Welcome!

today's presentation will start at the top of the hour!

The Refinery-Wide Optimization
Webinar Series

Discover new ideas and solutions to improve your bottom line

invensys
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Real-Time Answers

Using New Modeling Technology to Help Solve Heavy Oil Processing Issues

ON DEMAND

Heavy feedstocks present difficult operational challenges for refiners that can add to safety risks and reduce profitability. Processing heavy crudes safely and profitably can require development of new equipment or major changes in operating conditions.

Reducing Material Losses with Better Yield Accounting

ON DEMAND

Leading refining and petrochemical companies worldwide require continually tighter controls over material losses. It's a complex issue, and numerous factors interfere with accurate accounting of refinery materials. Missing data, error-laden data, and time constraints, for example, can all prevent the development of a proper accounting.

Aging Workforce and Operator Training – Improve your bottom line with faster, more effective training techniques

DEC 4

Tuesday, December 4, 2012
11 AM EST/4 PM GMT
10 PM EST/3 AM GMT (Dec. 5)

Inexperienced and undertrained operators are a liability, risking not only the safety of refinery personnel but also the refinery's profitability. A less experienced operations workforce is likely to become a persistent trend as an older generation of employees is replaced by a new generation with less time on the job.

www.real-time-answers.com/refinery/

Operator Training: Faster, more Effective Training Techniques

Trevor Cusworth
Business Consultant

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Dynamic Simulation Consultant

invensys™
Operations Management

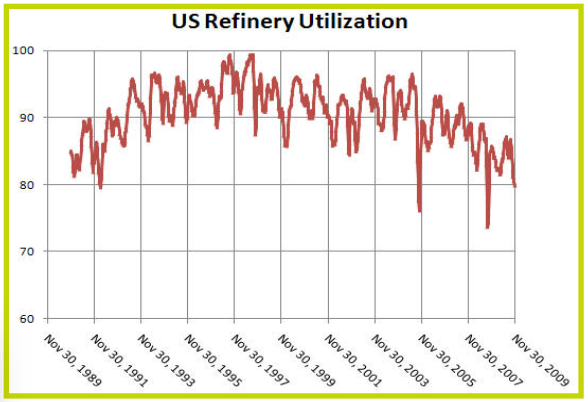
Avantis Eurotherm Foxboro IMServ InFusion SimSci-Esscor Skelta Triconex Wonderware

Agenda

- Today's Business Challenges
- The Human Resource Crisis
- Accelerating the Learning Curve
- Benefits
- Operator and Immersive Training Simulators
- Examples
- Q & A

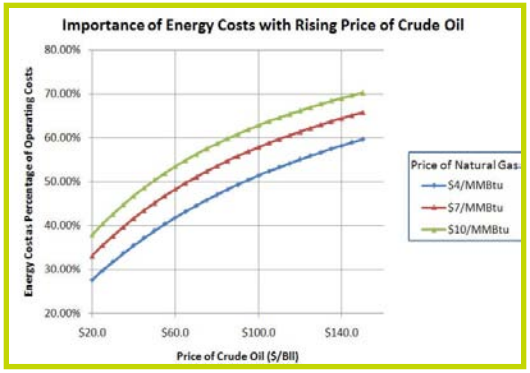
Industry Pressures - The “Perfect Storm”

Environmental Regulations

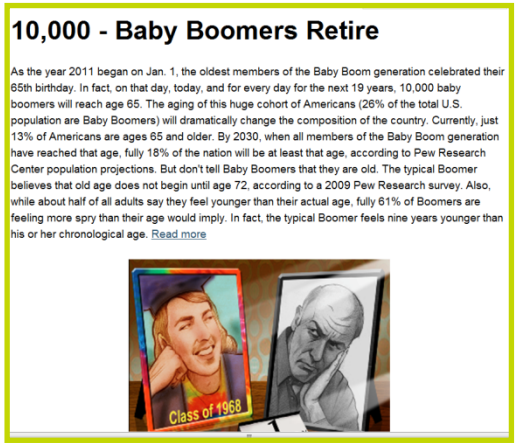


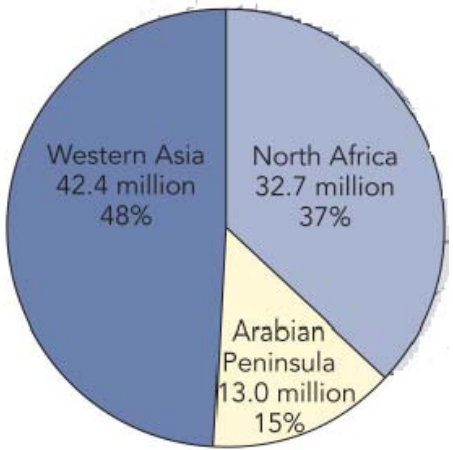
Utilization Down
Supply > Demand
Margins Down

High Energy Costs



Loss or Lack of Experience



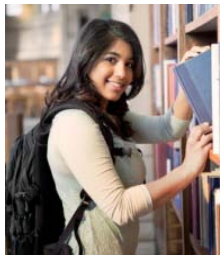


Population in ME and NA between ages 15-24

Business Environment

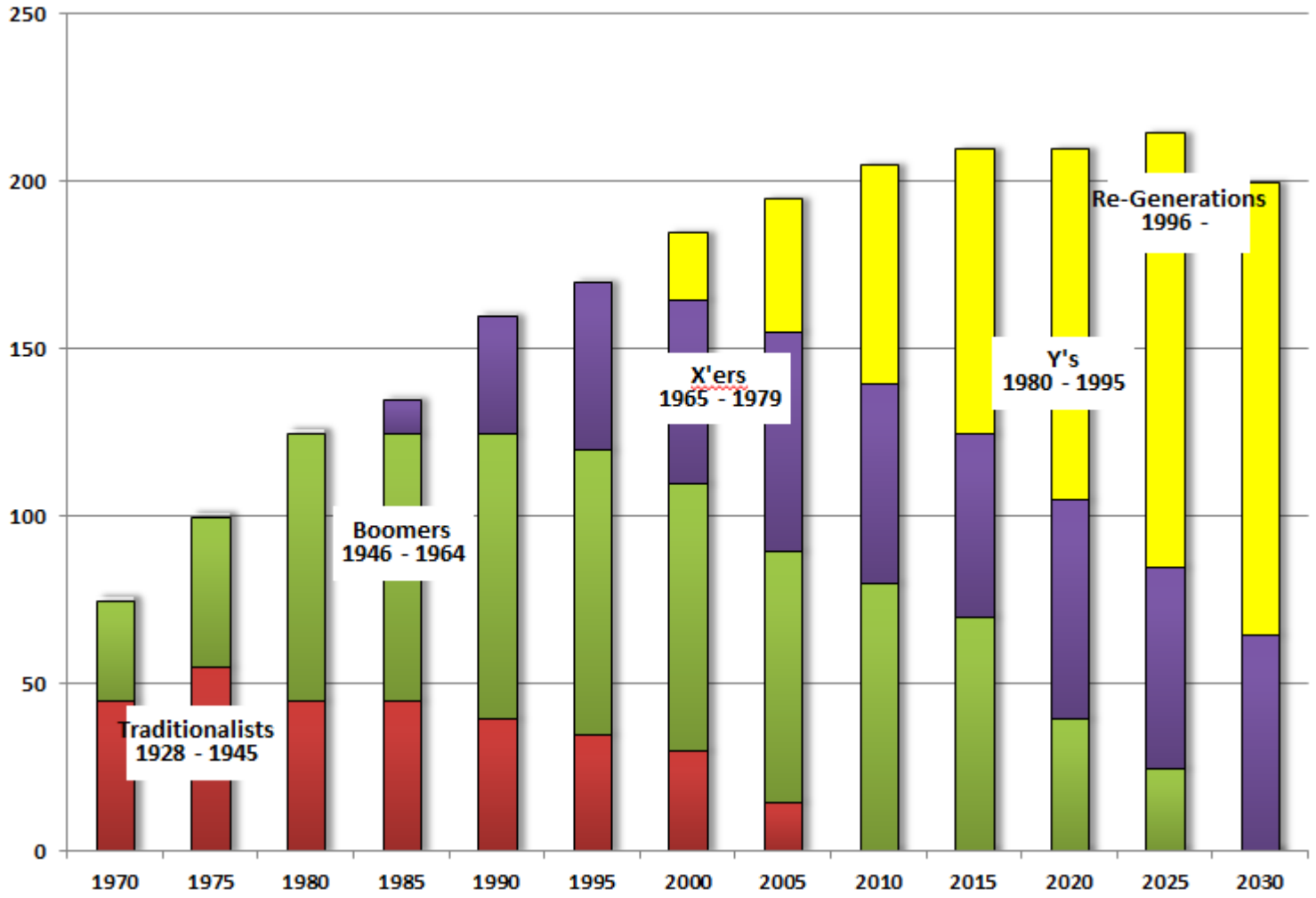
- Attracting and retaining high performing staff is becoming increasingly difficult
- Large amounts of experience is being lost as baby-boomers retire
- Need to develop ways to bring people up to speed faster and to higher levels of competence – Improve their “Time to Performance”
- Need new ways to engage the employees in the business by providing them with information to understand the impact they are having on the business

Workforce is changing. What are their expectations?

