



Power Plant Data Warehouse as a Primary Data Source for a for a Generating Company Control Center

Ninel Čukalevski, Goran Jakupović, Suzana Cvetičanin

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Motivation, long term

- **Liberalization and re-regulation of ESI**
- **New players (IPP, GenCo, traders), Market, Concurrency.**
- **Power system complexity increase.**
- **Business technical and commercial aspects getting more stringent.**
- **New capacity building slow down**
- **Fuel prices increase**
- **Economy crisis, how long?**

Challenges in Generation

- Increased requirements on environment protection (emission of CO₂, SO_x, NO_x,...).
- Older and older equipment/plants require best possible O&M practice.
- Older workforce, with valuable knowledge base, that can be easily lost
- Pressure to reduce production cost (€/MWh)
- Increased threats to security, ...

Challenges for GenCo's and IPP's

- To be able to take competitive technical and commercial decisions **need adequate and timely process data from the power plants on the regular basis.**
- **Numerous power plant data are needed** (technical, process historic, real-time and non-real time). Between them **on-line, real-time available unit capacity, unit efficiency and unit production cost** (as ¢/kWh, based on the unit heat rate) are of the prime importance.

Functionality needed can differ

- **Technical performances** of the individual power plants/units are to be followed and analyzed (**on-line real-time monitoring and analysis system**), fleet wide.
- Together with the **activities on assets condition monitoring and coordination of power plant maintenance**.
- **Generation Management System (GMS)** are used to perform functions related to resources scheduling, load forecasting, and generation control.

G&T CC can include

To be able to perform daily activities gen. companies on the upper (Fleet) level need **Generation (+ Trading) Control Center**, with IT support functions to:

- Schedule resources
- Trade energy & AS
- Monitor & Control generation

Current situation in generation segment at EPS

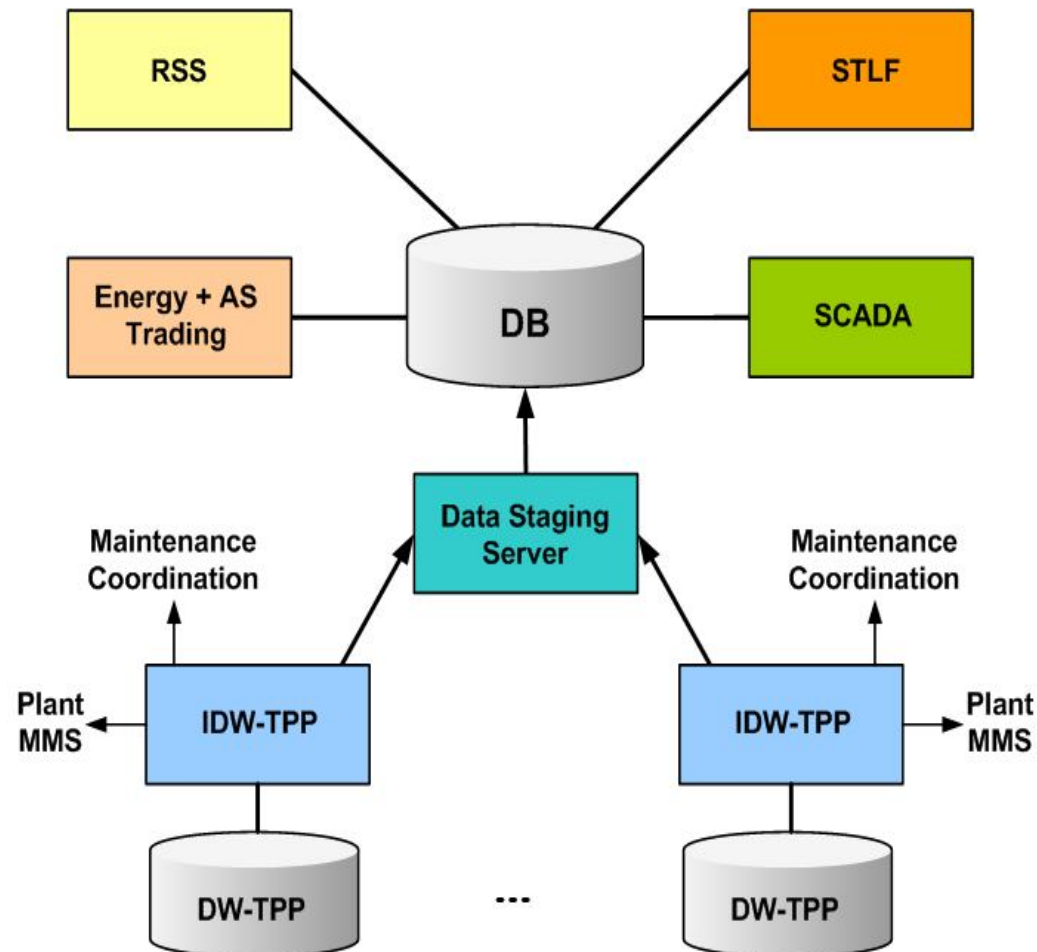
After restructuring of Serbian VIU 5-6 years ago, on generation side (EPS), new **GCC** was formed, today with the following **functionality**:

