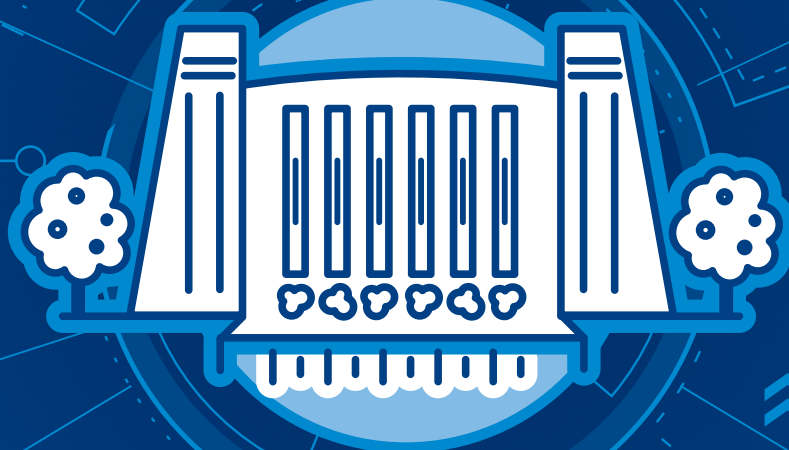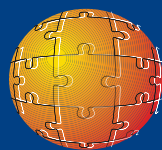# KONČAR's complete river basin solution
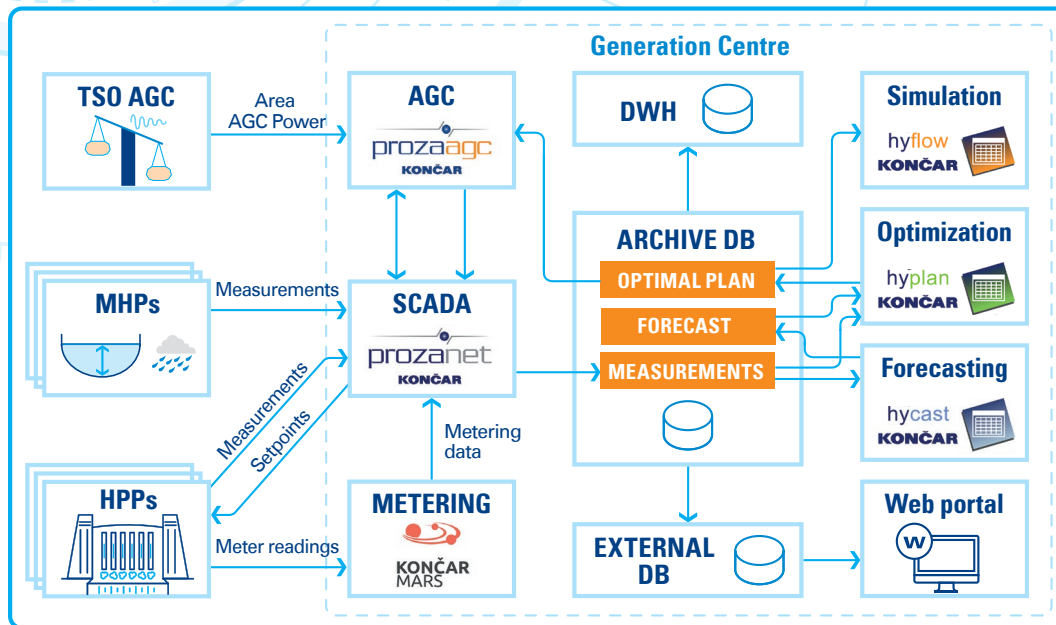
monitoring, planning, control and reporting

**KONČAR KET**

## River basin control centres

**Končar's solution** contains a set of applications for monitoring, planning, control and reporting in a river basin control centre. Data from all hydro power plants, other facilities and measuring stations in the whole basin is received, validated and processed in centre's applications. Based on collected data, the optimal production plan of each power plant is calculated, validated and automatically executed. All essential data is archived and used for on-line overview and generation of user-defined reports.

## Inputs and outputs

- Measurements and statuses from hydro power plants (HPPs), as well as measurements from meteorological, hydrologic and piezometric stations in the area **are received** in SCADA application.
- Smart meter readings from HPPs and its facilities **are received** in metering application.

- A total required regulating power for the whole area, sent from TSO, **is received** in AGC application.
- Schedules and forecasts **are imported** from external database of from files through FTP.
- Setpoints and control signals **are sent** to HPPs from SCADA in the centre.

## SCADA



**PROZA NET SCADA** is centre's central application. It is based on the latest computer technology and openness standards in order to provide possibility of long-term upgrade and improvement. PROZA NET is designed to conform to the high demand of real-time operation as well as large system databases and communication. Secure and reliable operation by redundancy of critical SCADA functions at the hardware and software level is ensured. Due to its modular architecture, it allows easy integration with 3rd party software. PROZA NET has a rich library of symbols, dynamical styles and animations which allow creation of complex but easy to use HMI pictures.



