New IT for Improved Schedule Adherence

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Project Objective

Implementation of a Dispatch Information System (DIS) to ensure adherence of the re-optimized schedules with the Berlin power plant as the sub-balance area boundary.

- Control the complete product range, starting with Berlin

- Minimize response and communication times between Unit Commitment and the power plant (in case of incidents, changes in the market)

- Quarter-hour forecasts and long-term trends

- Predictive schedule display (up to 4 days)

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Berlin Power Plants: Offering a Wide Variety of Products (I)

- Product palette controlled by unit

- Power (I)

  – Schedule power by optimizing combined heat & power and condensate generation

  – primary control

  – secondary control

    - symmetrical/asymmetrical control

    - positive/negative control

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Berlin Power Plant: Offering a Wide Variety of Products (II)

- Power (II)

  - minute reserve

  - long-term reserve

  - document reactive power requirements

- Heat

  - Heating grid flow quantity
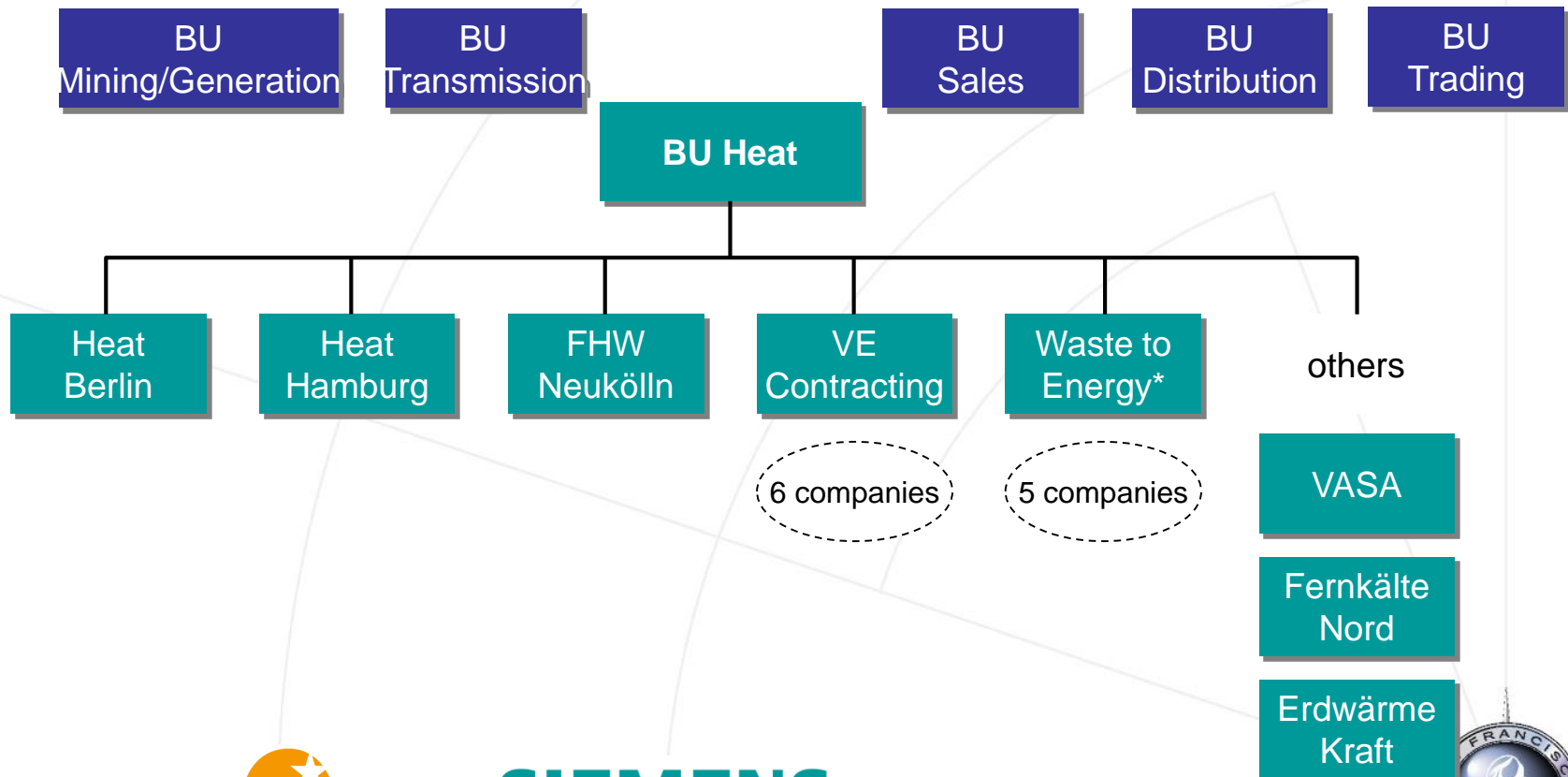
  - Heating grid flow temperature