- SCADA (IMP)
- Some Web input from PP
- HIS (IMP)
- RSS (Resource scheduling system) (Areva)
- STLF (Load Forecast) (In-house devlpm.)
- SDDP (Long term planning) (PSR)

Challenges and Needs

- So far,
 - Daily work is performed mostly using heuristic approach
 - Applications are not integrated
 - SCADA data are obtained via ICCP from the TSO
 - Luck of on-line/RT unit efficiency, unit production cost and other plant/unit data
- Energy trading and Risk Mngm. s/w (ETRM)

Future IT support for EPS GCC



Enabling factors for the project

- ❑ Progress in the area of automatic control methods, and tools
- ❑ Modernization of process interface, intelligent transmitters, gas/liquid analyzers, sensor networks, wireless...
- ❑ Modernization of control of almost all units at EPS of Serbia, ongoing
- ❑ Progress in the area of ICT: DW, DM, BI...

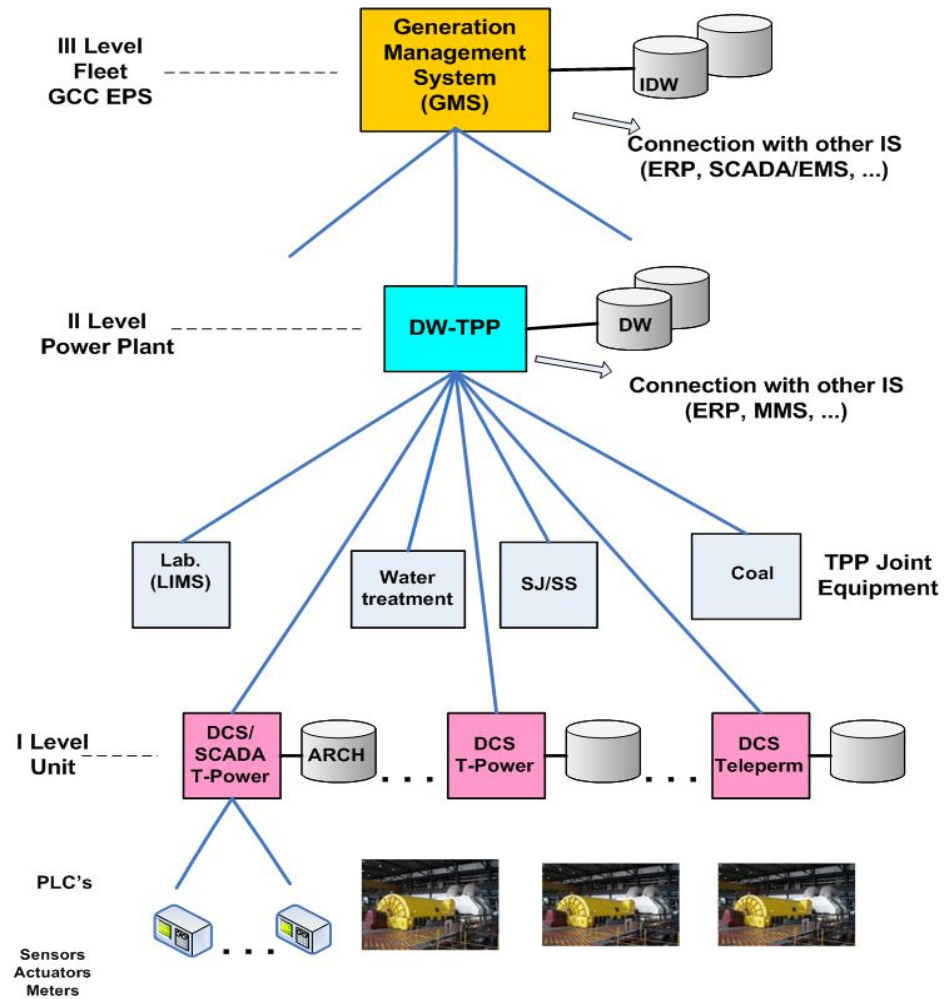
DCS Typical constraints