## Smart metering



Application **MARS** is used for collecting, analysing, verifying, managing and reporting of data from smart meters. It can communicate with many different meter types with numerical or pulse readings, by using various communication protocols. Končar's DCI concentrators gather data from all meters in a remote location and send it to MARS.

# Automatic generation control

**PROZA AGC** application is primarily used for automatic execution of the optimal production plan, calculated in Hyplan application. Additionally, PROZA AGC can be a node in load-frequency control (LFC). In that case, it optimally redistributes in real-time the total basin's required LFC power to all units that are engaged in LFC.
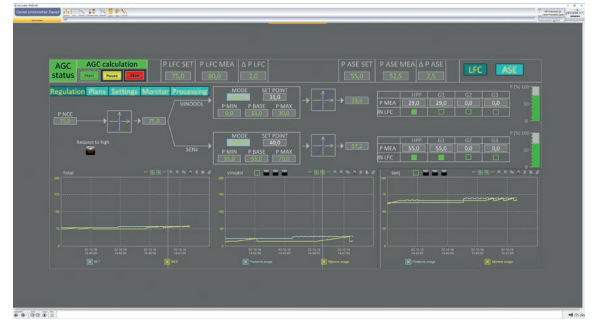
# Production planning

The input data for **Hycast** application are meteorological, hydrologic and piezo metric measurements, as well as meteorological forecast. The application calculates forecasted inflows at selected points of the basin using rainfall-runoff model. The model of each basin is identified and calibrated using several years of historical data.

**Hyplan** application calculates optimal production schedule of all power units for periods 1-7 days, with 30 or 60 minute time resolution. The optimization is performed separately for each basin, with a goal to minimize water usage, while maximizing electrical energy production, but taking into account hydropower system's physical, technical and operational constraints. There is a possibility for intra-day re-planning.

**Hyflow** application is used for simulation of the optimal production plan calculated in Hyplan application. It can also be used for what-if analysis of different variations of the optimal plan or for testing various scenarios of forecasted AGC generation. Simulation of water waves propagation is based on basin's hydrodynamic model.
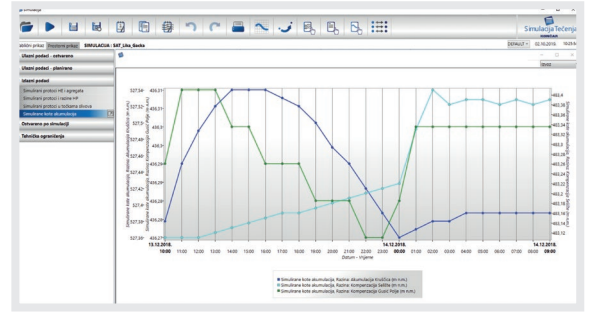
# Databases

There are four separate databases in each centre: SCADA database, Metering database, Archive database and External database. **SCADA database** and **Metering databases** are input databases for SCADA and MARS data.

**Archive database** is the central place for acquisition, processing and saving of data in the centre. Archive database also serves as permanent data storage.

The **External database** contains only a subset of the data from the Archive database, which is required by Web portal.

Apart from standard database configuration and administration tools, an Apex platform can be used for monitoring of database jobs statuses, manual execution of procedures, data values modifications and inspection of errors.