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Vattenfall Europe – Organized in Business Units

Project Environment
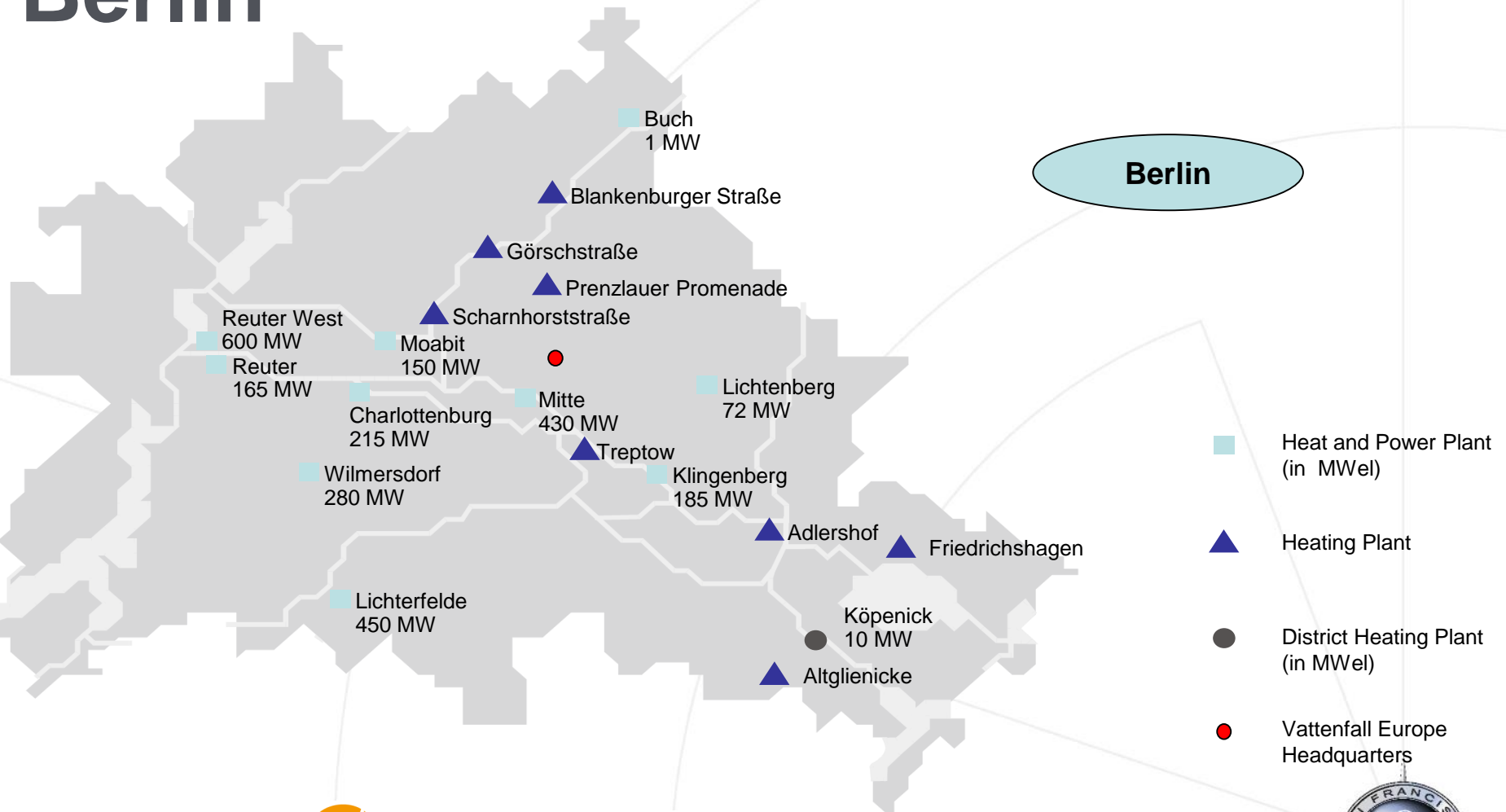
BU Heat: Data and Facts

