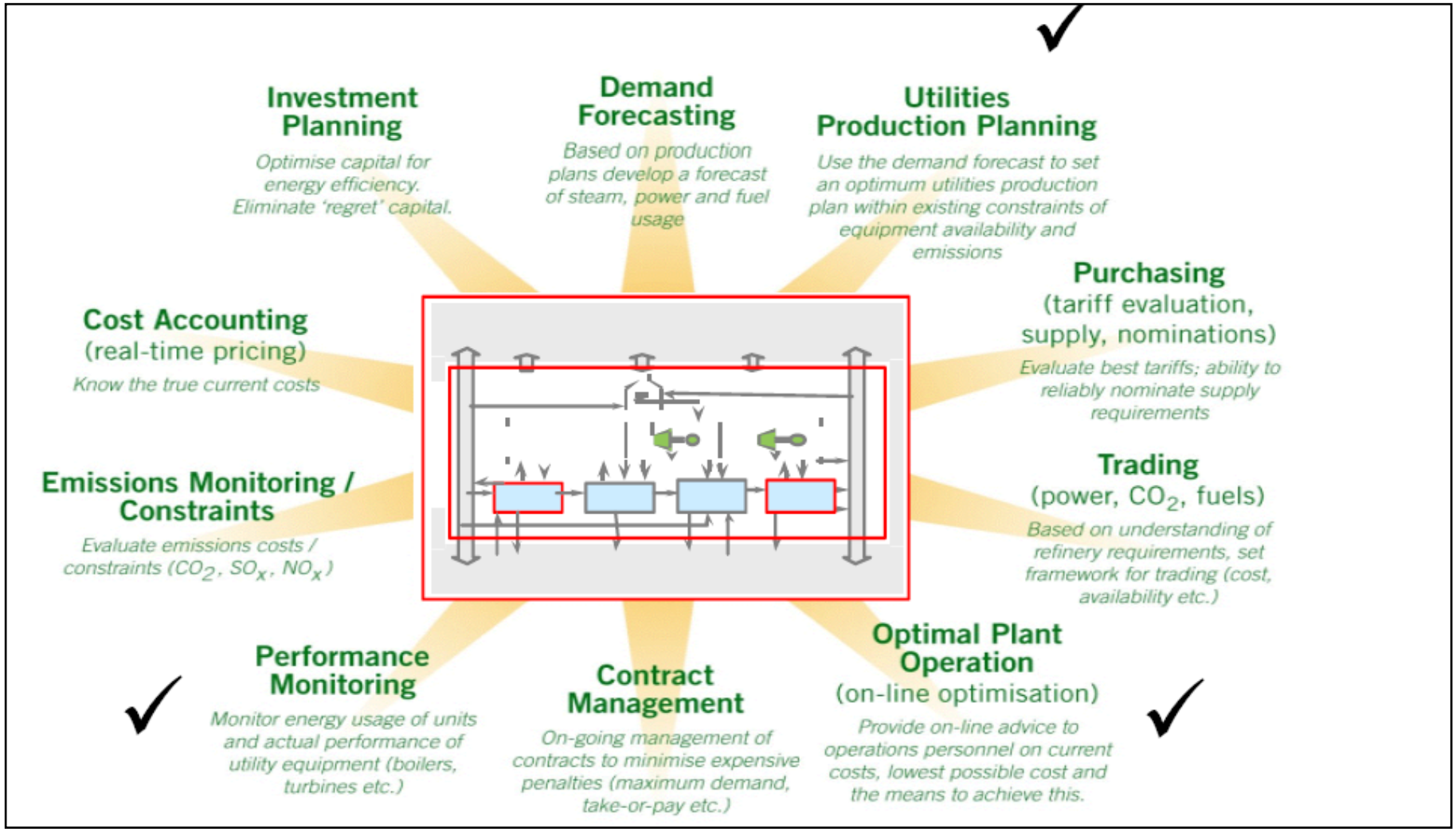

# Energy Optimization and Management Solution