- All data are in local **proprietary archives**, relatively closed. Proprietary protocols.
- Used solely for process monitoring, command and automatic regulation.
- Modest use of the data outside the unit control room.
- No automatic relation with the Daily report application. i.e. repeated manual data entry.
- Data in "siloses", un related.
- **Minimal use of analytic applications.**

TPP DW System

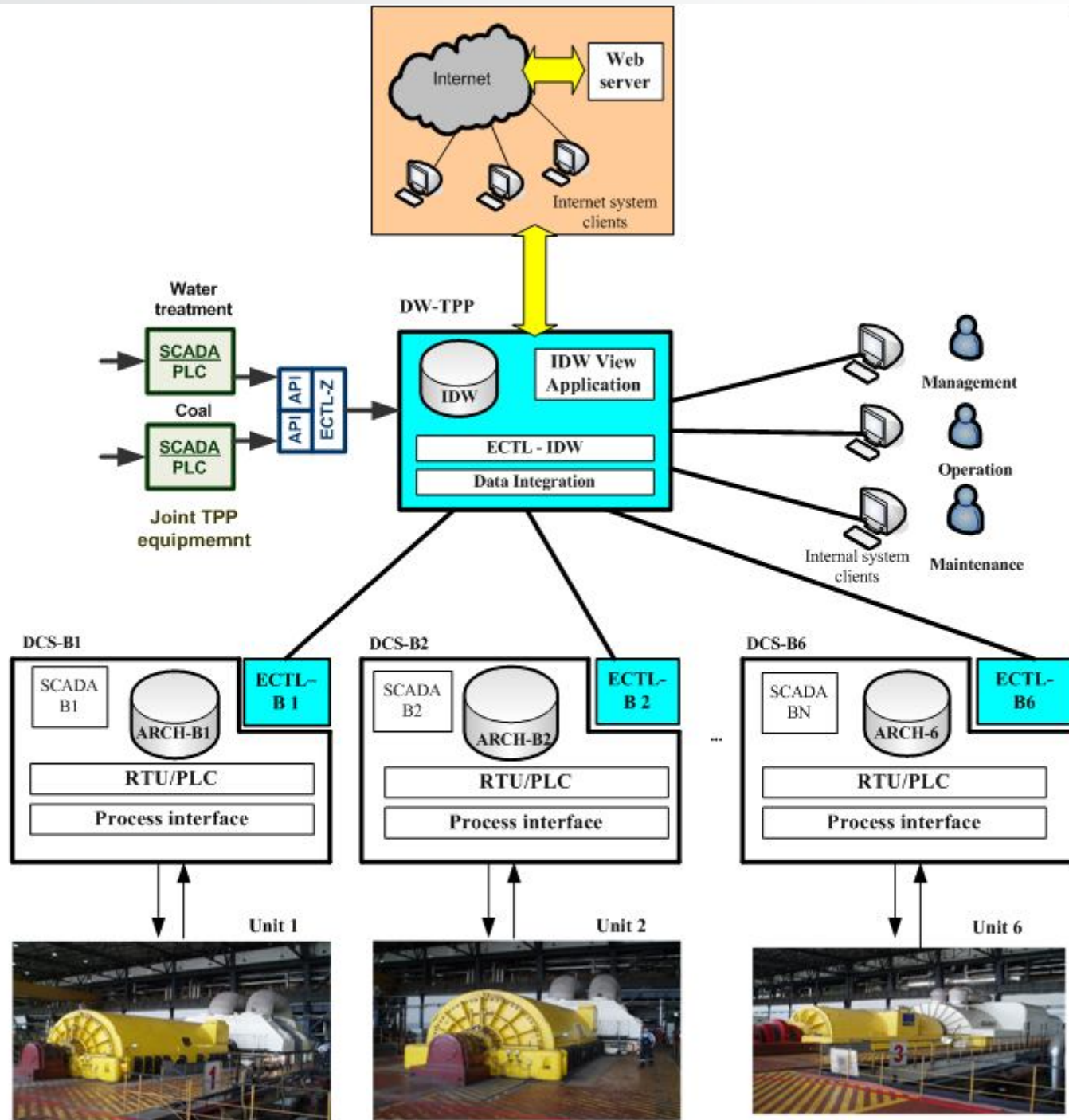
- The DW-TPP system proposed and developed, in its essence represents a specific information system (**DSS type**) intended for **decision making support** in the domain of **TPP operation effectiveness, operations planning and energy efficiency**.
- As its central part system has an **integrated data warehouse (IDW)** that contains all relevant (almost) real-time and historic process data, but also data from other sources.
- **Additional service and user software (ECTL, T-View)**
- Fits well in designed multi level control **hierarchy**

