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INTEGRATION IMPACT OF CMS AND CMMS ON OPERATION & MAINTENANCE OF ELECTRIC POWER PLANTS

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  - CMS Overview
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Introduction:

- The efficient and optimum operation, planning and maintenance of electrical generation systems have always occupied an important position in the electric power industry. Recently the environment factors has been added to the problem of generation planning as a major new dimension.

Introduction

- These factors have been considered by the manufacturers of the modern power plants which are equipped with

  Computerized Monitoring systems (CMS) and

  Computerized Maintenance Management systems (CMMS).

- Unfortunately the power plants of the seventies and eighties, which are not equipped with computerized systems and constitute for example more than the half of installed capacity in Syria, have been run with low efficiency and low availability.

Introduction

Main challenges for maintenance management

- protection of the investment against damages
- reduction of planned outages through optimized planning and scheduling
- reduction of unplanned outages
- reduction of stock costs and Maintain plant experience

CMMS Overview

CMMS may be used to:

- control the company's list of maintainable assets through an asset register
- control accounting of assets, purchase price, depreciation rates, etc.
- schedule planned preventive maintenance routines
- control preventive maintenance procedures and documentation

CMMS Overview

CMMS may be used to:

- control the issue and documentation of planned and unplanned maintenance work.
- organise the maintenance personnel database including shift work schedules
- schedule calibration for gauges and instruments
- control portable appliance testing

CMMS Overview

CMMS may be used to:

- assist in maintenance project management
- provide maintenance budgeting and costing statistics
- control maintenance inventory (store's management, requisition and purchasing)
- process condition monitoring inputs
- Provide analysis tools for maintenance performance
- Perform data interface with Computer Monitoring System (CMS).

CMS Overview

- The CMS enables plant engineers and management to permanently supervise and optimize plant operation, and to receive advisory support in case of deviations.
- Plant management shall as well have the opportunity to simulate possible physical changes in plant configuration and operation mode and evaluate the technical consequences.
- By making use of the simulation capabilities of the proposed system, plant operators and engineers shall enlarge their understanding of the generation process and thus receive permanent training.

CMS Overview

Features of the Condition Monitoring System

- Online technical calculations of main process parameters and important components.
- Online technical calculation for emissions
- Advisory source for condition-orientated soot-blowing
- Advisory source for operation modes of important process parts
- Visualization for operating staff and plant engineers

The technical calculations by CMS

- Economical and commercial results of the whole power plant
- Gross / net efficiency
- Power output
- Total fuel consumption and costs
- Specific fuel costs / kWh
- Auxiliary consumption
- Net power