	Traditionalist	Boomer	Gen X	Gen Y	Re-Generation
Born:	1928 - 1945	1946 - 1960	1961 - 1979	1980 - 1995	1996 -
					
	• Loyal • Respectful • Fiscally conservative	• Competitive • Anti-authoritarian • Idealistic	• Self-reliant • Mistrustful • Dedicated parents	• Immediate • Optimistic • Digital natives • Family-centric	

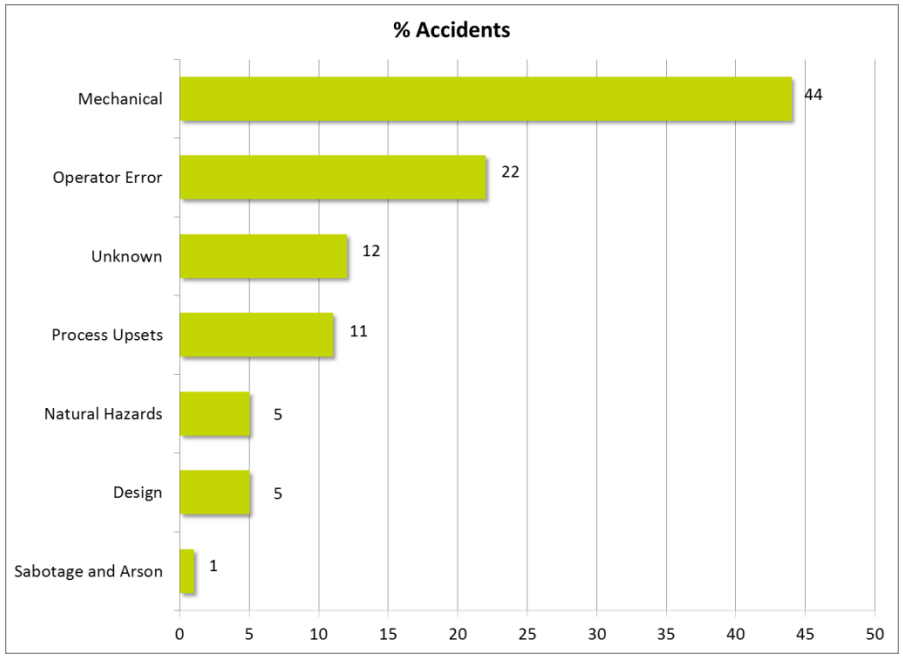
- Each generation with different assumptions about how the world works
- Based, in part, on common interpretations of shared experiences
- Common is desire for <u>empowerment</u>, increasingly as generations shift to the right

Generational shifts in the labor force composition



Source: US Census Bureau

Operator Training



Reference: Causes of losses in the largest hydrocarbon-chemical plant accidents. Source: Large Property Damage Losses in the Hydrocarbon-Chemical Industries: A Thirty-Year Review. (New York: J & H Marsh & McLennan Inc., 1998), p. 2.

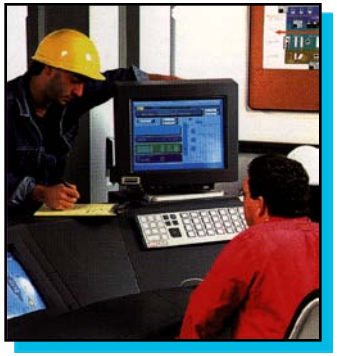
- Challenges
  - Operation errors are the 2nd leading cause of accidents
  - Operators unfamiliar with DCS configuration and plant design
  - Retiring Operators (“Grey Hair” Factor)
  - Longer run time between shutdown limits startup training
- Training Objectives
  - Increase startup/shutdown training frequency
  - Maintain system & operator battle readiness
  - Expand operator comfort zone
  - Capture best practices procedures

Improved Time to Performance - Training

Academic ⟷ Real Time Off Line Experiential ⟷ Real Time On Line Experiential

Self study

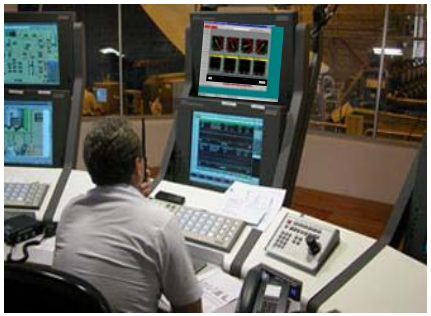
Operator Simulation



On-the-Job Operations

Classroom

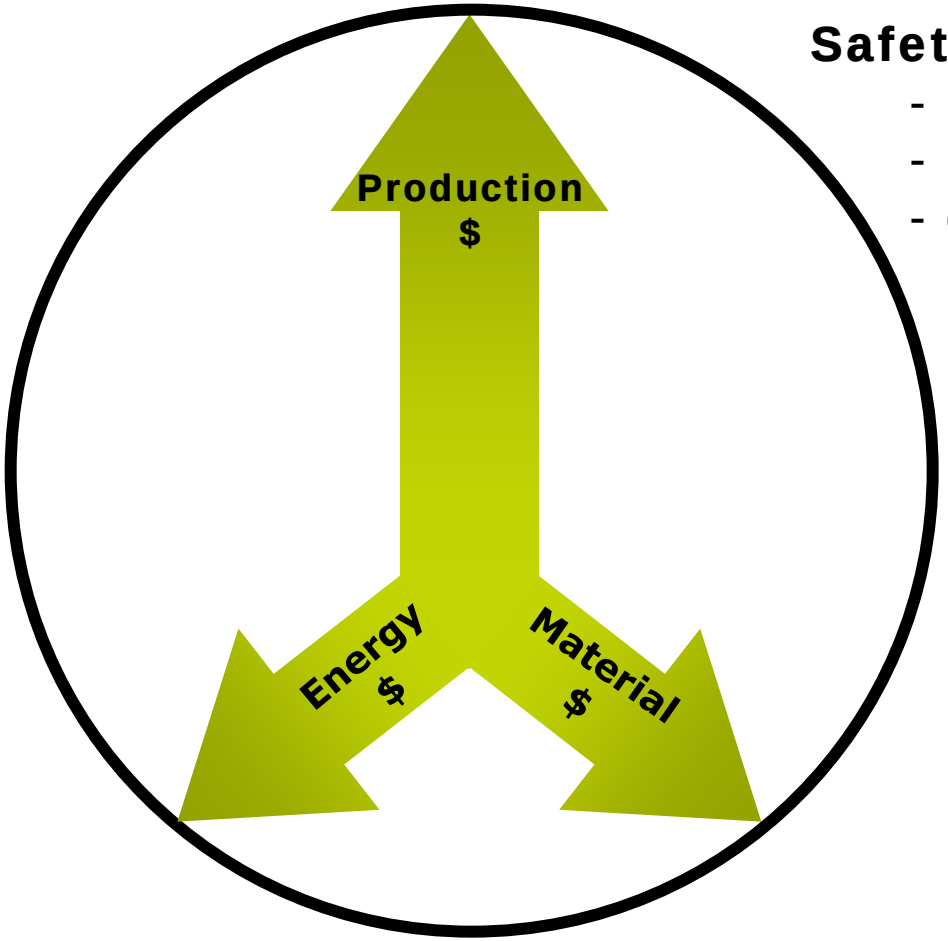
Virtual Reality



On-the-Job Performance

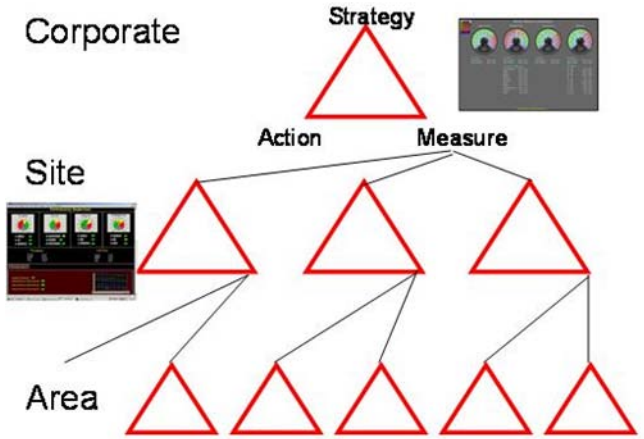
The Right Combination for Maximum Performance