Proposed system global architecture, 3-level



Approach: TPP Data Warehouse

- Process data integration and retention point
- For reporting and BI use
- For better PP planning, CM and maintenance
- As a source data system for future generation fleet maintenance coordination and control center.
- System Architecture →



TPP-DW data content

- Each unit generates about **4000-6000 measurements** on **every scan** (2-5 seconds). Adding calculated and derived data, we come to about **10.000 data per unit**, or 60.000 "measurement" data per TPP.
- Of approximately **1600 analogue measurements/unit** about 1000 are from boiler, 400 from turbine and 200 from generator.
- Available measurements: **electrical** (like current, voltage, frequency, active/reactive power, active/reactive energy, etc.) and **non-electrical** (like temperatures, pressures, levels, flows, vibrations, speed of rotation, concentration, etc.) that plant/unit SCADA/DCS/PLC system can provide.

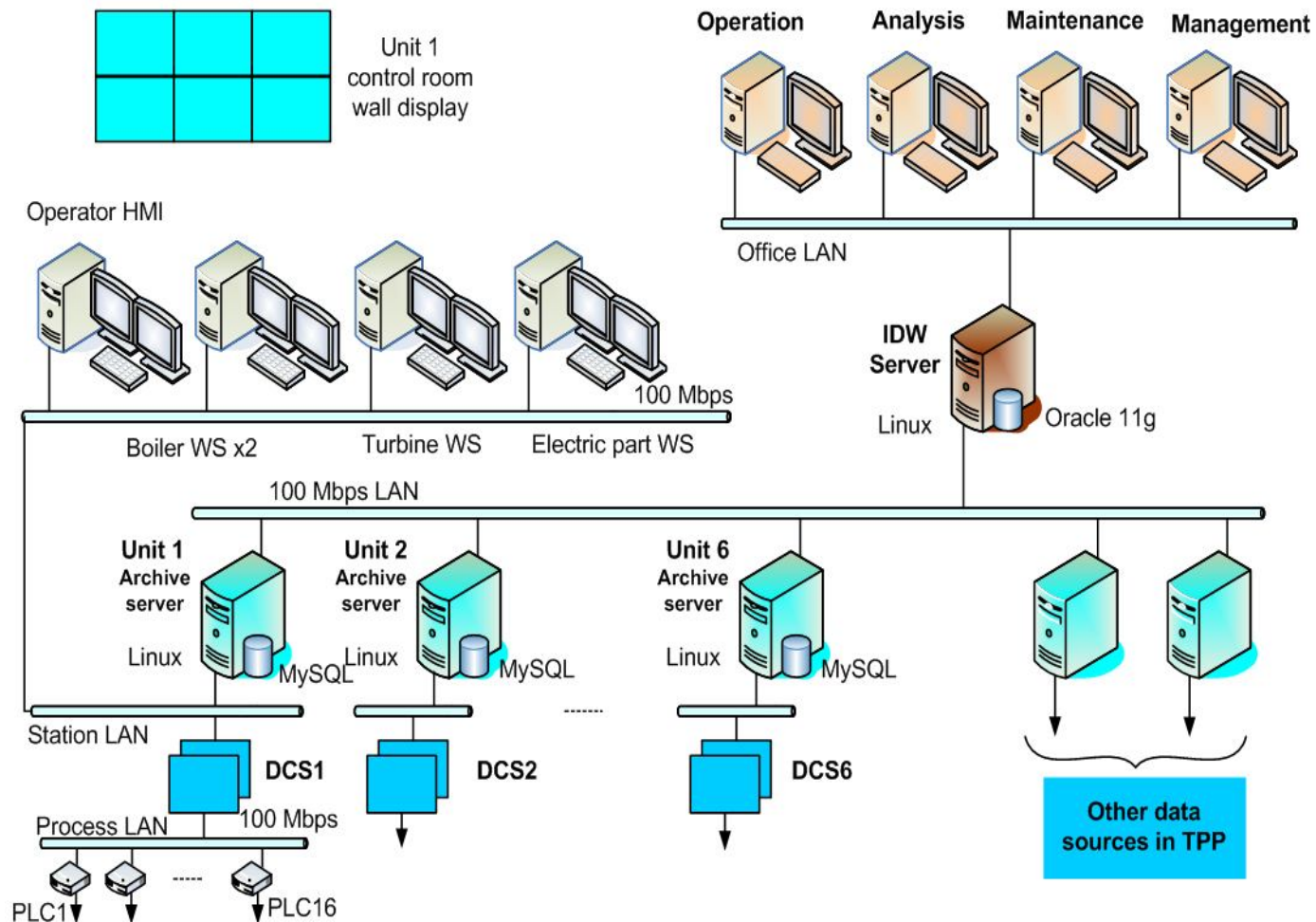
TPP-DW contains **two main data groups**:

