Steam System Improvements

Finding Benefits by Modeling and Optimizing Steam and Power Systems

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Overview

- Visual MESA
- INEOS Chocolate Bayou
- Chocolate Bayou Visual MESA Users
- Examples
  - Operational Changes
  - User Interface
- Conclusions

Visual MESA

- What is Visual MESA?
- Components
- Features
- History

What is Visual MESA?

- Computer Modeling Program
  - Models steam, BFW, condensate, fuel, and electrical systems
- Online Program
  - Utilizes live plant data
- MESA Utility System Models and Optimizer
- Integrates MESA with Microsoft Visio and Microsoft Excel to Form a Complete Energy Management Package

Visual MESA Components

- The Calculation Core: MESA
  - Models the steam system "As Is"
  - Non-linear equipment and thermodynamics
  - Includes all common unit operations
    - Boilers, gas turbines, steam turbines, etc…
  - 90 companies, including several engineering companies
  - 200 sites

Visual MESA Components

- The Interface: Microsoft Visio
  - Easy to learn
  - Simple and standard graphic interface
  - Real-time data access
- The Reports: Microsoft Excel
  - Easy to use
  - Numerous capabilities
  - Easy to share

Visual MESA Features

- Monitoring
- Optimization
- “What-If?” Case Studies
- Auditing and Accounting

Visual MESA History

- 1983 – 1992
  - MESA developed by Steve Delk
  - Steve models hundreds of plants and develops modeling tools dedicated and optimized for utility systems
- 1993 – 1996
  - Chevron adopted MESA and deployed it at refineries
  - Built Version 1 of the graphically-based Visual MESA
  - Steve Delk added optimization
- 1997 – 2006
  - Nelson & Roseme, Inc. founded
  - Nelson & Roseme, Inc. and MESA Co. operate as one company
- 2003 – 2005
  - Visual MESA rewritten
- 2006
  - Visual MESA, LLC formed

Visual MESA Installations

# of Sites	Company	Comments
5	Chevron/Texaco	4 Refineries, 1 Chemical
1	BP	1 Refinery, 1 Chemical
1	INEOS	1 Chemical
1	Marathon/Ashland	1 Refinery
4	Shell/Equilon/Motiva	3 Refineries, 1 Chemical
1	Valero	1 Refinery
1	Air Liquide	1 ASU/Cogen
2	ConocoPhillips	2 Refineries/Chemical
10	Refining Co./Chem Co.	9 Closed Loop
1	Rohm & Haas	1 Chemical
1	Aramco	1 Gas Plant
1	Irving Oil	1 Refinery
1	Dow Chemical	1 Chemical
1	Sunoco	1 Refinery
5	Repsol	5 Refinery/Chemical
1	Cytec	1 Refinery
1	Eastman Chemical	1 Chemical
38	**Total Sites**	53 Gas Turbines Modeled

INEOS Chocolate Bayou

- Formerly BP Chemicals
- 2 Olefins Units
- 3 Polypropylene Units

Steam System Overview

- Four Steam Levels
  - High-high pressure
  - High pressure
  - Medium pressure
  - Low pressure
- Generation from Waste Heat, Boilers and Cogen
- Due to Nature of Processes, Uses Steam Turbines as Pump or Compressor Drives
- Numerous Turbine/Motor Pumps to Consider

Chocolate Bayou VM Users

- Primary Users
  - Shift Supervisors
  - Site Energy Manager
- Secondary Users
  - Site Engineers
  - Site Management
  - WTL/Foreman in Utilities - Boiler area

Shift Supervisors

- Responsible for Site-Wide Operations
- Main Day-to-Day User
  - Coordinates implementation of plan with unit Team Leaders
    - Boiler/HRSG loading
    - Turbine loading to avoid over condensing
    - Switchable (turbine or motor) pump selection

Shift Supervisors

- Provide a Single Point of Focus and Site-Wide Understanding
  - Help avoid sub-optimizing the site as a whole by moves that benefit individual process plants
- Utilize Web-Based Report Generated by Visual MESA and Accessible Throughout the Site
  - Distribute recommendations and help all plant personnel understand the current recommended operation

Site Energy Manager

- Responsible for Overall Site Energy Consumption, Balancing and Development/Implementation of Energy Improvement Projects
- Uses VM to Identify Changes in Operational Philosophy and Capital Projects
  - Saves energy at the site