Real-Time Profit Impact Model

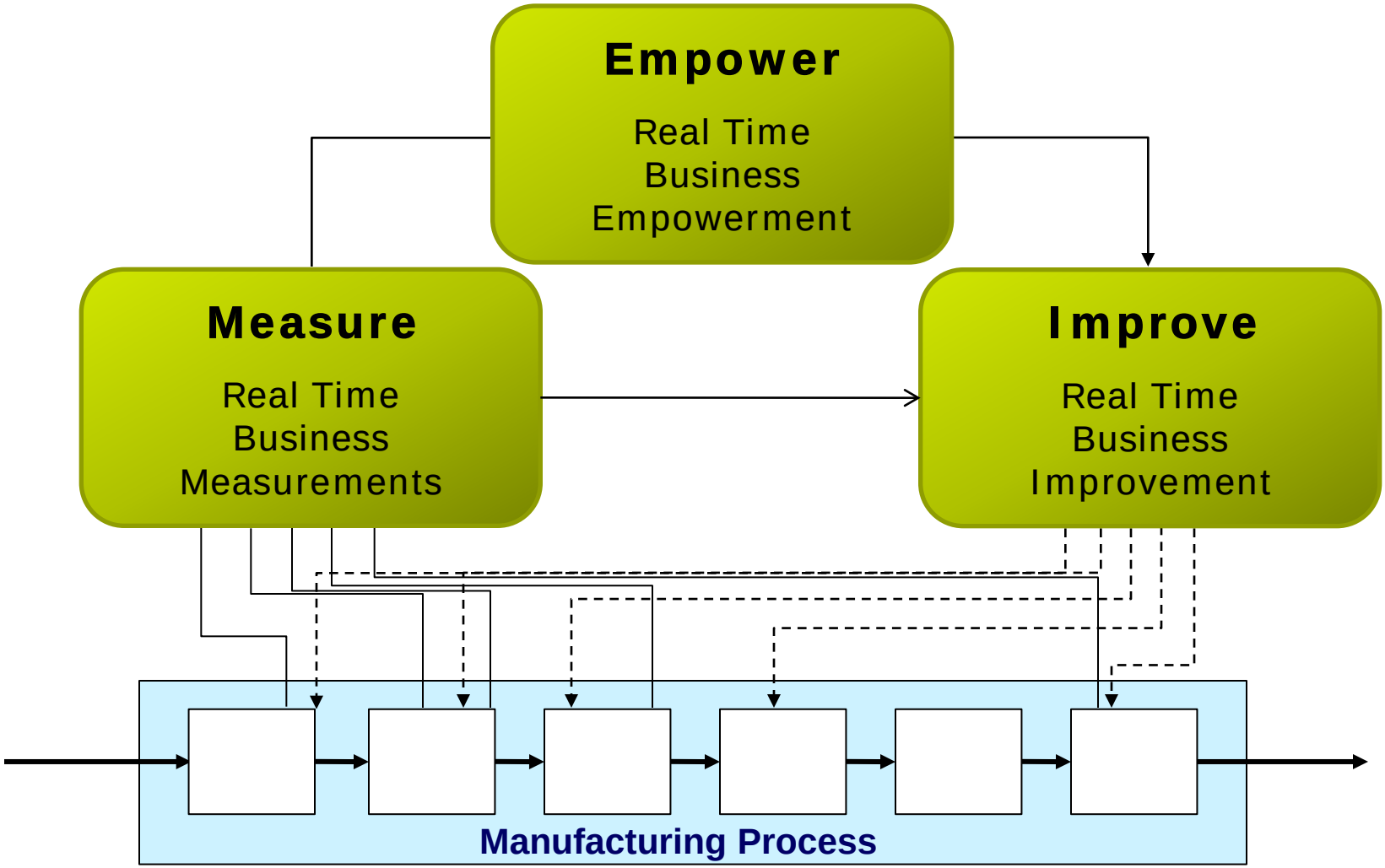


Safety

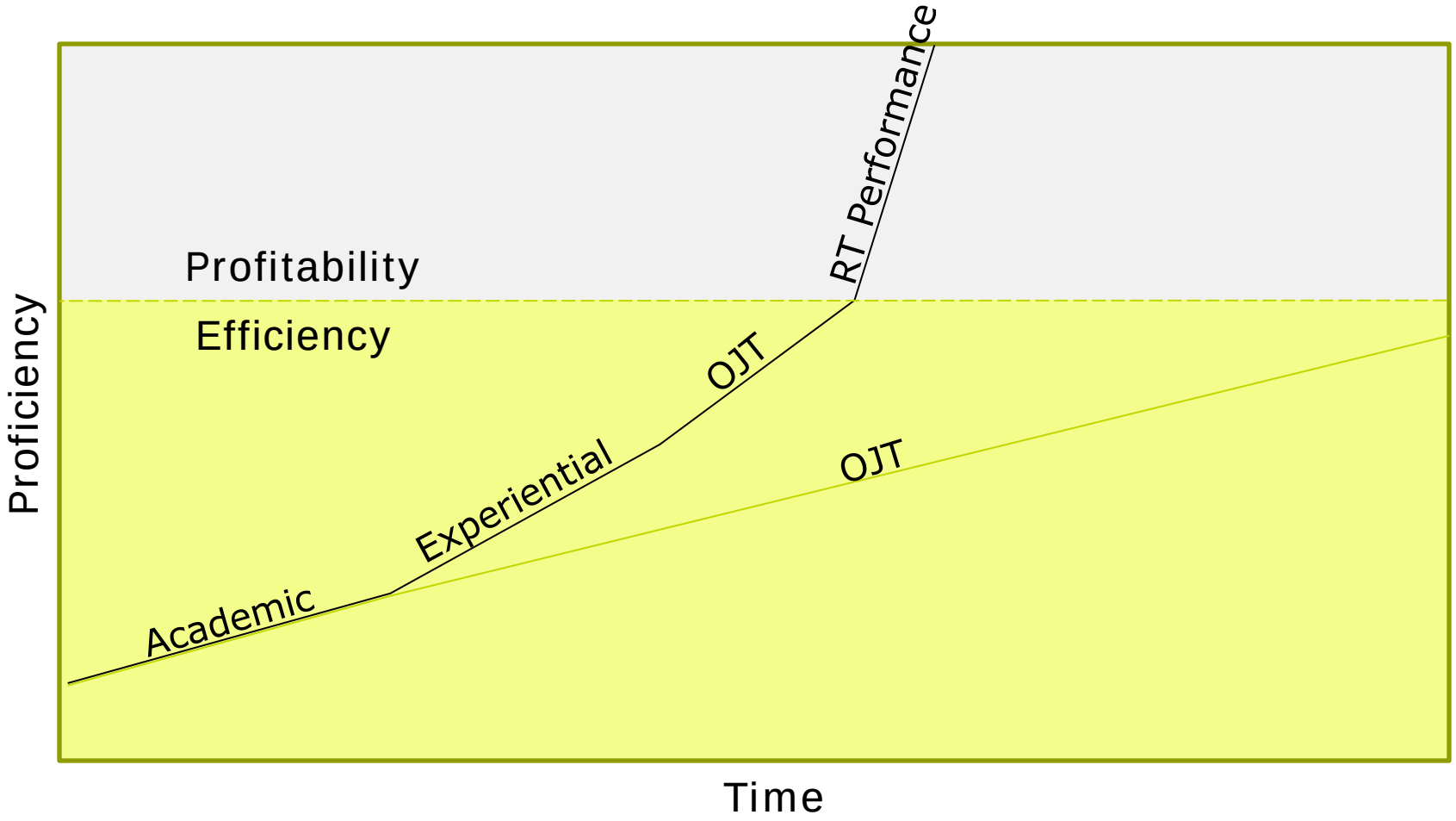
- people
- plant
- environment



Real-Time On-Line Experiential Learning



Human Resource Proficiency Model



Sasol (South Africa)