- **"Catalog", model data** that describe the plant/unit structure and their elements.
- **Data extracted from the SCADA/DCS systems**, measurements from the process.
- **Historical** (time tagged) DW data are organized in three tables ("archives"):
 - Daily archives (with a 5-15 min. resolution)
 - Monthly archives (with a daily resolution)
 - Yearly archives (with monthly resolution)

ECTL-B, Extraction s/w functions:

- Access to real-time data in the DCS run-time segments
- Data extraction from the DCS historical archives
- Data extracted processing and their conversion in a form suitable for data transfer
- Connection and processed data transfer to Oracle data base

Architecture of the DW-TPP system



TPP DW IT Platform

- API: C++
- ECTL: C++
- RDBMS/DCS side: My SQL
- RDBMS/DW side: Oracle 11g
- Viewer Application: Oracle APEX

Conclusions

The DW for the biggest TPP at EPS that:

- 1. Integrates at the power plant level relevant process data collected from the individual unit DCS's**
- 2. Serve as a platform for different applications that will use mainly historic process data from the data warehouse.**
- 3. Platform to enable TPP data to be feed to the GCC**

Contact:

Dr. Ninel Čukalevski, dipl.ing.

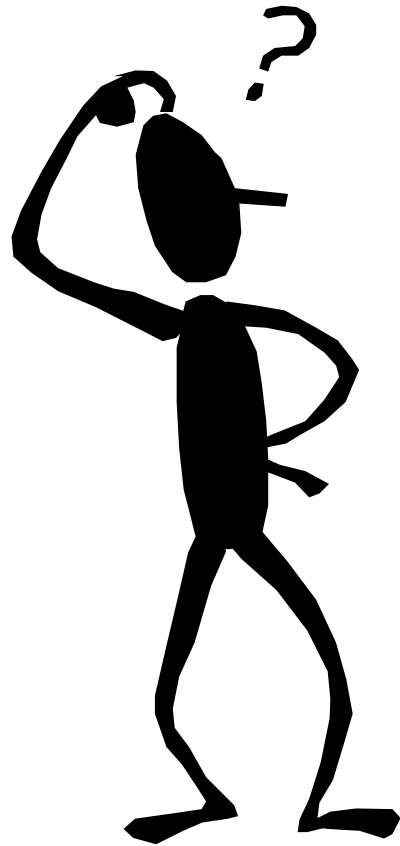
ninel.cukalevski@pupin.rs

Institut Mihajlo Pupin-Automatika

Volgina 15

Beograd, Serbia

<http://www.pupin.rs/>



**Thanks for your
attention!**

Questions?