The technical calculations by CMS

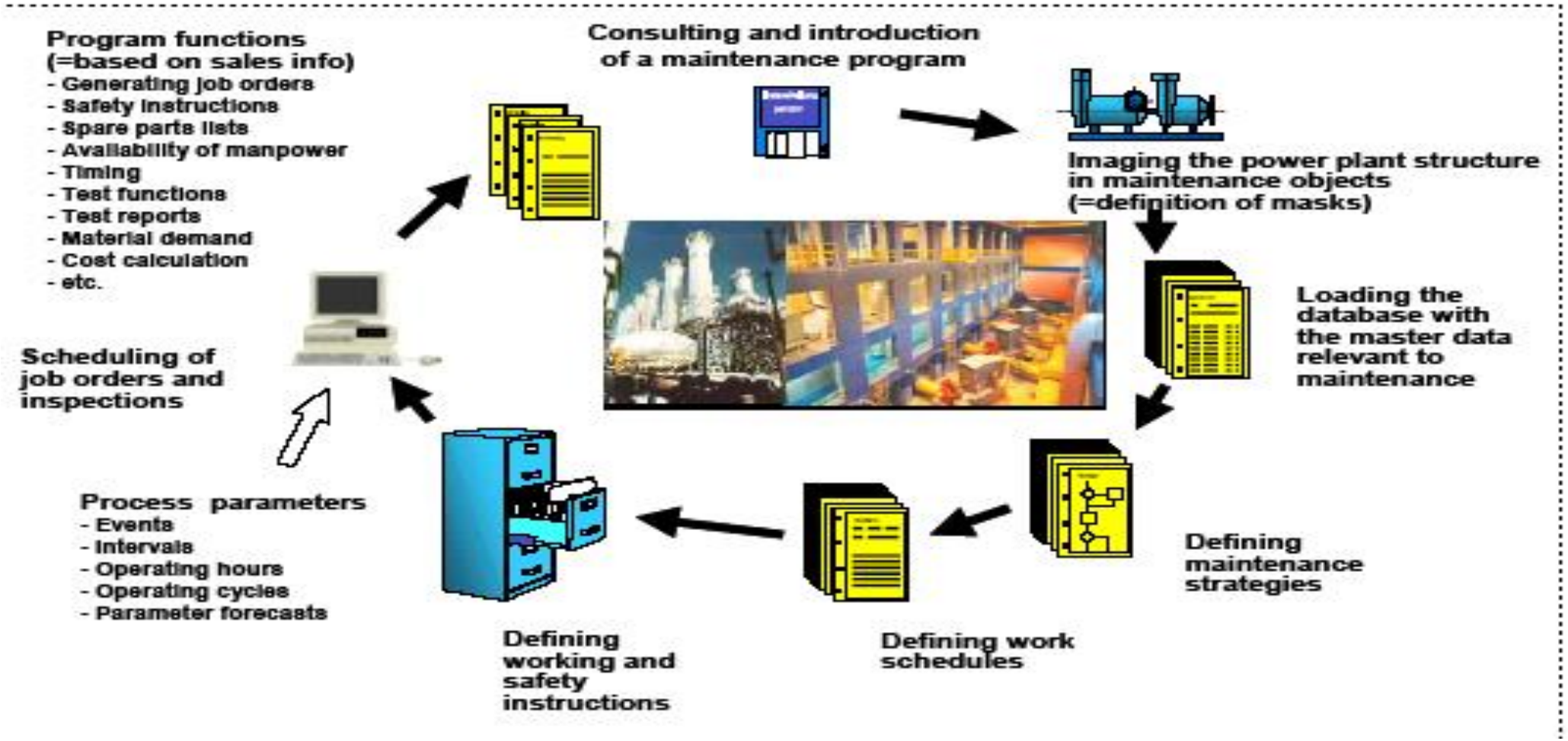
Principles of technical calculations are:

- Technical calculations are based on measured process variables.
- Methods are computing of losses or computing via input output principle.
- Process variables which cannot be measured due to technical reasons will be computed due to the physical equations.
- The optimal values of the unit and important process parts are based on a thermodynamic model of the unit.
- The computed model of the unit will be balanced with some measured variables like electrical active power and cooling water flow.
- Comparison between the actual values and the optimal values.
- Presentation for the difference between actual status and computed ideal status.
- For calibration and fine tuning operation experience of the power station and acknowledgement of supplier are completing one another.

Adaptation process of CMMS

The CMMS is an universal system. In general, the CMMS presents many possibilities to build up specialized maintenance tasks, but it doesn't offer a ready to run solution. Also the maintenance process influences nearly all other systems of the power plant (beginning with material handling, cost evaluation, depreciation of components, human resource accounting, document management…). That is why such systems must be adapted in any case to the specific needs of the target system (here the power plant units).