- Installed capacity of 6,400 MW thermal and 3,100 MW electrical

- 35 generation sites (of which 12 heat and power plants, 9 heating plants, 1 electric boiler, 4 incineration plants)

- 6 operating companies in VE Contracting

- District heating grid of 2,200 km (about 1,360 miles)

- supply to 1.4m residential units

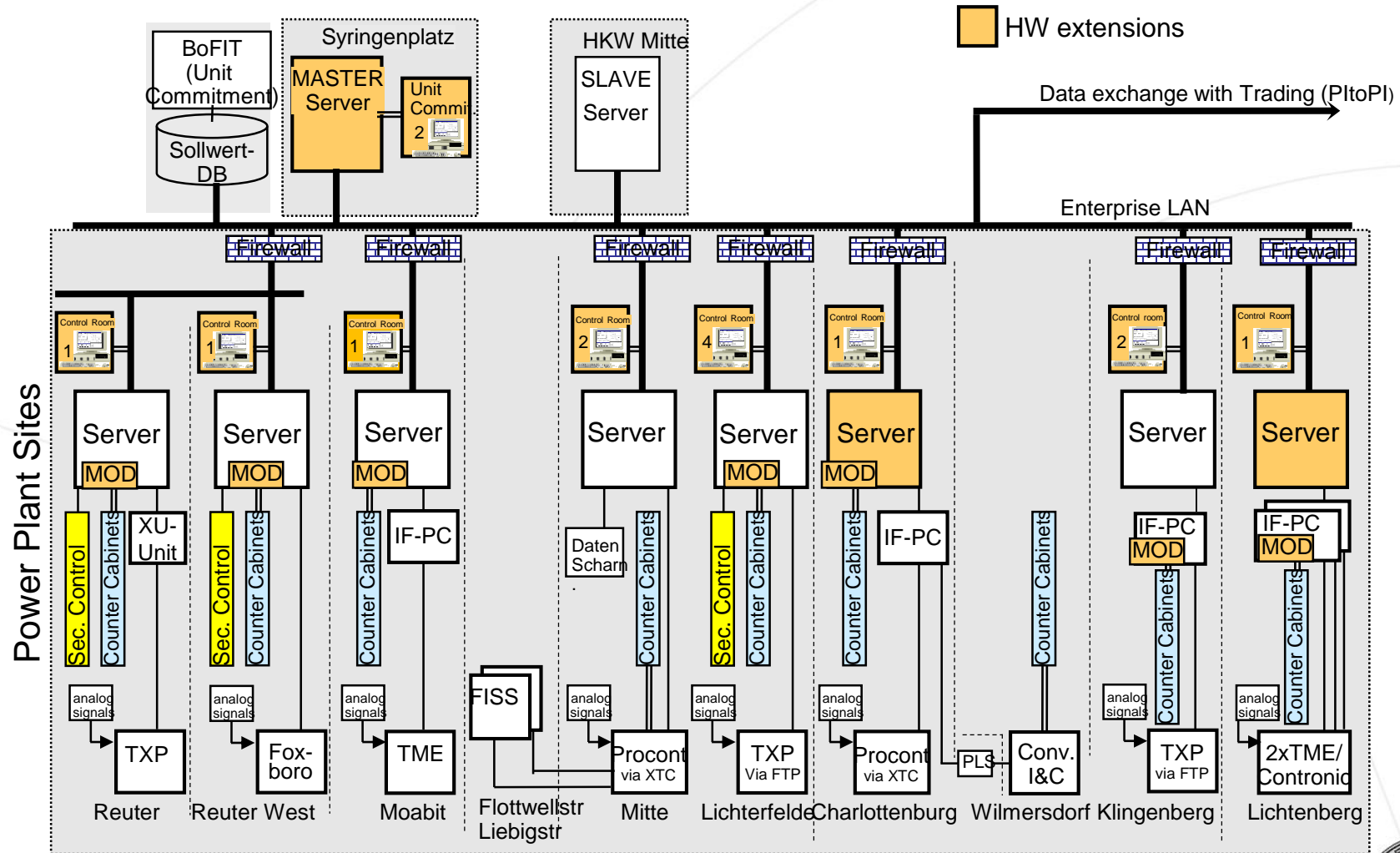- 2,600 employees (PY)