Challenge

- Unpredictable energy costs
- Control energy costs while maintain output

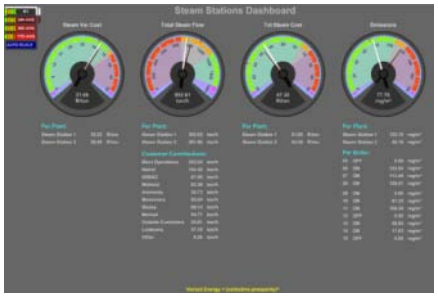
Solution

- Empower operators
- RT performance metrics

Benefit

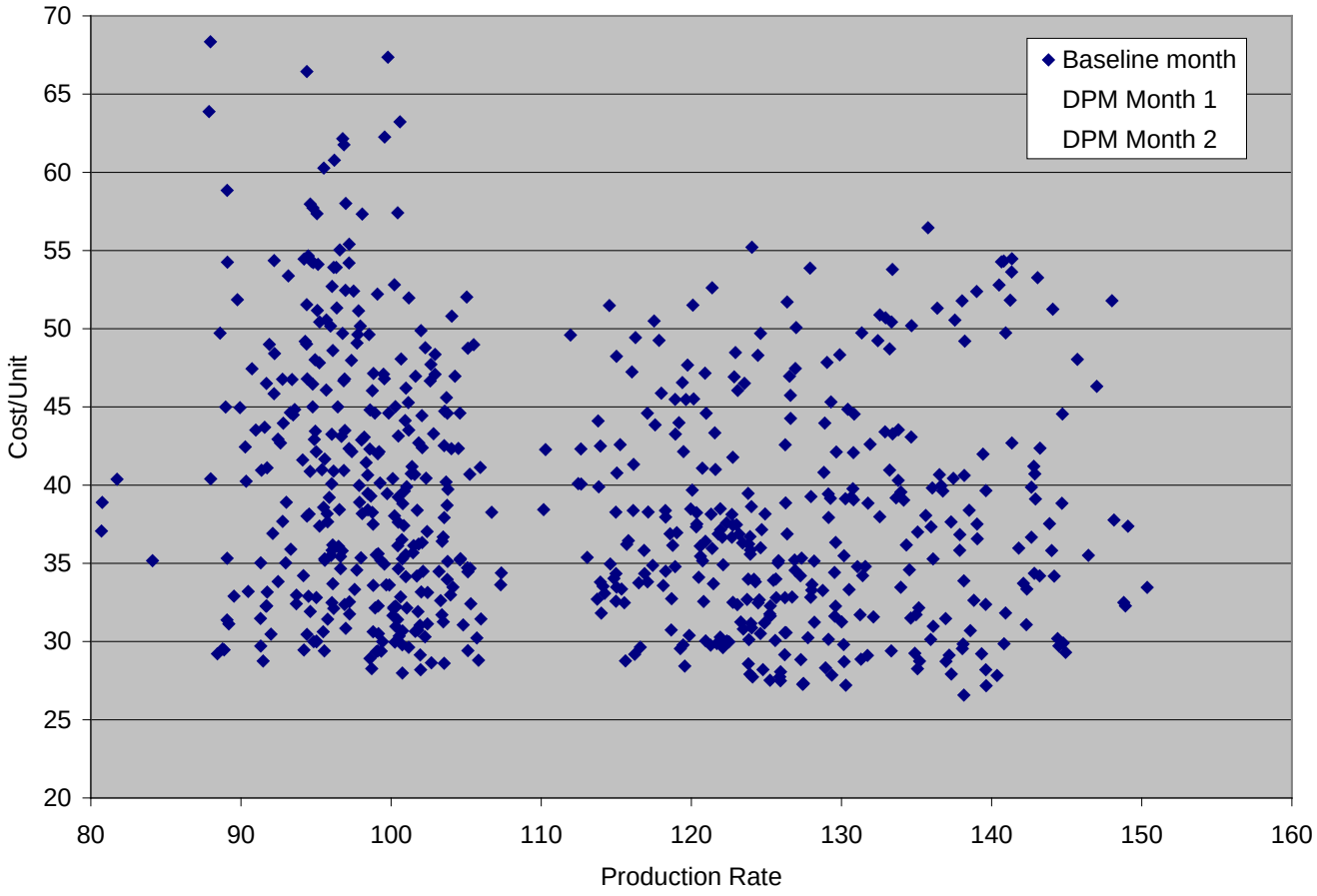
- $6.1 M in energy savings

Management Dashboard

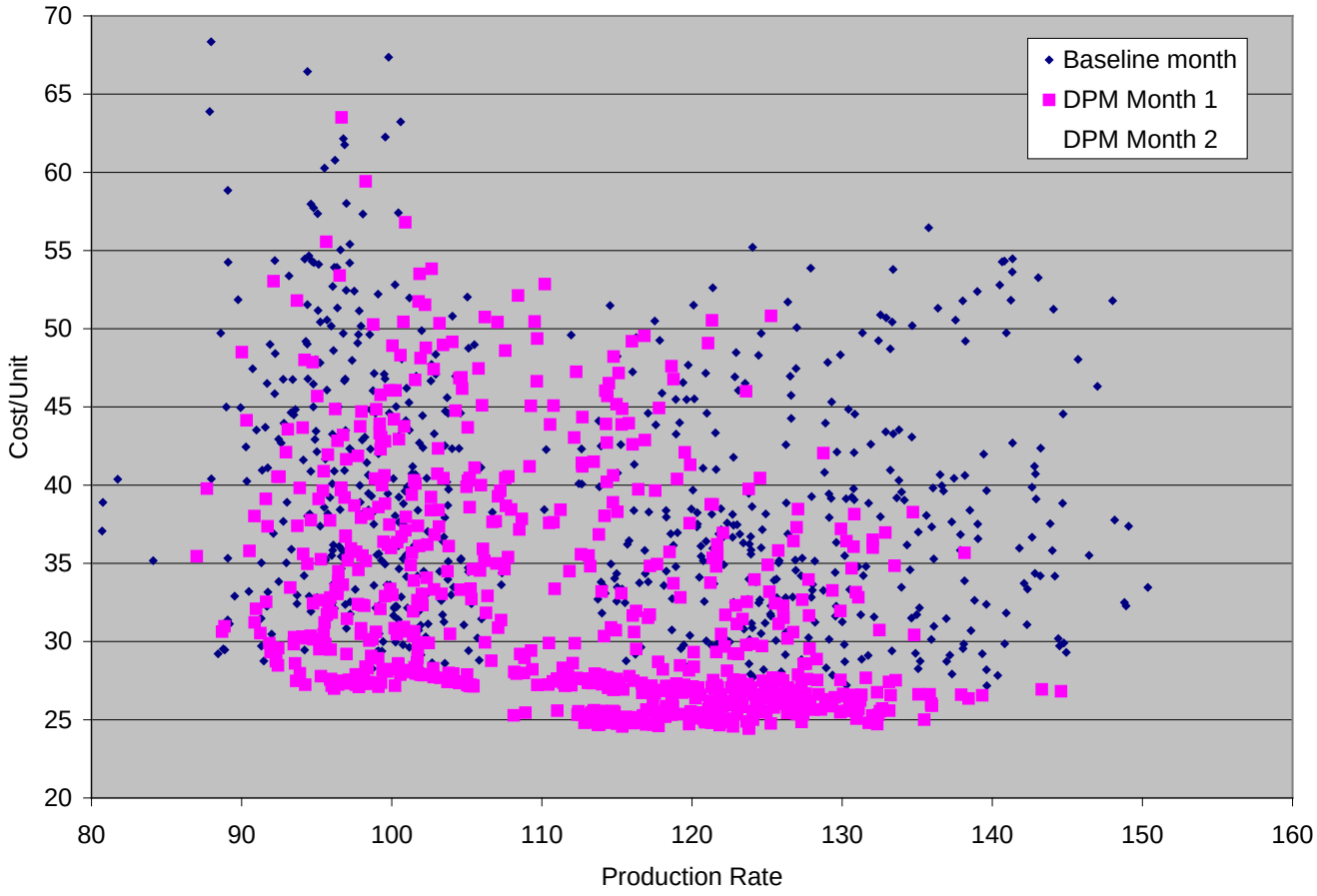


Operator Dashboard

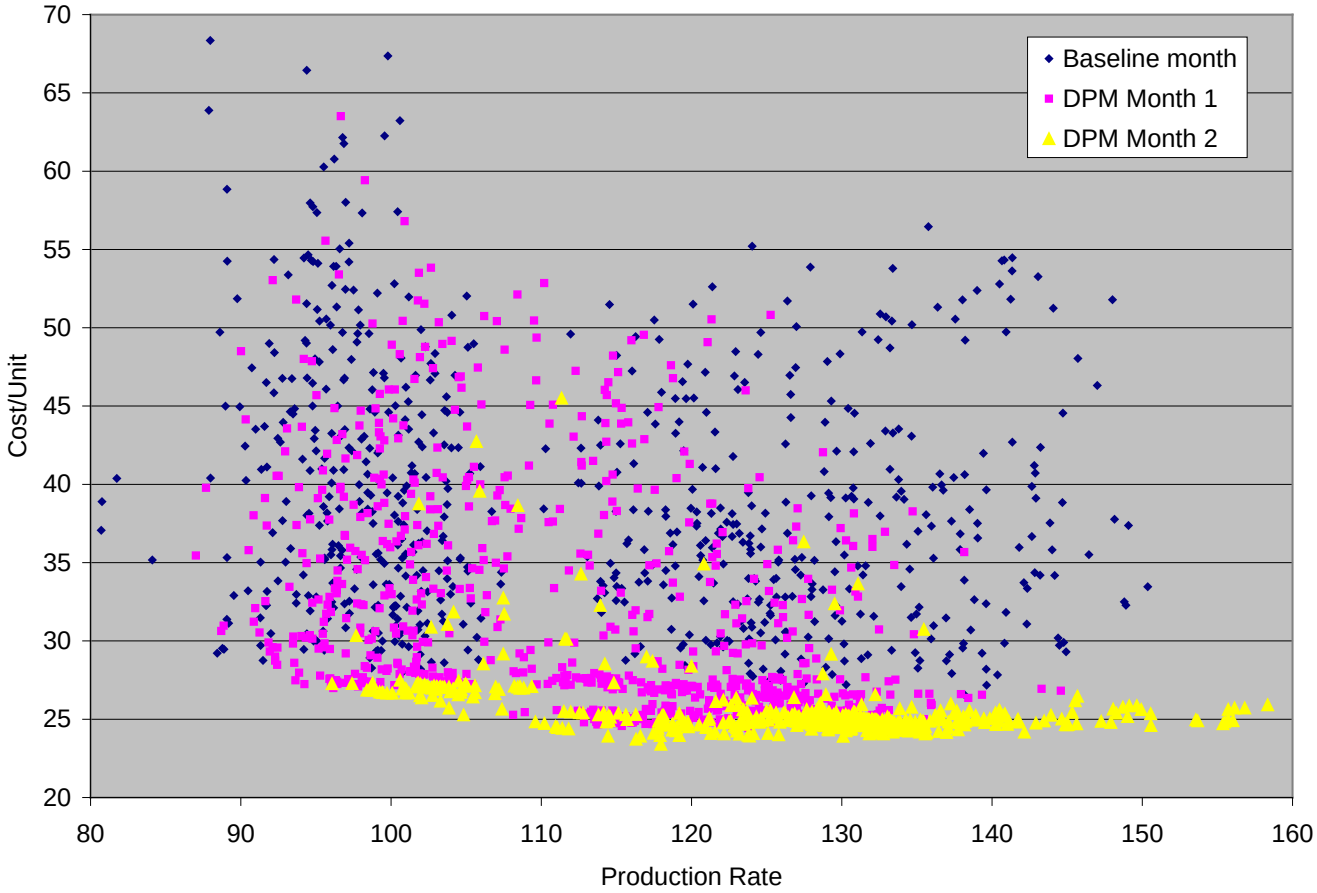
Measure



Empower



Improve

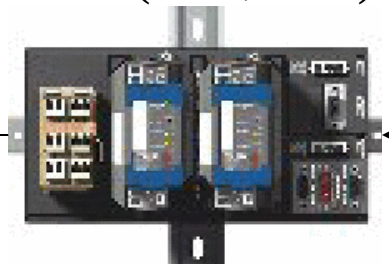


Operator Training Simulators

Simulator Representation

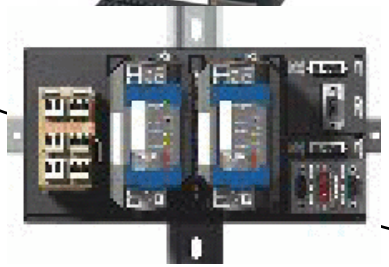
Control Room

Controls
(DCS, ESD)



Plant

Trainee
HMI

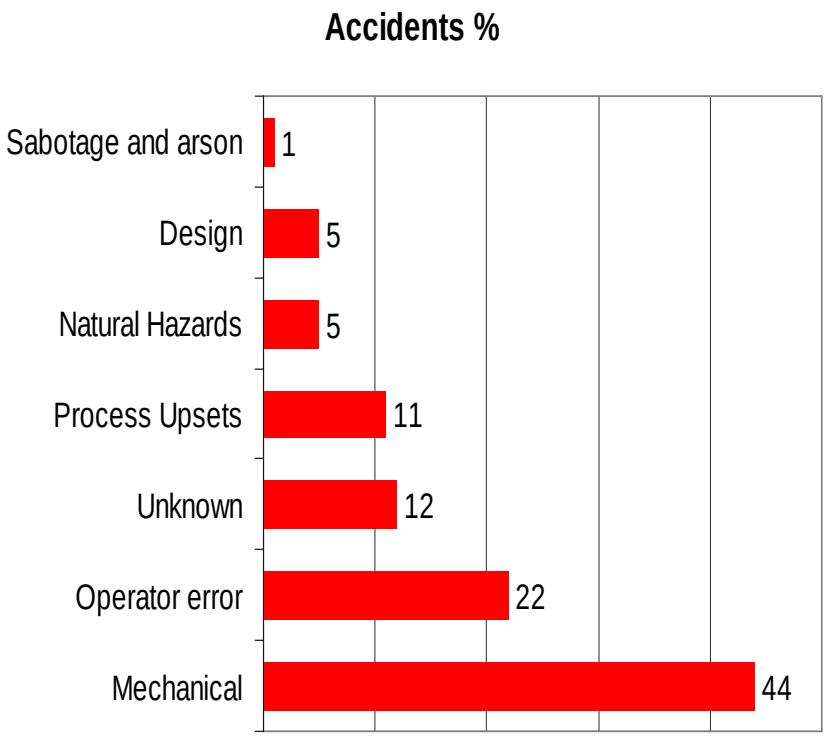