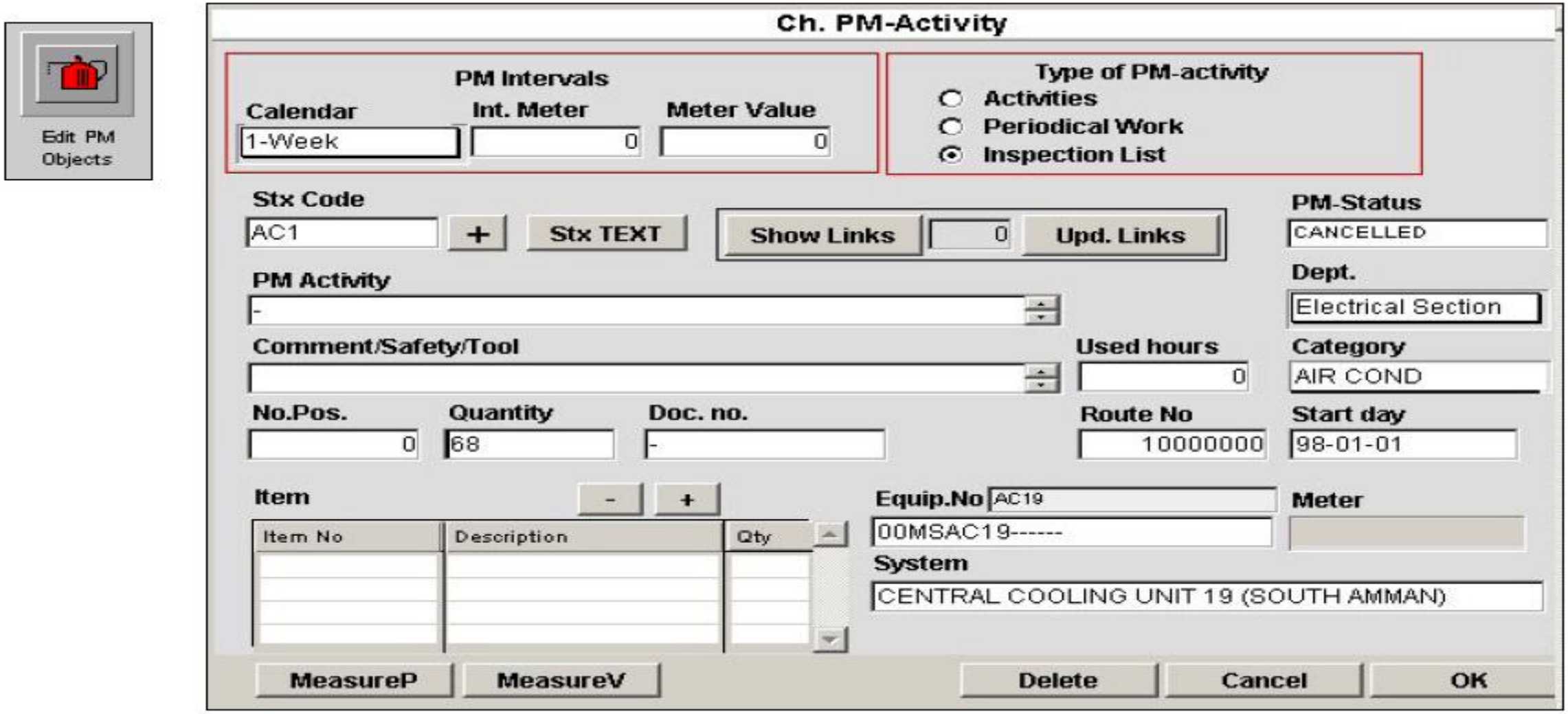
Adaptation process of CMMS



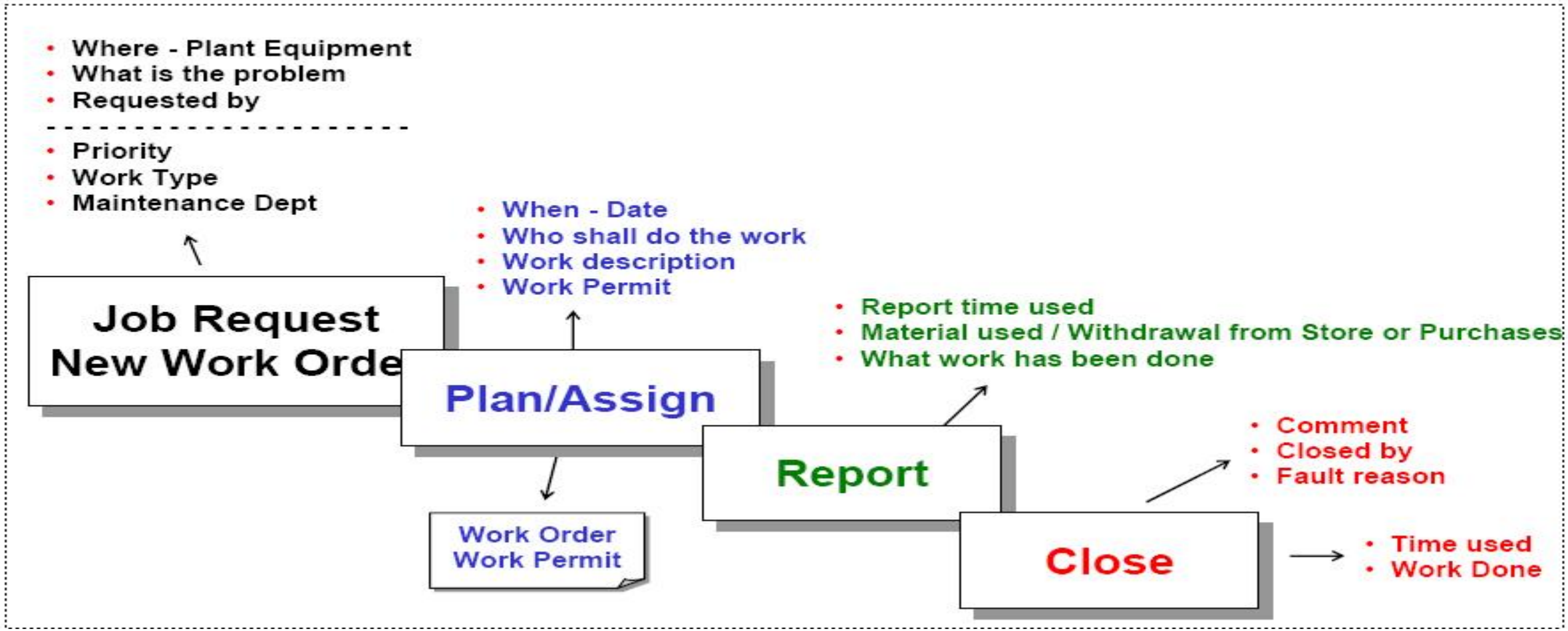
Basic functional modules of CMMS

- Asset Management and Asset Register
- Preventive Maintenance (PM) Scheduling
- Preventive Maintenance Procedure Library Control
- Unplanned Work Reporting
- Scheduling of Planned Maintenance
- Planned Work Order Generation and Issue
- Viewing Outstanding Work
- Maintenance Personnel Database
- Stores Requisitioning, Stock Control and Purchasing
- Statistical Data and Reports

Preventive maintenance activity as applied to the Aleppo 1000MW-power-plant



MAIN WORK ORDER CYCLE



A report generator for maintenance staff belonging to the 1000 MW Aleppo power plant

REPORT GENERATOR FOR MAINTENANCE STAFF
Example from Equipment Database

Equip. Report No of Records : 18437

Equipment	Description	Suppl. Code	Installation
--	Equipment without unit		
00	COMMON FOR ALL STAGE		
01	GENERATING UNIT NO.1		
02	GENERATING UNIT NO.2		
03	GENERATING UNIT NO.3		
04	GENERATING UNIT NO.4		
05	GENERATING UNIT NO.5		
06	GENERATING UNIT NO.6		
07	GENERATING UNIT NO.7		
08	GAS TURBINE #1		
09	GAS TURBINE #2		
10	SWP		
11	SWP		
12	STAGE 1 & 2		
13	STAGE 3 & 4		
14	DIESEL ENGINE		
15	GENERATING UNIT 1,2,3		
16	GENERATING UNIT 4,5,6,7		
20	OUTSIDE THE POWER STATION		
----	EQUIPMENT WITHOUT SUB UNIT		
0001	STAGE 1		
0002	STAGE 2		
0003	STAGE 3		
0004	STAGE 4		
0010	ALL STAGE 1,2,3,4		
0011	STAGE 1,2		

Search... Sort... Show all Report... Export Labels Cancel

Integration of CMS and CMMS

- Condition monitoring is a form of predictive maintenance where continuous monitoring of the condition of specific areas of plant and equipment takes place. When any pre-defined limit is exceeded, an alarm output is turned on. This alarm output can be input to a CMMS so that a work order will be generated immediately. This is particularly suited to continuous process plant, say paper mills, where plant failure could be extremely costly.
- Typical conditions, which can be monitored, are temperature, vibration, over voltage or current and liquid level; in fact any condition that can be detected by a sensor.