Examples of Operational Changes

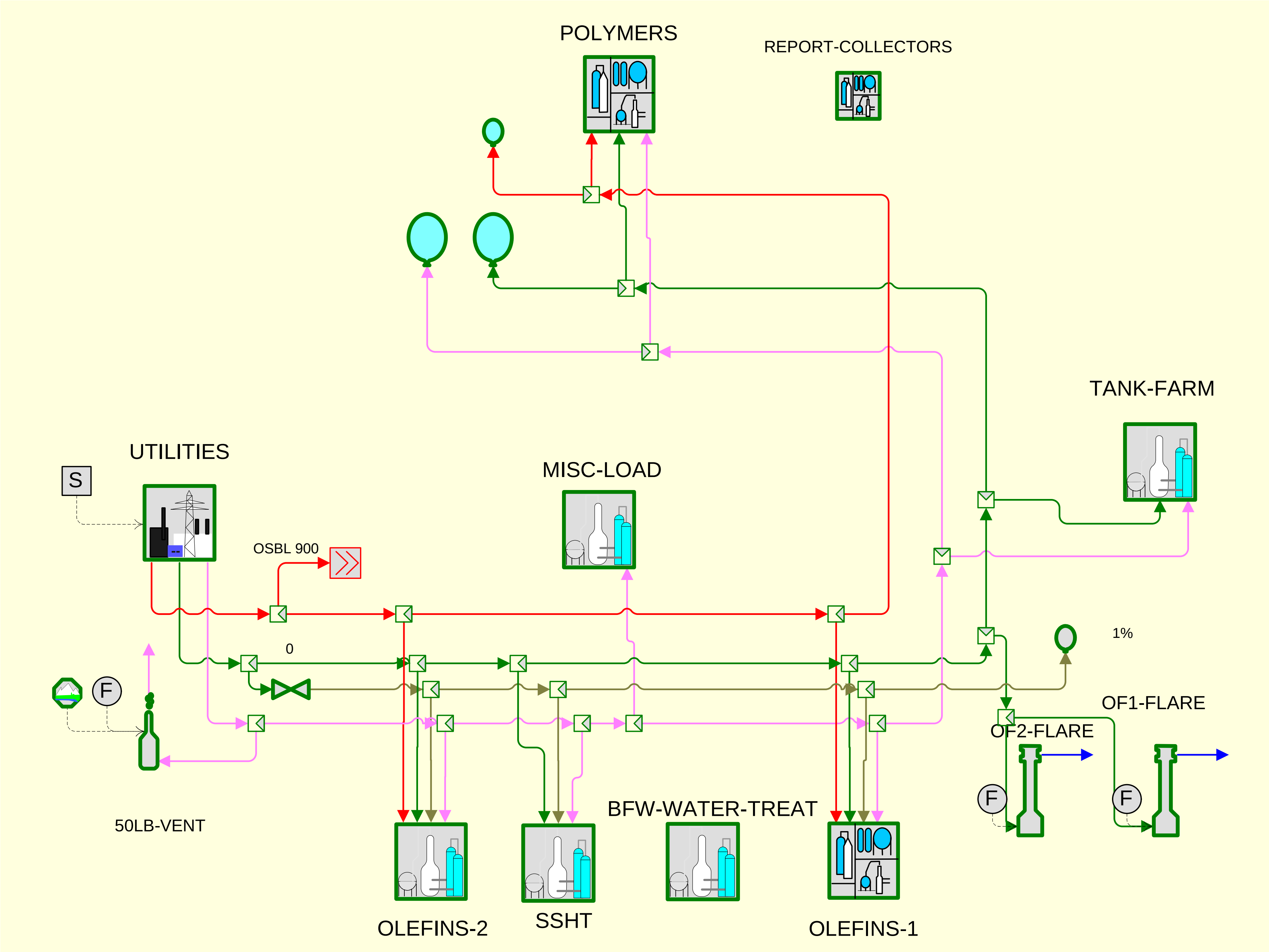
- Identify Key Steam Turbines to be Replaced with Motor Drives
  - Due to site venting issues
  - Where turbines were driven by medium-pressure steam that was effectively letdown from the super high-pressure systems

Examples of Operational Changes

- Understand How to Operate an Older Cogeneration Unit
  - Despite a perceived high efficiency, identified as actually the least efficient incremental steam producer on the site