Controls Representation

Outside
Operation

Instructor/
Models

Operator Training:
More Efficient Training



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Challenges

- Operation errors is one of the leading causes of accidents
- Retiring Operators (Changing Workforce)
- Longer run time between shutdown limits startup training

OTS Objectives

- Increase startup/shutdown training frequency
- Maintain system & operator battle readiness
- Expand operator comfort zone
- Capture best practices procedures

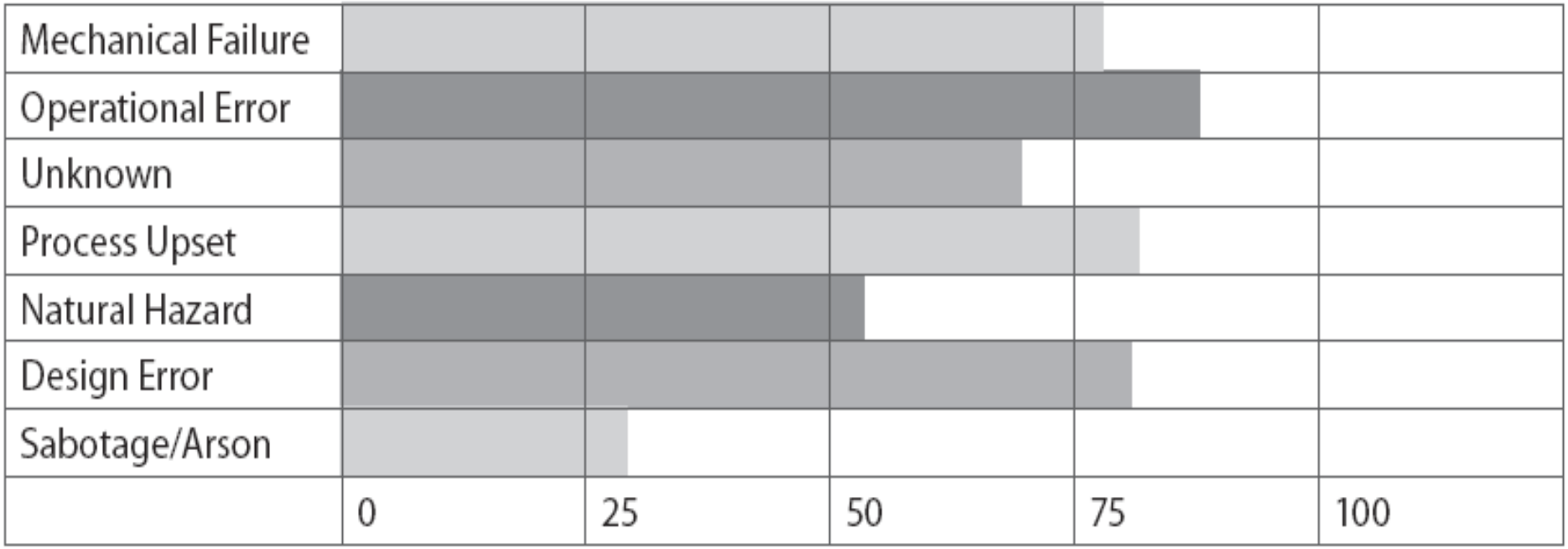
OTS Benefits

- Reduction in Production Losses
- Productivity Benefits.
- Safety

Benefits - How Much Money To Save?