Integration of CMS and CMMS

The transition to CMS/CMMS will require a substantial investment. The return on this investment will be dependent on the suitability of the selected software package, the effectiveness of its implementation and the commitment of all personnel to the new system. The proper CMS realizes an optimal operation and the proper CMMS provides an optimal maintenance.

Most vendors sell their packages by claiming:

- increased plant availability - by reducing down time
- lower operating costs - by reducing overtime, spares inventory and
- prolonged asset life - by more effective maintenance
- reductions in spare part inventory - by identifying parts through links to equipment
- much improved control over preventive maintenance schedule and documentation
- simplified access to maintenance data and statistics - through report generator

Whatever the claims made by the supplier, one of the main benefits to be gained from a CMMS is that it helps and encourages the user to focus on good maintenance practice. Procedures become formalised and organised through having to conform to the requirements of the new system. The table below illustrates a few of the common differences in an organised versus a disorganised maintenance department.

Case study

Rehabilitation of Banias power plant

The Syrian power system has three major problems which need to be resolved in order to improve its operation & maintenance and consequently to reduce the air emissions. First, the technical electrical losses are about 30% of net electricity supplied to the grid. Second, the power factor had reached alarming levels in some parts of the power system, indicating a lack of reactive power compensation. Third, the efficiencies in old power plant units are very low and still decreasing rapidly

Case study
Rehabilitation of Banias power plant

A feasibility study in the area of global warming, supported by the Joint UNDP/GEF (Global Environment Facility) was carried out for Syria by a consultant office (Ekono Energy Ltd) during 1994. The proposed projects:

- training
- Computerized Monitoring System (CMS)
- Computerized Maintenance Management System (CMMS),

were planned to be implemented on one of the Syrian power plants (Banias). According to the study, the efficiency and the production availability would be improved by about 13% and 12% respectively. Besides, the emission of pollutants (CO2 and SO2) would be reduced by 13%.