- € 1.5bn. sales revenue

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Generation Plants of BU Heat in Berlin

Berlin

Buch
1 MW

Blankenburger Straße

Görschstraße

Prenzlauer Promenade

Reuter West
600 MW

Scharnhorststraße

Reuter
165 MW

Moabit
150 MW

Charlottenburg
215 MW

Mitte
430 MW

Lichtenberg
72 MW

Treptow

Wilmersdorf
280 MW

Klingenberg
185 MW

Adlershof

Friedrichshagen

Lichterfelde
450 MW

Köpenick
10 MW

Altglienicke

Heat and Power Plant (in MWel)

Heating Plant

District Heating Plant (in MWel)

Vattenfall Europe Headquarters

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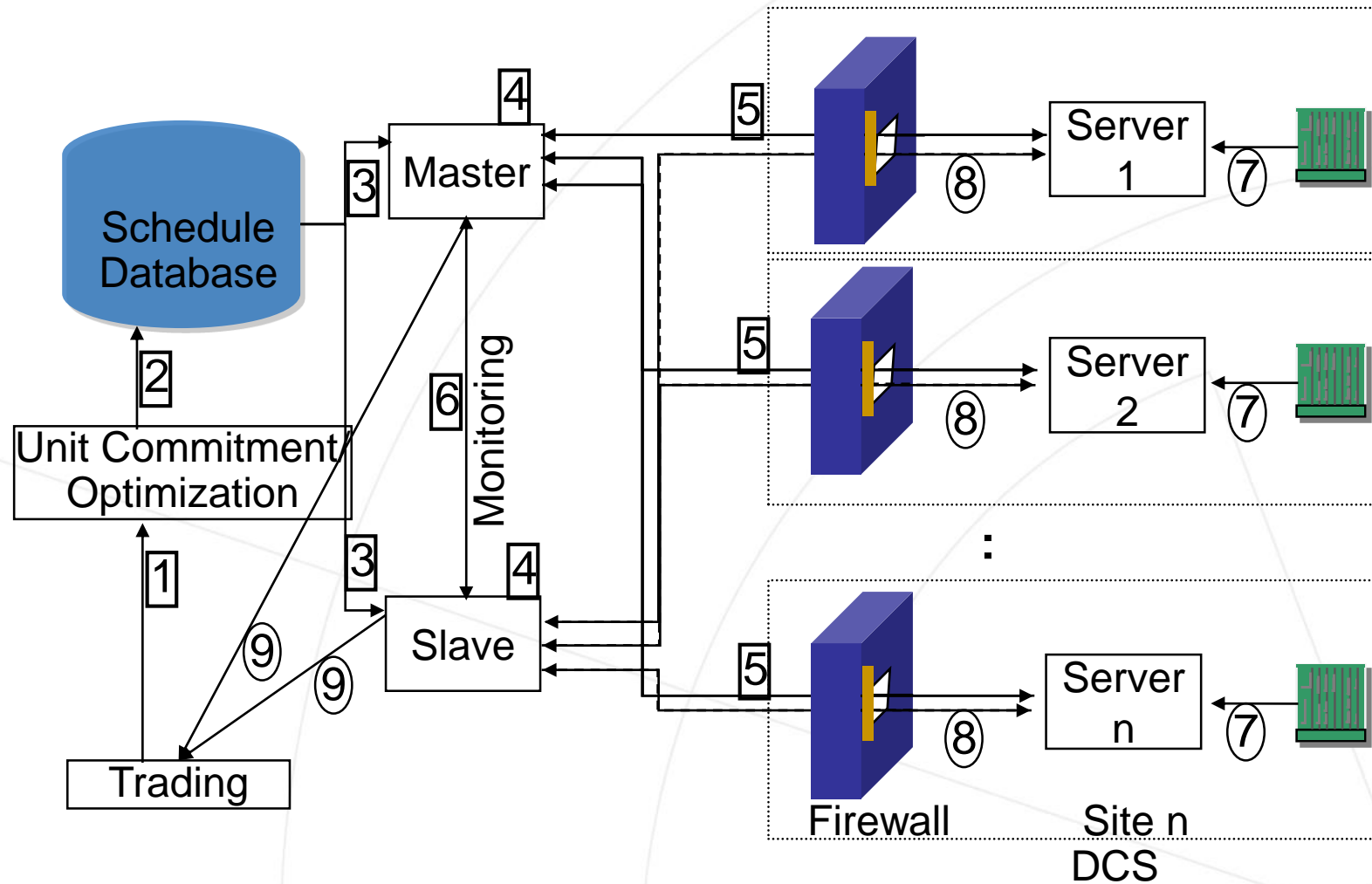**VALUE NOW, VALUE OVER TIME**