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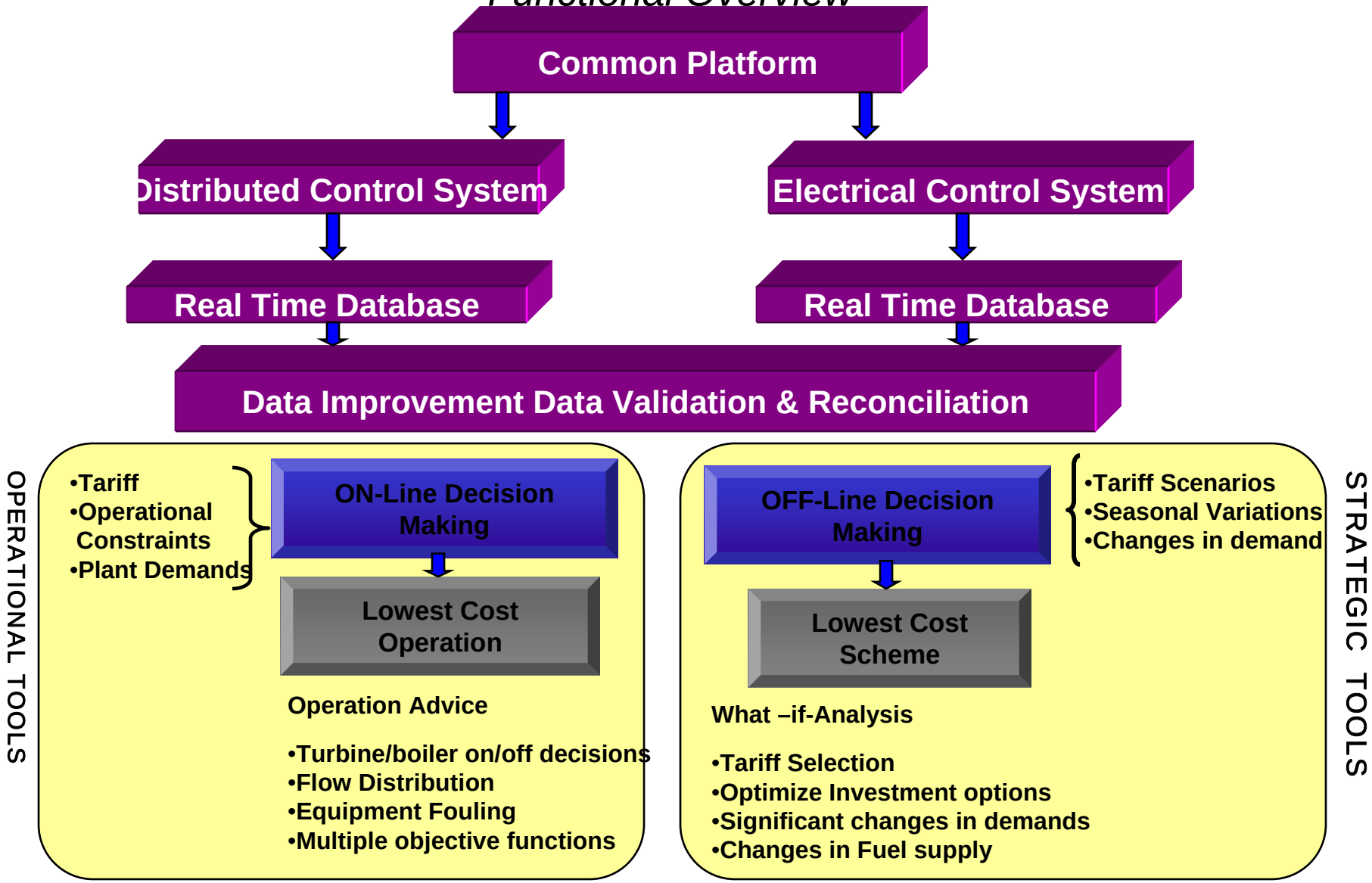
*Functional Overview*