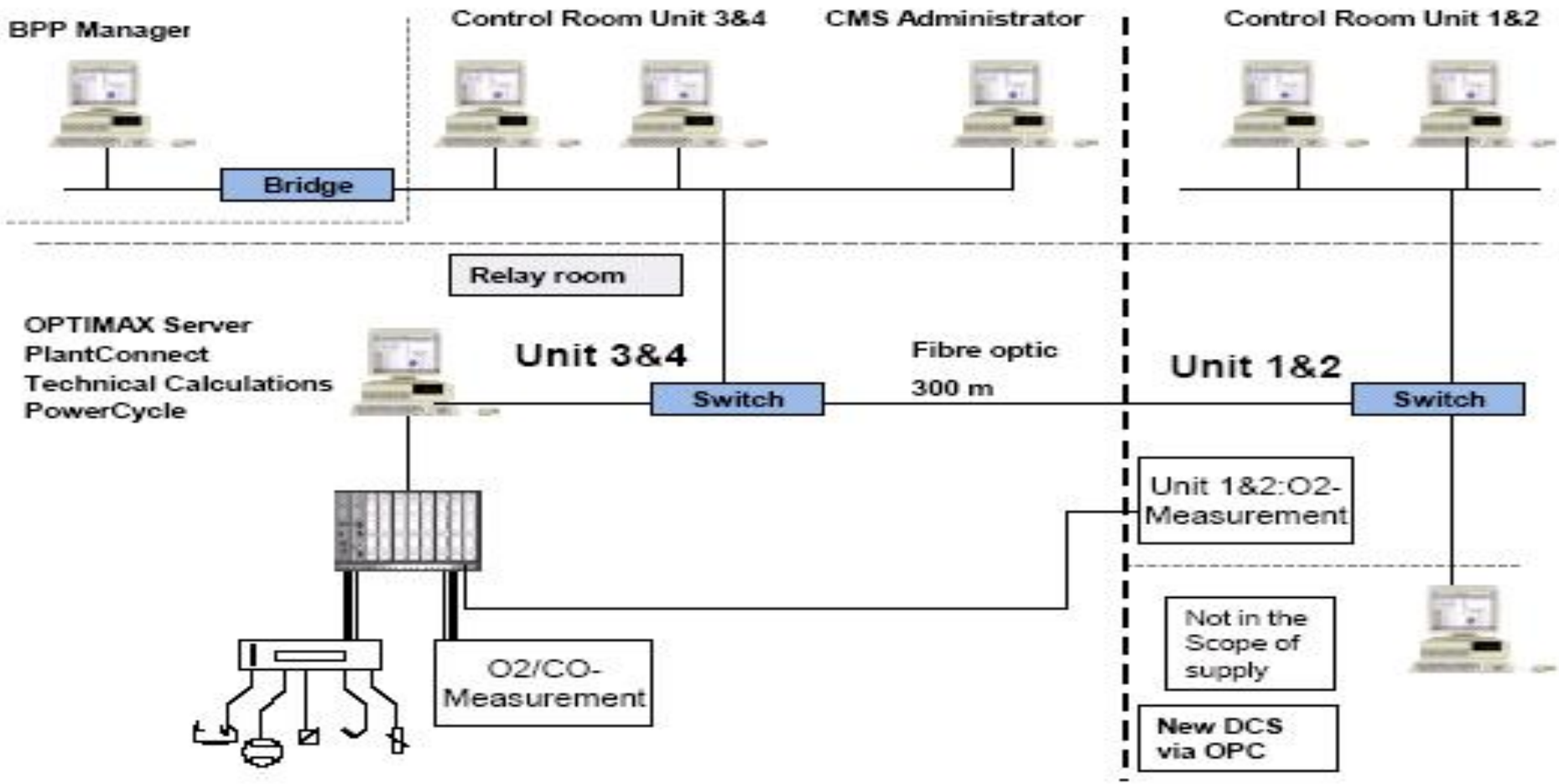
Case study
Rehabilitation of Banias power plant

Results Summary of the Economic Analysis [mill USD]

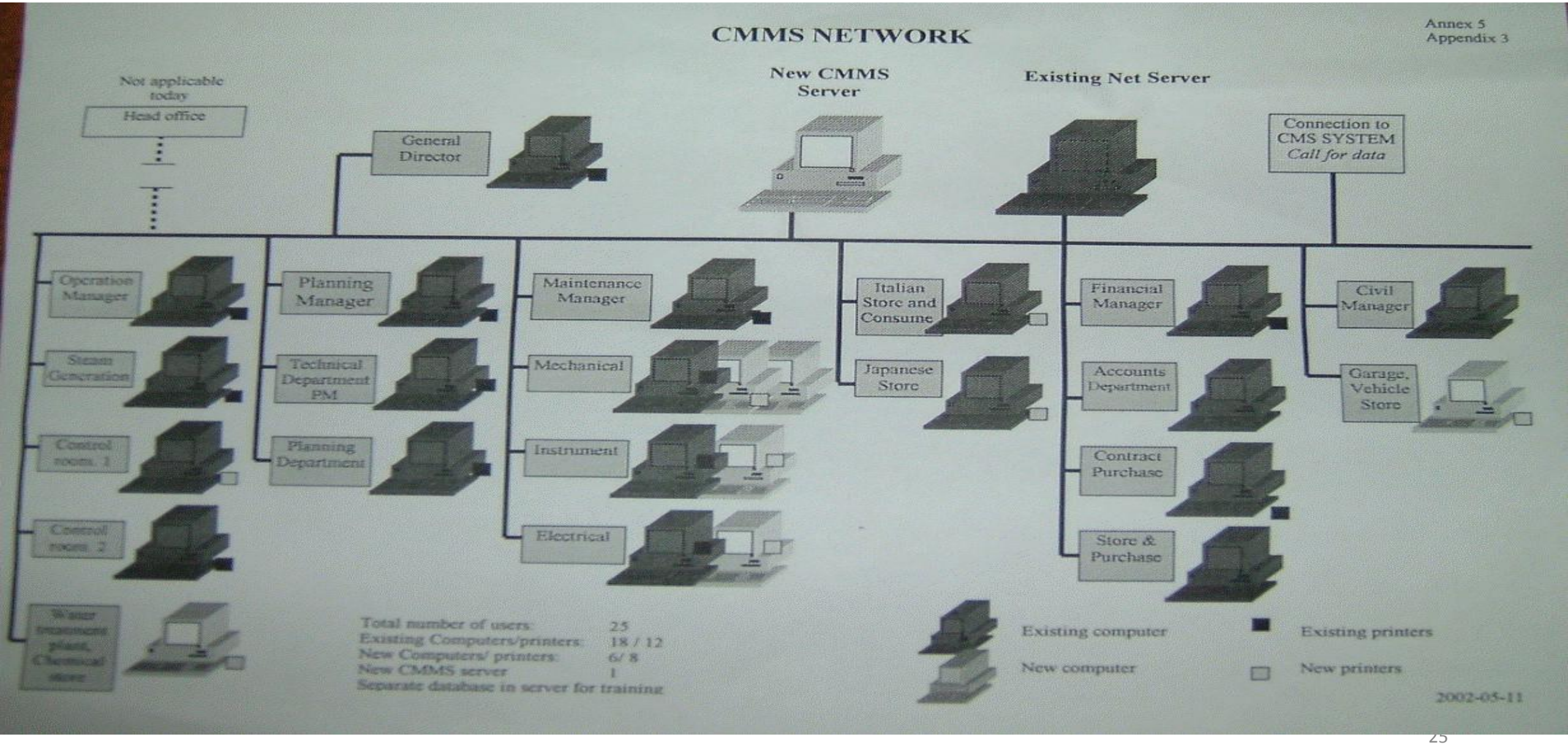
Values	Cost	Benefit	Savings
Current	27.058	120.316	93.258
Present	25.692	74.344	48.652