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Topology

Data Flow

Achieving the Project Objective (I)

Calculations

- calculation of actual value based on power output and allocated station service
- calculation of substitute load values
- calculation of available condenser capacity
- evaluation of actual/scheduled value difference for control/schedule deviation

Monitoring

- status entry for every program step in log
- display of every transmission run
- documentation of manual entries
- monitoring of the subsystems even from headquarters

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Station Service

$$P_{NSp} = f\left(m, n, P_1, \ldots, P_m, Eb_1, \ldots, Eb_n\right)$$

general formula for calculating station service

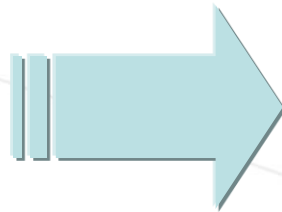PNSp -   power fed into grid
m –   number of generators
n –   number of service transformers
Pi –   power of the ith generator feeder (high-voltage side);
              generator output less station service (Eb) and step-up
              losses with1 <= i <= m
EbJ –   j[th] service transformer with 1 <= j <= n

Total station service

$$Eb_{Ges} = \sum_{j=1}^{n} Eb_j$$

total generation

$$P_{Ges} = \sum_{i=1}^{m} P_i$$

$$P_{NSp\,i} = P_i + Eb_{Ges} * \frac{P_i}{P_{Ges}}$$

for PGes<>0:

$$P_{NSp\,i} = P_i + \frac{Eb_{Ges}}{m}$$

for PGes= 0:

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Evaluation of Schedule/Control Deviation

Diff.	Control (plan)	Check	Control deviation	Schedule deviation
<0	Positive	-	-	Difference
<0	Negative	|Difference|<= SRNeg	|Difference|	-
<0	Negative	|Difference| > SRNeg	SRNeg	|Difference| - SRNeg
<0	Symmetrical	|Difference|<= SRNeg	|Difference|	-
<0	symmetrical	|Difference| > SRNeg	SRNeg	|Difference| - SRNeg
>0	Positive	Difference <= SRPos	Difference	-
>0	Positive	Difference > SRPos	SRPos	Difference - SRPos
>0	Negative	-	-	Difference
>0	symmetrical	Difference <= SRPos	Difference	-
>0	symmetrical	Difference > SRPos	SRPos	Difference - SRPos

Difference = actual value – schedule target value
SRNeg = SCHEDULE value for negative secondary control
SRPos = schedule value for positive secondary control

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Achieving the Project Objective (II)

Displays

- – consistent displays for units/sites with actual/setpoint comparison, expected value with constant load, accumulated output so far

- – displays for Unit Commitment (balance area, control status, reserve status)

- – displays for manual entry of schedules, reserves and reactive power requirements

- – management of gas contracts and display if permissible volume is exceeded

Schedule and Control Deviation

Schedule Forecast — 13.04.2005 13:00:06 Übertragung von Fahrplanwerten aus der Zentrale läuf | Historie | 13.04.200

Poolsignal [%] -25

13.04.2005 13:00:00   13.04.2005 13:15:00

	Target Values SOLL-WERTE						Actuals IST-WERTE			Target Values SOLL-WERTE				
	Soll	R2N	R2P	R3A	R4A	result. FP	Ist	R2	Abw	Soll	R2N	R2P	R3A	R4A
SUMME	862	70	200	0	0	862	328	-40	6	858	70	200	0	0
RWD	251	70	0	0		251	211	-40	0	251	70	0	0	
RWE	0	0	0	0		0	0	0	0	0	0	0	0	
REC	103	0	0	0		103	103	0	0	103	0	0	0	
REM	27					27	27		0	27				
MOA	72					72	73		1	72				
MOGT	0					0	0		0	0				
MIGT1	0				0	0	-1		-1	0				0
MIGT2	132				0	132	119		-12	132				0
MIDT	57					57	54		-3	57				
MI SUMME	189				0	189	172		-17	189				0
CHGT4	0			0	0	0	-1		-1	0			0	0
CHGT5	0			0	0	0	-1		-1	0			0	0
CHGT6	0			0	0	0	-1		-1	0			0	0