# Software Architecture

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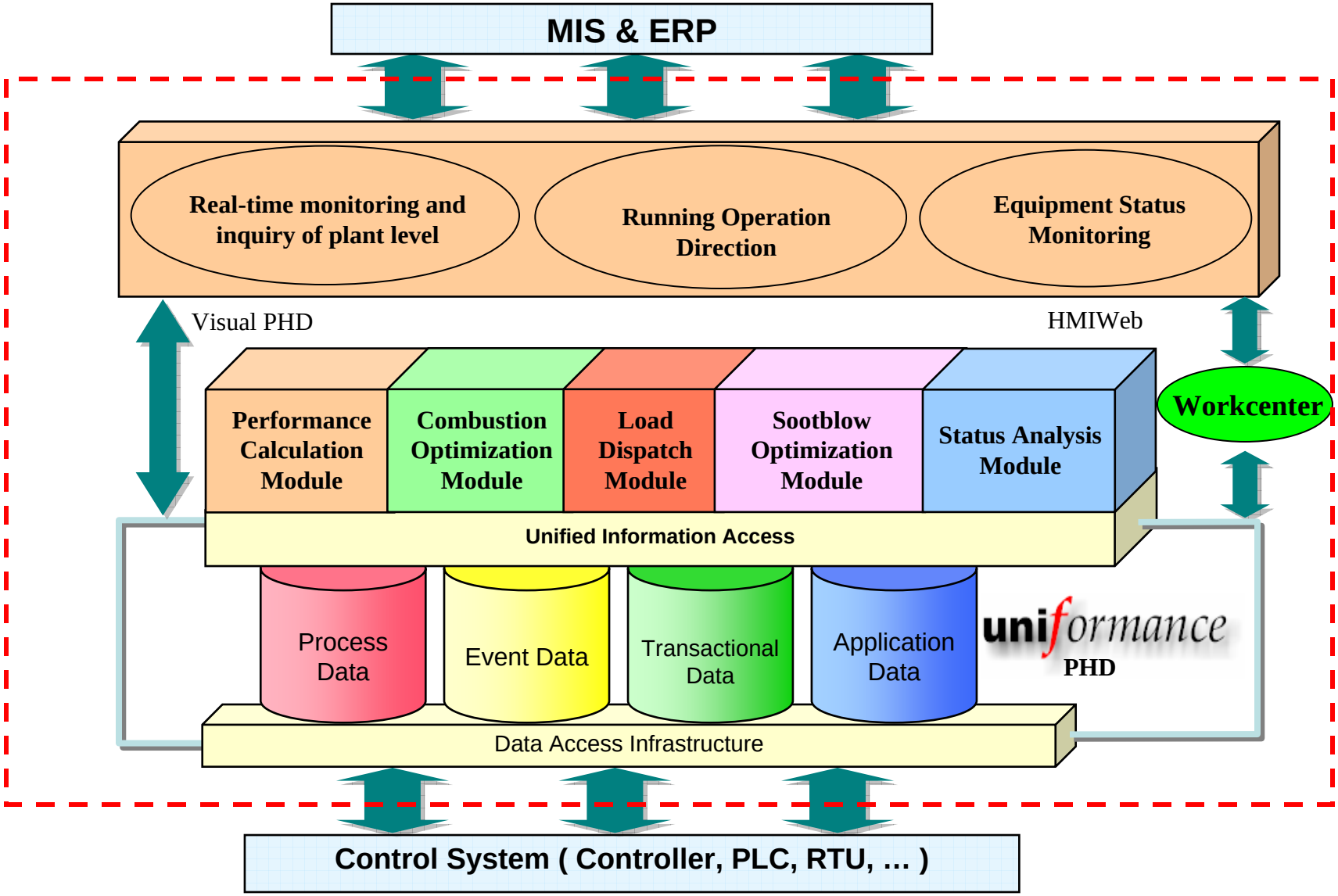