Rehabilitation of Banias power plant

Configuration of Banias Condition Monitoring



Rehabilitation of Banias power plant



Case study
Rehabilitation of Banias power plant

- The projects have been implemented in BPP by ABB Utilities GmbH, Germany between Mai 2003 and November 2005. The CMMS has been put in service at full extent in February 2006. The CMS has been tested and operated successfully.

- With rehabilitation of Banias units and installation of these systems the ABB expects efficient operation by guiding operation staff will be achieved:

- Less costs of production
- Increase of live time
- Saving good quantities of fuels (100000 toe/year)
- Reducing Green House Gases in the sense of Kyoto conference (300000 tone CO2 equivalent / year)
- The combination of CMS with CMMS shows new ways of predictive maintenance.

Case study
Rehabilitation of Banias power plant

The actual operation analysis of the rehabilitated plant has shown:

- **the improvement of**
  - **plant efficiency by about 12%**
  - **production availability by 10%.**
  - **emission of pollutants (CO_2 and SO_2) has been reduced by 14%.**
- While the projects required USD 29 million, they saved about USD 130 million over 10 years (which has a present value of USD 90 million)

Conclusions

- The CMS and CMMS are universal systems. In general, they present many possibilities to build up specialized operation and maintenance tasks, but they don’t offer a ready to run solution. That is why such systems must be adapted in any case to the specific needs of the target system (here the power plant units).

Conclusions

- The transition to CMS/CMMS will require a substantial investment. The return on this investment will be dependent on the suitability of the selected software package, the effectiveness of its implementation and the commitment of all personnel to the new system. Most vendors sell their packages by claiming:

Conclusions

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Conclusions

- A case study about the rehabilitation of an old power plant in Syria (Banias power plant) is presented. The rehabilitation was finished at the end of 2010 and comprised mainly the installation of CMS and CMMS for the plant. The operation analysis of the rehabilitated plant has shown the improvement of the plant efficiency by about 10% and the production availability by 12%. Besides, the emission of pollutants (CO2 and SO2) has been reduced by 14%. While the projects required USD 29 million, they saved about USD 130 million over 10 years (which has a present value of USD 90 million).