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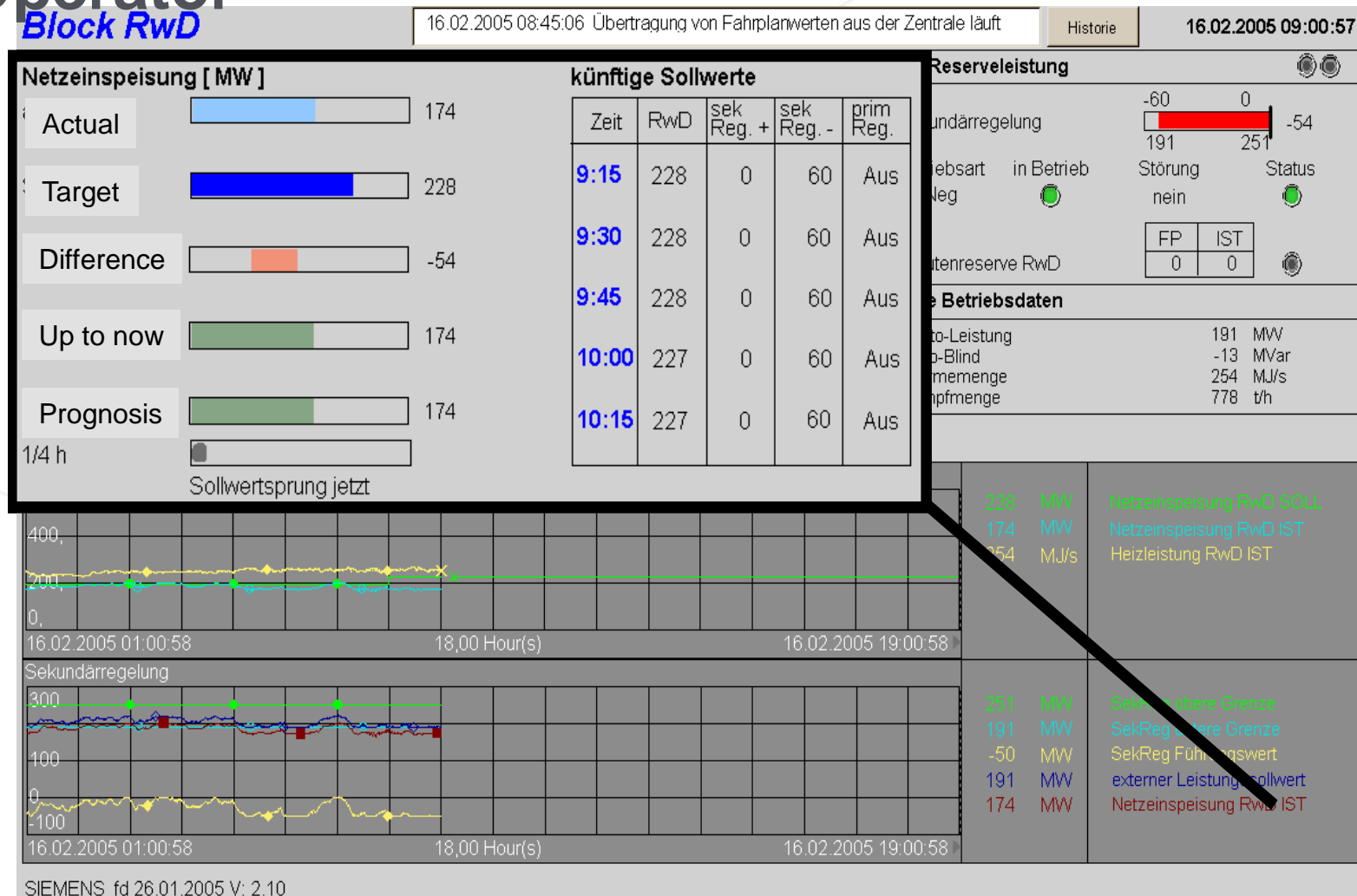