# Benefits

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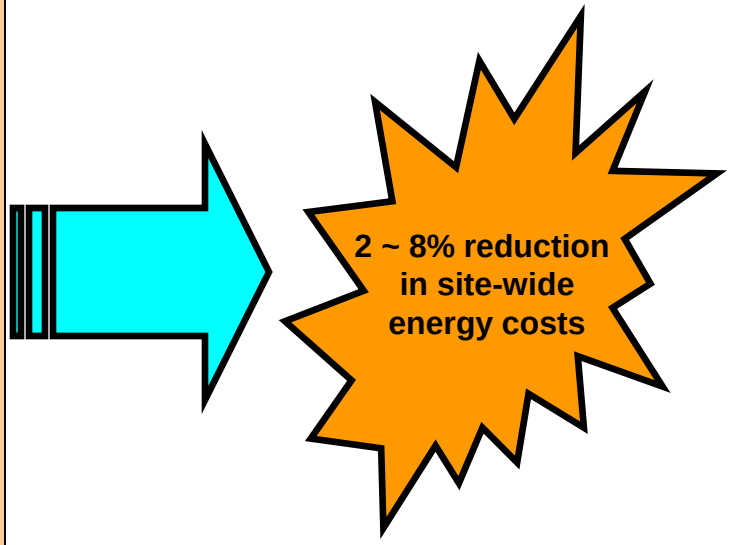
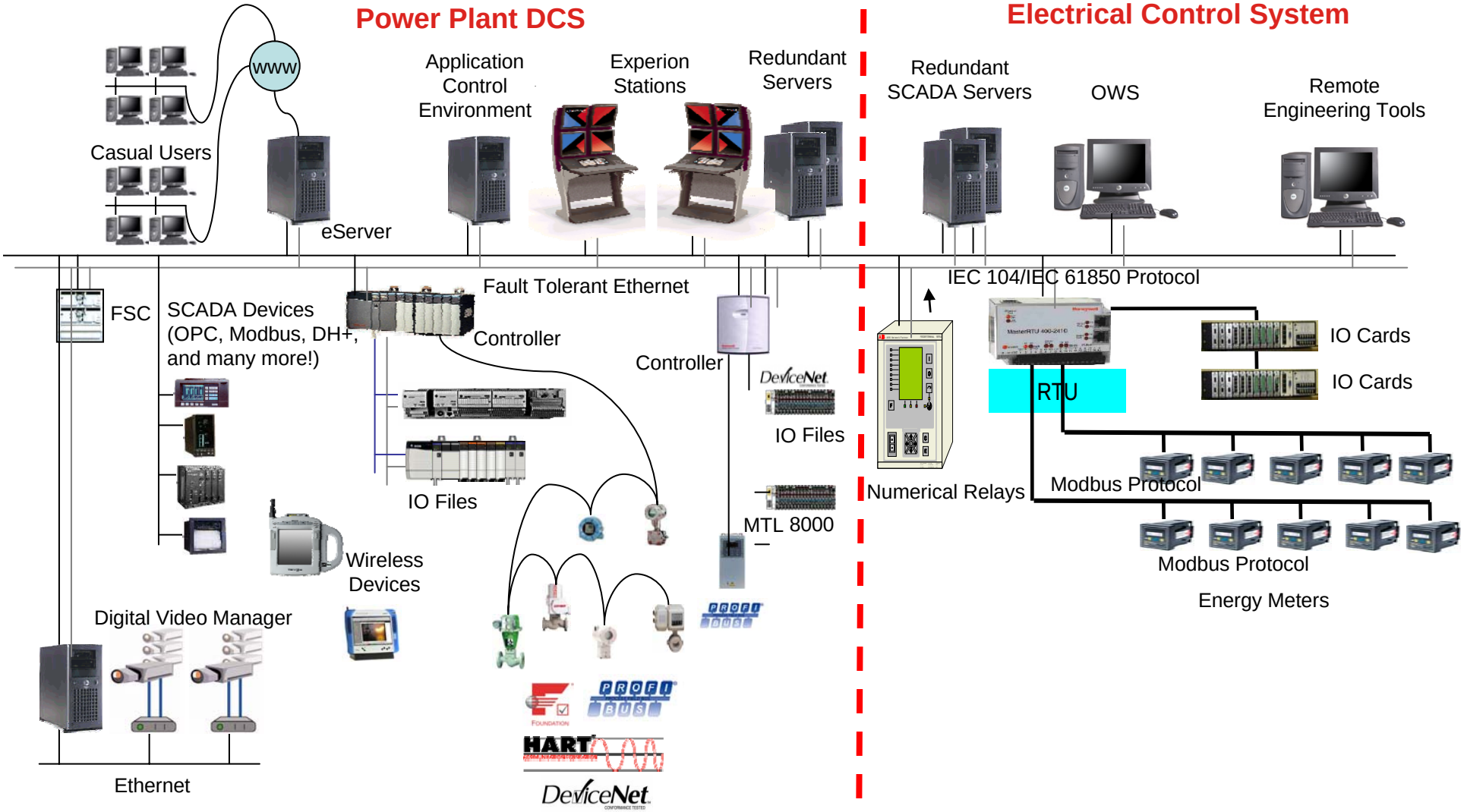
- Better purchasing (lower contract price, more reliable nominations)
- Better adherence to contract/tariff terms – reduced penalties
- Maximising use of most efficient equipment
- Correct choice and use of fuels
- Reduced hot standby
- Reduced venting of steam
- Better cost accountancy, better decisions based on true costs
- Faster response to problems (and better targeting of problems)
- Optimum scheduling of maintenance
- Reduced time/manpower for accounting, purchasing etc
- More profitable trading
- Reduced capital investment for improvements in energy efficiency
- Increased production (if utilities are bottlenecked)



# Integrated Power Plant DCS+ECS



# Experion™ Process Knowledge System

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## Services

Industry domain expertise, global resources
Fast delivery of benefits
Sustained value


World-class automation technology
Brings together field, asset and automation information
Enables Process Knowledge

## Platform

# Your EMS Solution Partner

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## Improving Business Performance and Peace of Mind

| Better Technology | Better Delivery | Better Lifecycle Support |
|---|---|---|
| Turning resources into results with technology that solves a larger problem | Achieving quicker startup and more immediate benefits | Supporting continuous evolution and protecting your investment |
| R300, Wireless, Corrosion, Foundation Field-bus, Safety Solutions | 98%+ on time & on budget delivery<br>Global Delivery & Support | 3000 service engineers<br>Best investment protection<br>TAC, 24x7 call centre |

**Proven Track Record across Industries – Performance Guarantee**

# Thank you