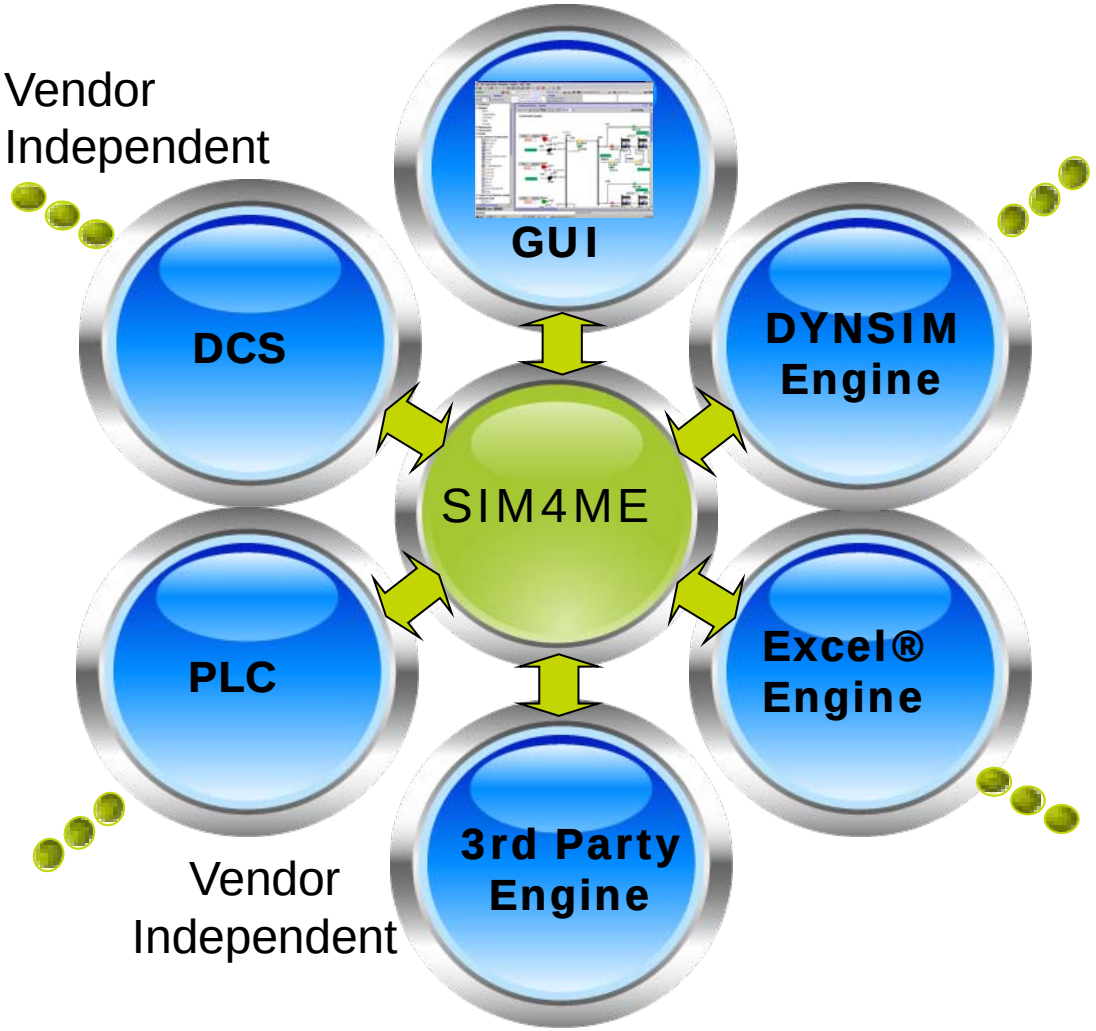
- Average cost per major incident related to operator error exceeds $80M.
- Findings by the Chemical Safety Topical Committee (funded by DOE) reveal an average of one chemical incident/day.
- Average cost to comply with ORPS process is estimated at $2M per incident *

Figure 3: Average dollar loss per major incident by cause (number indicates millions of dollars).



Source: J & H Marsh & McLennan, Inc.

Modular System Architecture
Controls Emulations & Engine Links

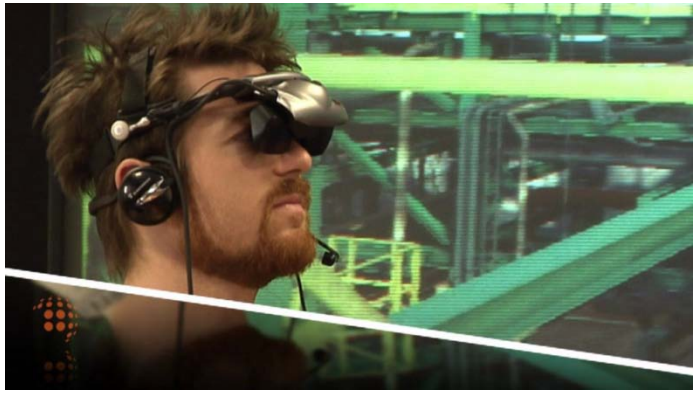


Immersive Training Simulators

Immersive Virtual Reality Plant (EYESIM)

IMMERSIVE VIRTUAL REALITY PLANT
is a comprehensive solution linking Control Room Operators…..

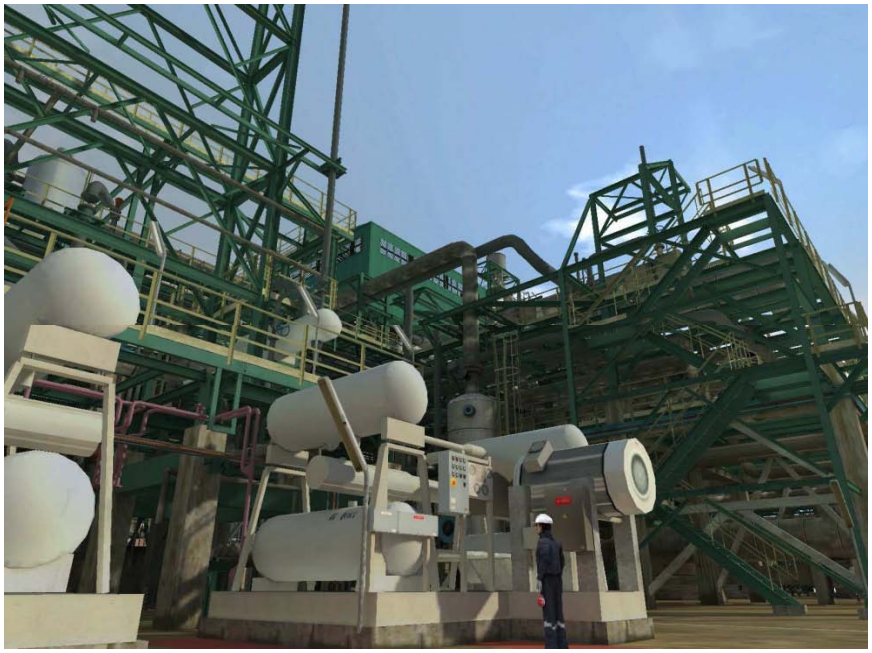
…to Field Operators ..



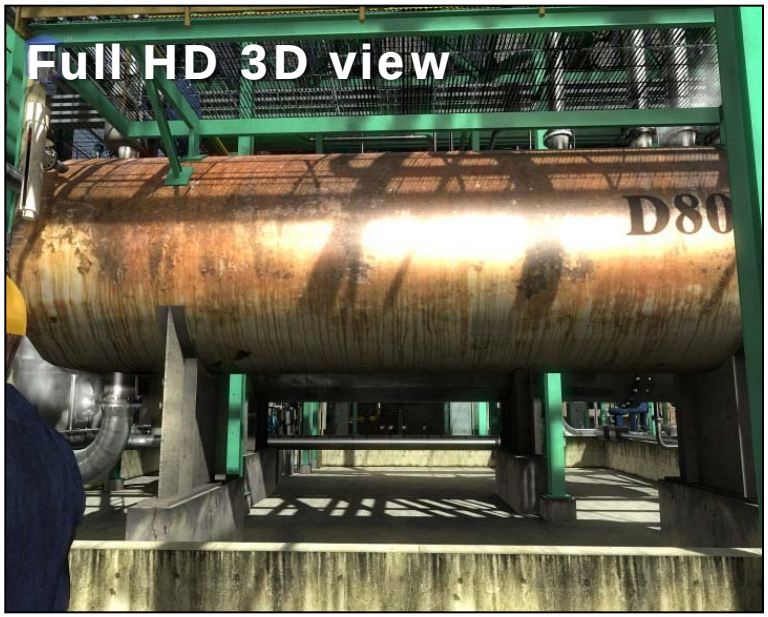
…. by means of high fidelity Process Simulation and a Virtual Walkthrough Plant Environment for a complete:
PLANT CREW TRAINING