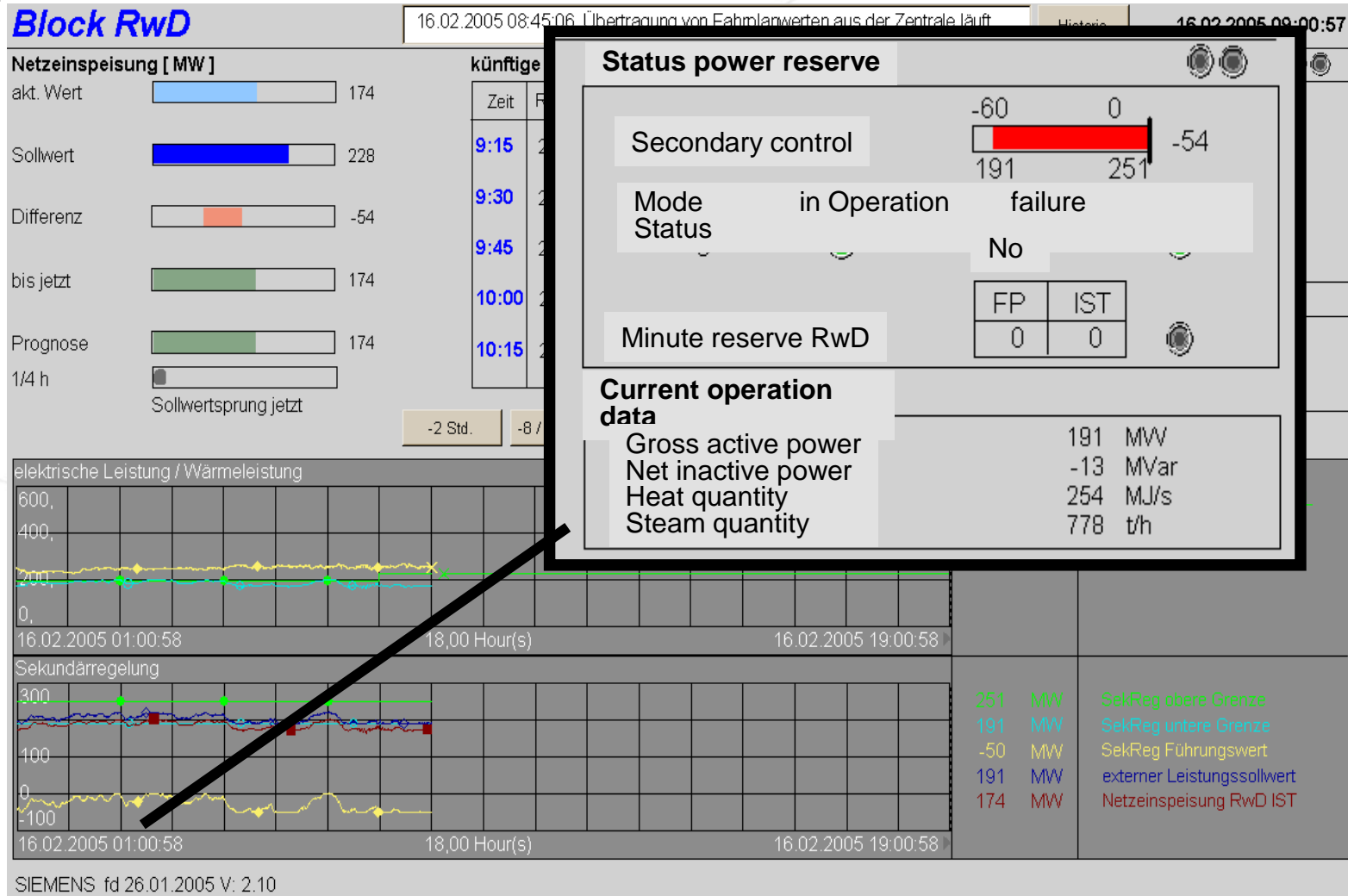
All Unit-specific Values in one Screen for the Operator