User Interface

- Graphics of Entire System
- Excel Reports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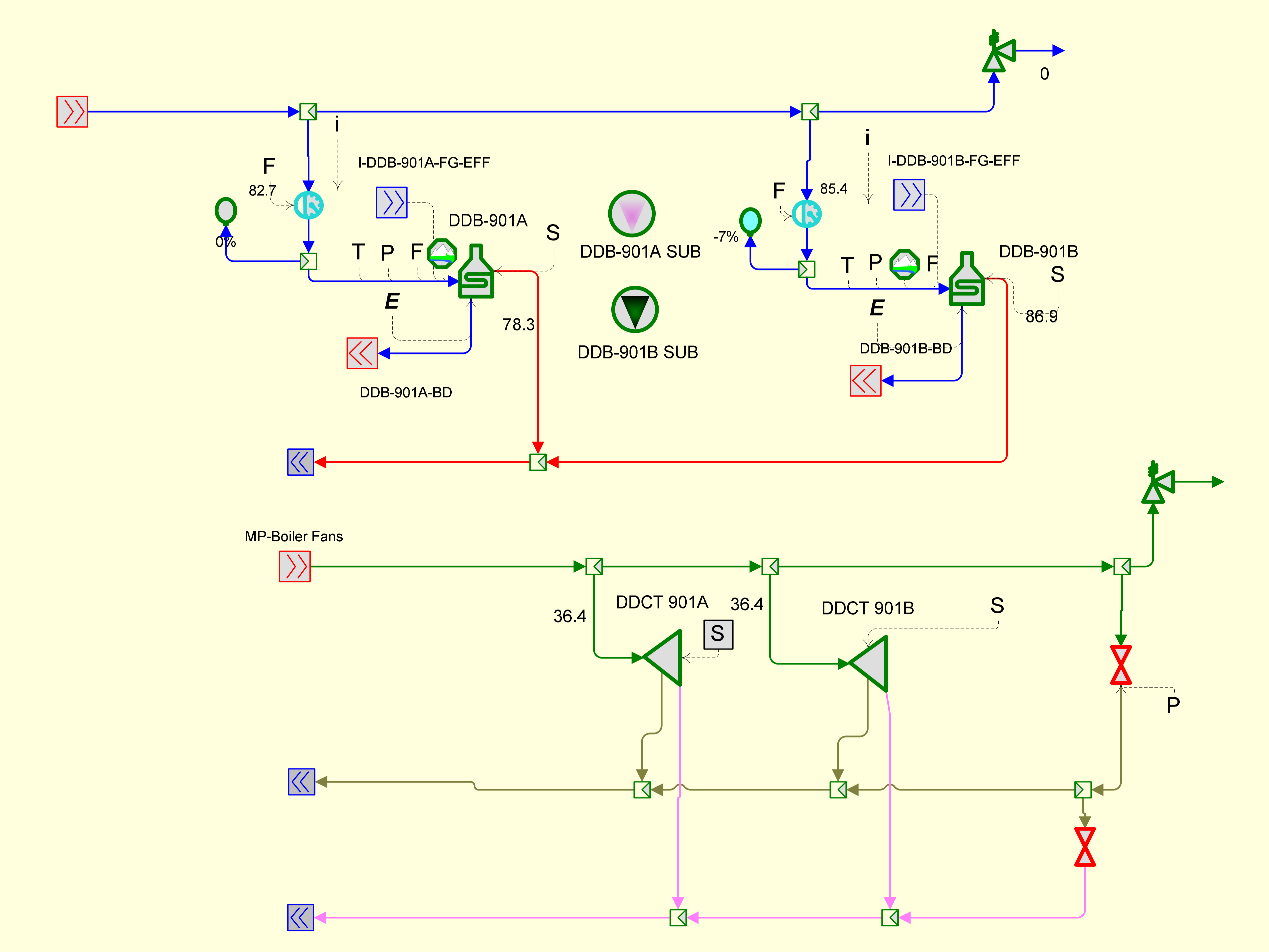

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MP-Boiler Fans
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DDCT 901A
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36.4
DDCT 901B
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Steam System Optimization Summary

Model Status 2: GOOD SOLUTION: SQP STOP DUE TO FRACTIONAL CHANGE IN OBJECTIVE FN
Model Last Ran 12:23:25 11/13/2006

Cost Summary ($/hr)

Current Cost	Optimized Cost	Savings	
$7,000	$6,800	$200	$/hr
		$2,400	$/shift
		$4,800	$/day

Steam Flow to Flare (klb/hr)

	Current
PP2	10
PP3	0
PP4	0
Olefins #1	0
Olefins #2	15
Total	**25**

Fired Steam Make (klb/hr)

	Current Steam Make	Optimized Steam Make	Delta
Cogen	220	171	-49
DB-901A	220	120	-100
DB-901B	134	120	-14
DB-901C	0	0	0
DDB-901A	78	180	102
DDB-901B	87	128	41
Total	**739**	**718**	**-21**

Conclusions

- Visual MESA Success at INEOS Chocolate Bayou
  - Optimization and Management of the Site Steam System
- Shift Supervisors and Site Energy Manager are Main Users of System on a Short and Long-Term Basis