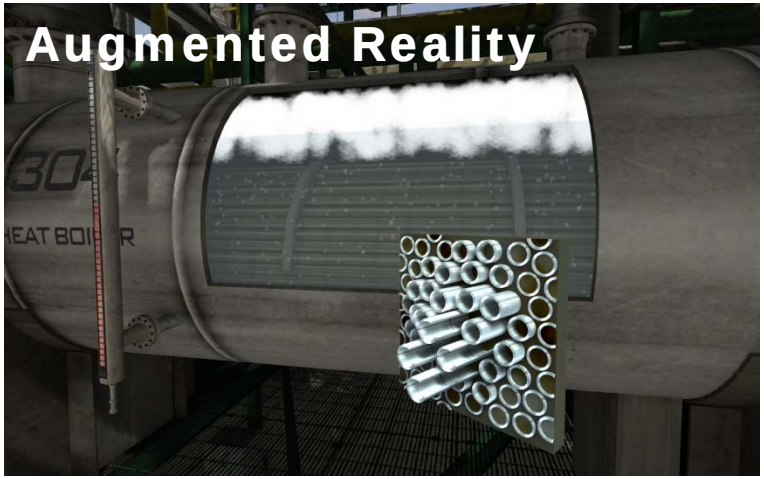
A New HMI – Virtual Reality 3D Interactive Models

Starting from 3D CAD…….Completed by photo scanning



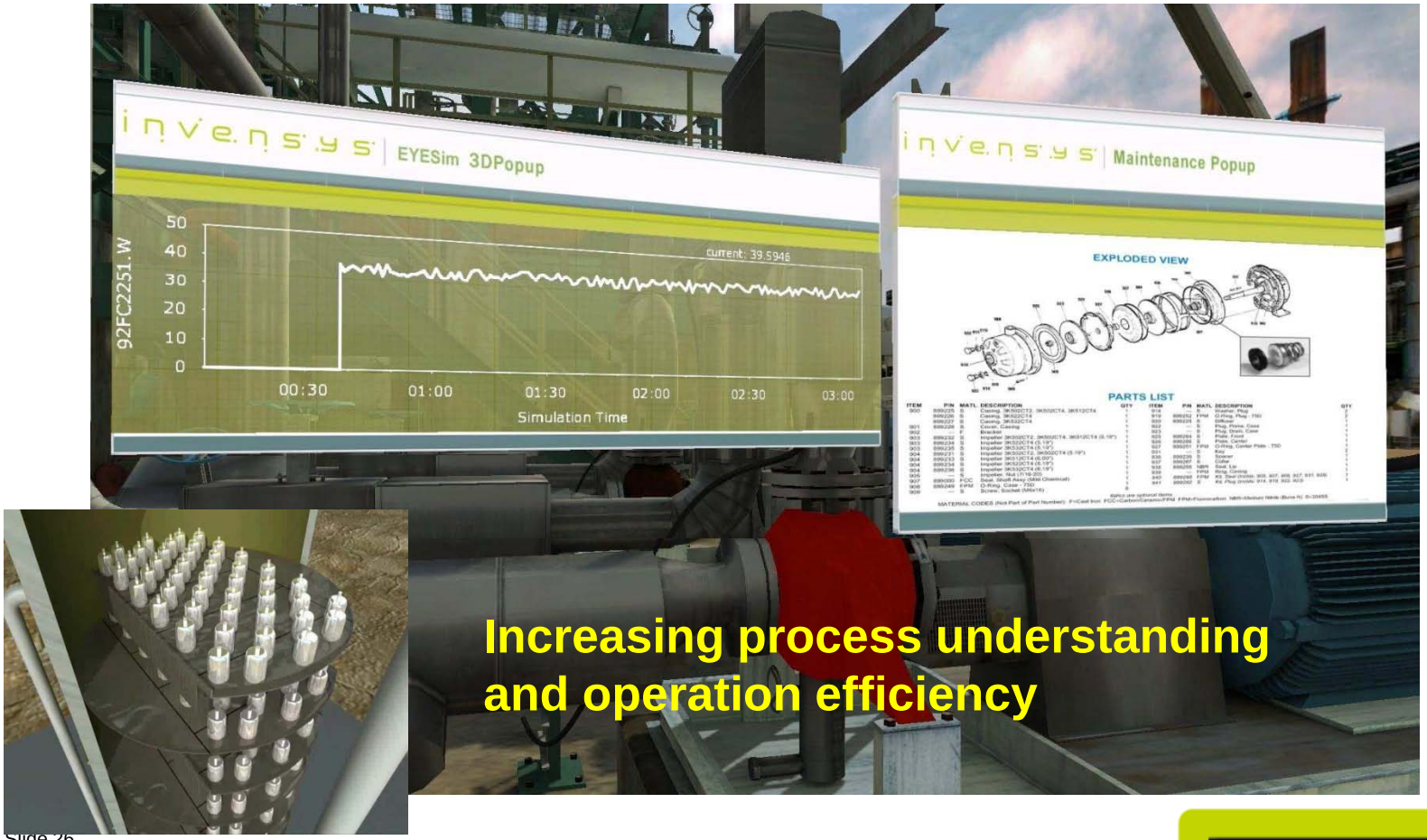
Some Key Features



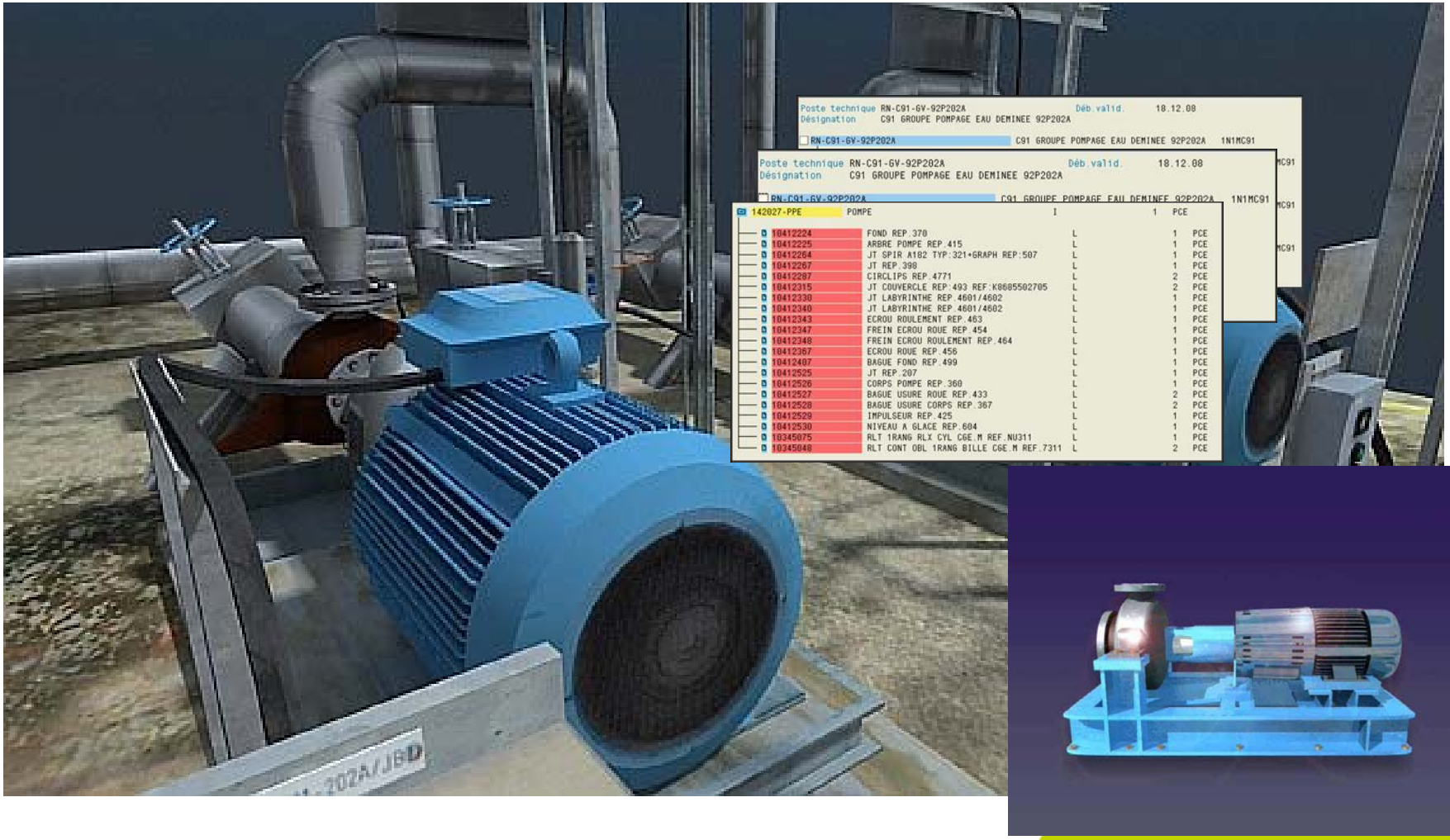


- **Multiple users: 1st or 3rd person**
- **Start / Stop / Freeze / Playback**
- **Simulation Response**