All Unit-specific Values in one Screen for the Operator

System Monitoring

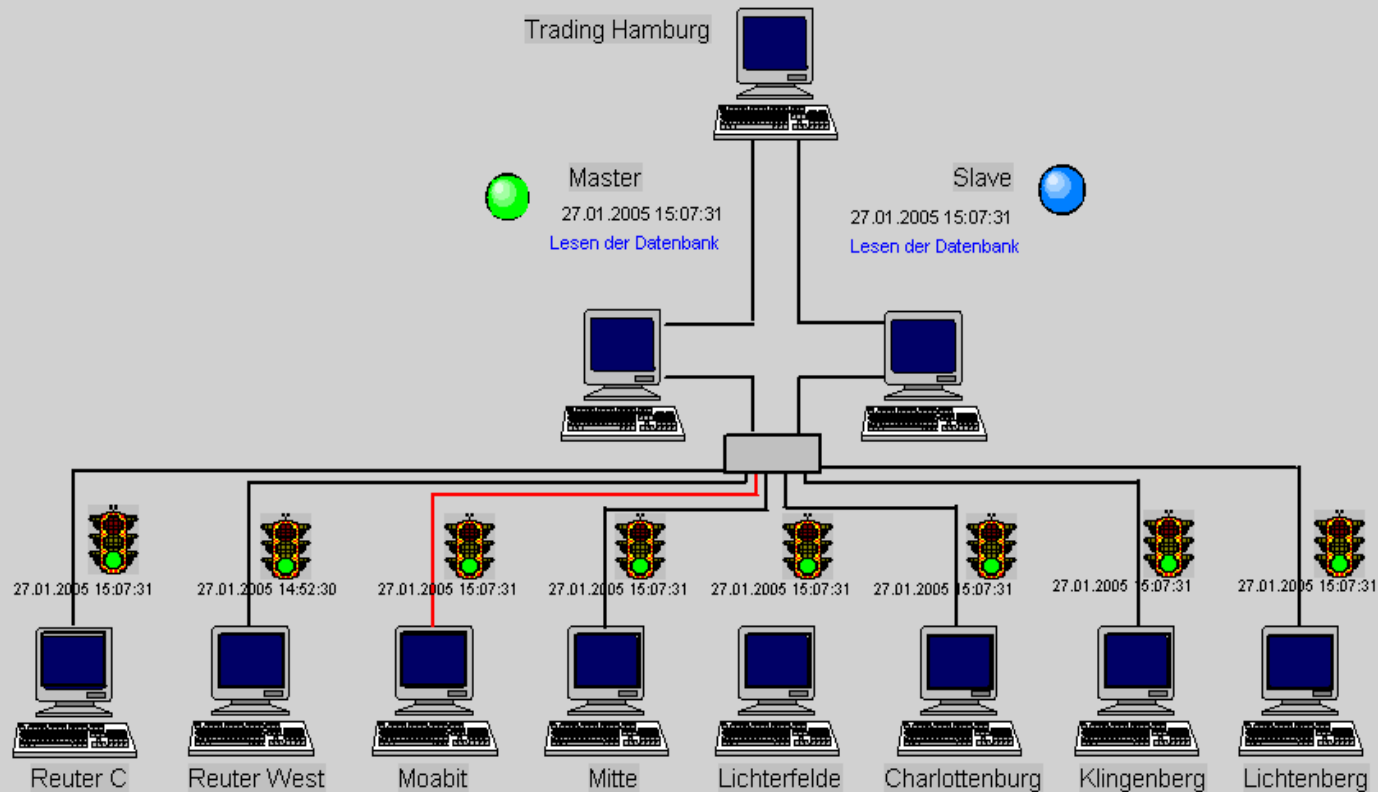# Conclusion & Perspective (I)

- No ready-to-use product found during market analysis ▶development work required

- Visualizations for communication between Unit Commitment and the Power Plant

- Detailed requirements/performance specification not sufficient for covering all findings made during project execution ▶ joint know-how development by Bewag and Siemens basis for project's success

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Conclusion & Perspective (II)

- Solution integrated in existing IT infrastructure & developed on basis of OSIsoft's PI

- Additional possibilities for using PI, e.g. reporting, opened

- Optimized fleet control within premises of schedule adherence & provision of system services according to contract achieved

- Project's goal of considerably improving schedule adherence & thus halving costs resulting from schedule deviations will be achieved from today's perspective

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Thank You for Your Attention!

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