Augmented Reality



Equipment Pre-Analysis and Training



Training on Safety and Critical Tasks

- Improving skills in safety related tasks
- Rarely performed in reality
- React quickly and correctly
- High stress conditions
- Team Training
- Communications

Examples

NETL Dynamic Simulator R&T Center

Project Overview

- Mission
  - R&D, demonstration, education, and training for advanced energy solutions
- Objectives
  - Portfolio of full-scope, high-fidelity, real-time dynamic simulators
    - IGCC plant with CO2 capture
- Location
  - Flagship research center at NETL
  - Training and education center at WVU's National Research Center for Coal & Energy (NRCCE)
- NETL Partners
  - Invensys Operations Management
  - FCS, Enginomix, EPRI/CoalFleet
- Funding
  - NETL's Gasification Program
  - NETL's Carbon Sequestration Program

NETL
Morgantown, WV

NETL
IAES/CPDSR

NETL
Carnegie Mellon
University of Pittsburgh
West Virginia University

WVU/NRCCE
Morgantown, WV

IGCC project

Integrated Gasification Combined Cycle

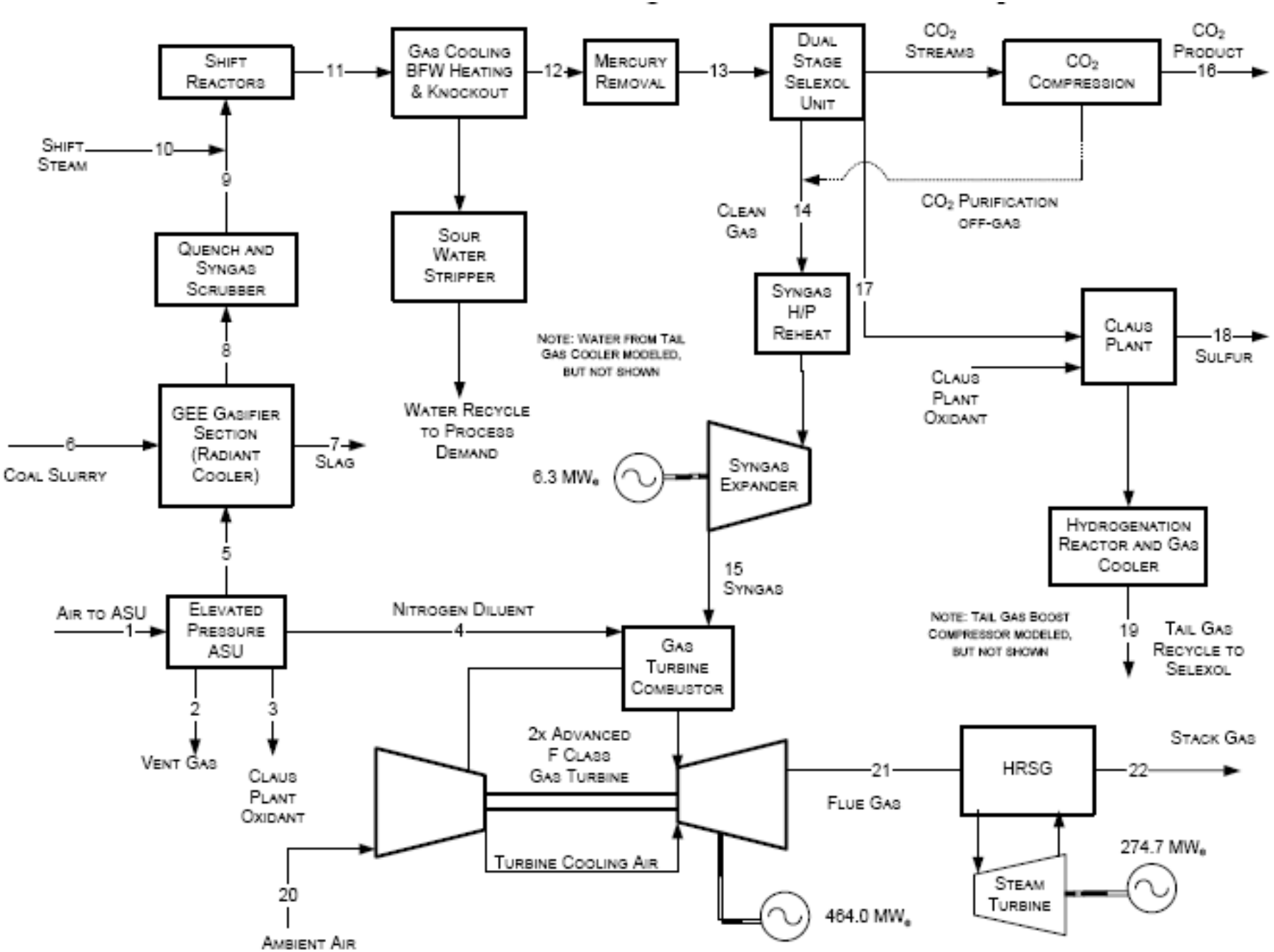
Department of Energy
National Energy Technology Laboratory

SCOPE

A comprehensive training system including control room and field operators:

- **25 different plant sections**
- **200 field operator actions**
- **200 process malfunctions**
- **30 major malfunctions or accident investigations**

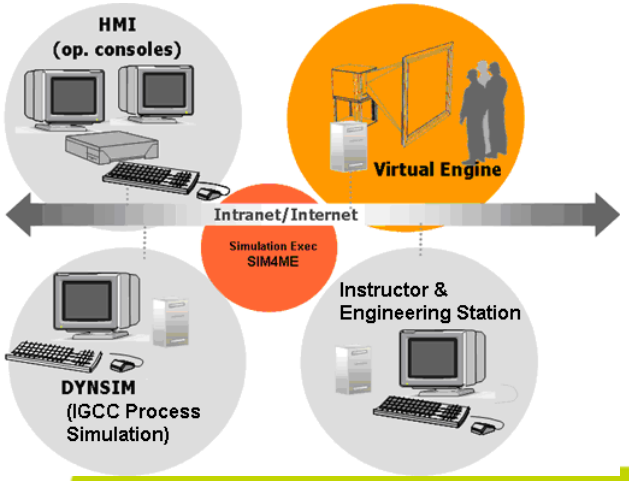
Process Overview for NETL IGCC



NETL Dynamic Simulator R&T Center

IGCC Immersive Training System

- Real-time, 3D, immersive, interactive virtual environment for training plant personnel
- IGCC plant start-up, shutdown, normal and faulted operations as well as safety and risk analysis
- Seamless integration, synchronization, and interoperability with NETL's IGCC Dynamic Simulator based on DYNSIM and SIM4ME software from Invensys
- Software/hardware components
  - Plant-wide IGCC 3D visualization model
  - Virtual reality (VR) dynamic engines
  - 3D real-time interactive interactions/content
    - Realistic response to field operator actions via hand valves, switches, etc.
    - Collision geometry, popup trends, and transparent equipment objects
  - VR devices and computers



IGCC project

Department of Energy
National Energy Technology Laboratory

Target

- **Technology, Process and Equipment Familiarization**

Users

- **Trainers: Process Trainer, Safety and Operational Managers**
- **Trainees: Field and control room operators, shift supervisor**

Expected benefits: “Active” virtual plant

- **“Shift crew training”**
- **Help safety decisions**
- **Help in maintenance procedures**
- **Increasing team confidence against abnormal conditions**

Operator Training Simulator Success Story

- Essential component in the safe and successful commissioning of the world's most complex state of the art upgrading facility

- Operators training on the simulator one year before Gasifier startup

- Benefits Summary:
  - Reduced commissioning time
  - Identification of control issues during design phase
  - Corrective actions taken prior to start up

Accident / Incident free commissioning !

OTS Client Testimonials

"The simulator training prepared the operator to handle an event (instrument failure), preventing a unit trip that would have taken the entire plant offline at a cost of about 1 MM per day"

"The Trainees are able to see the huge number of alarms on a unit trip and they learn to "cope" on the simulator so they can manage their first real occurrences. "

"I was very impressed with trainee's ability to troubleshoot an obscure compressor start-up problem. This skill would not have developed on the running panel."

Conclusions

- The industry is facing unprecedented challenges including a Human Resource Crisis with the need to train a new generation of workers
- A new training paradigm is offered by Invensys to accelerate the learning curve for the next generation of workers
- The benefits of implementing Invensys OTS and ITS solutions are very dramatic and quantifiable
- Invensys is happy to discuss your current training approach and to see if these types of solutions can help you meet your goals and challenges

For more information on products, engineering services or operator training simulators, contact either one of us :

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Webinar Series

Discover new ideas and solutions to improve your bottom line

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SimSci-Esscor
Real-Time Answers

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