# Web portal

**Web portal** is used for on-line presentation and reporting of centre's data to internal and external users. Through web interface it shows graphical and tabular presentations of all important system measurements and indications. The internal users can view all data, while the view for each external user is limited only to the data of its interest.
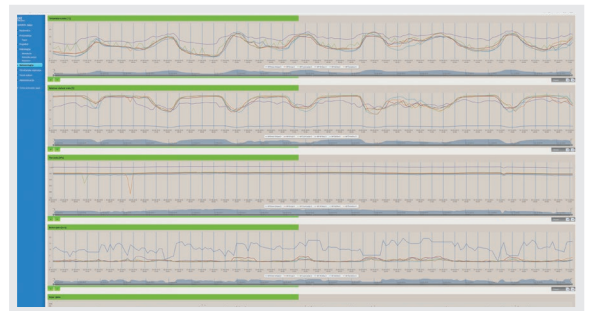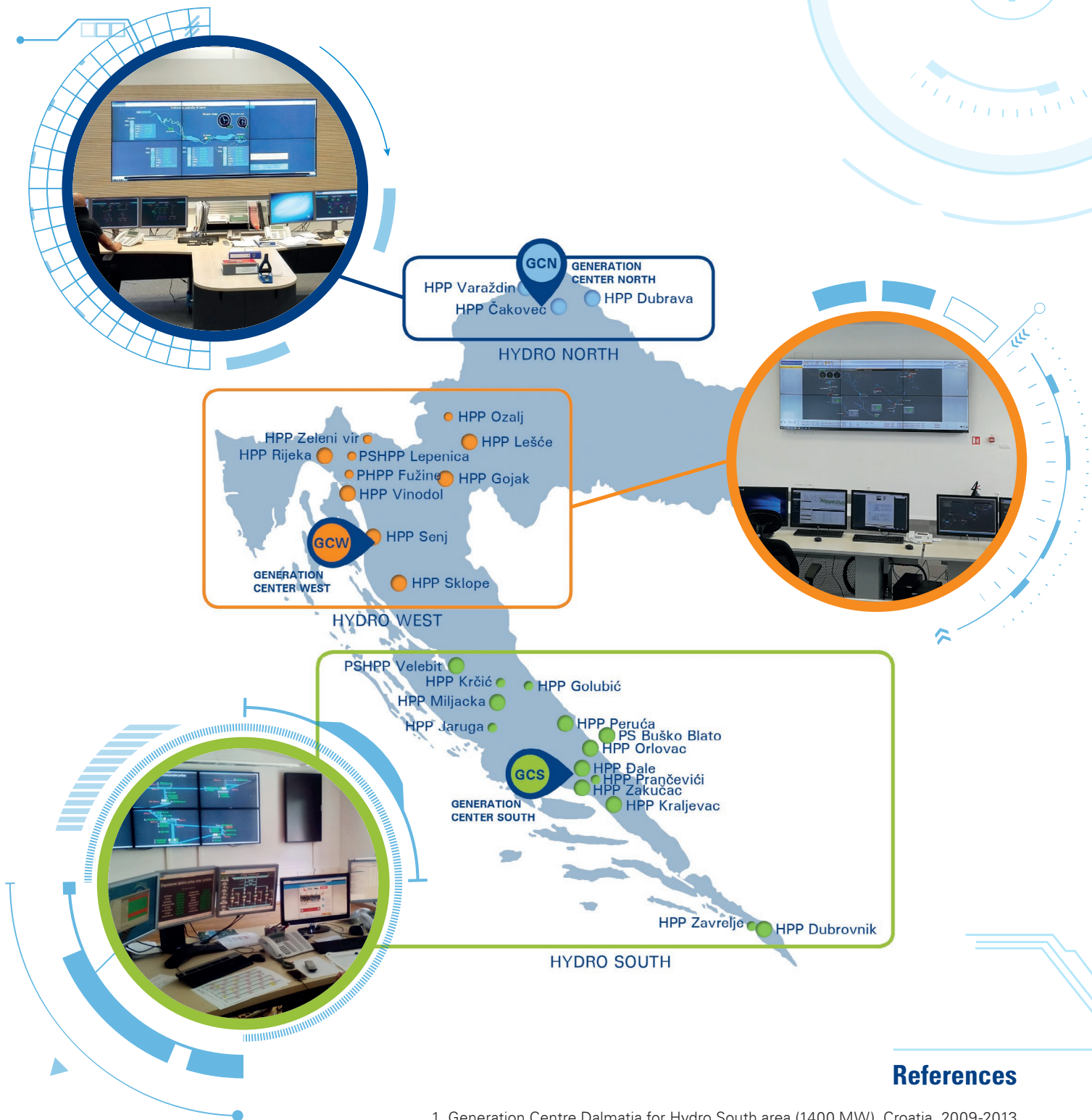
# Data Warehouse

**Data Warehouse** is used for acquisition and analysis of large amount of data. It generates smaller definite sets of data from very large data that is collected in centre's archive. Data Warehouse is used to generate corporate reports intended for business analysis and decision making.
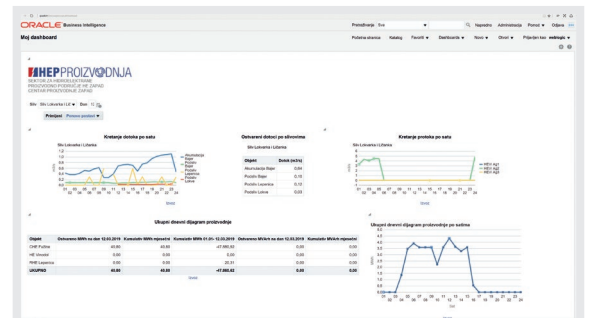
# ›› CONCLUSION

**Končar** provides a set of applications and systems for reliable and secure operation of a river basin control centre. The greatest part of the Končar's solution is a result of in-house development and therefore highly flexible to end-user requirements. Končar's experts have more than 10 years of continuous experience in implementing solutions for river basin control centres. The areas where centres were implemented had various terrain and basin configurations and contained different sizes and types of hydro power plants.



**GCN** GENERATION CENTER NORTH
HPP Varaždin
HPP Čakovec
HPP Dubrava
**HYDRO NORTH**

HPP Ozalj
HPP Zeleni vir
HPP Rijeka
PSHPP Lepenica
HPP Lešće
PHPP Fužine
HPP Gojak
HPP Vinodol
**GCW** HPP Senj
**GENERATION CENTER WEST**
HPP Sklope
**HYDRO WEST**

PSHPP Velebit
HPP Krčić
HPP Golubić
HPP Miljacka
HPP Jaruga
HPP Peruća
PS Buško Blato
HPP Orlovac
**GCS** HPP Đale
HPP Prančevići
HPP Zakučac
**GENERATION CENTER SOUTH**
HPP Kraljevac
HPP Zavrelje
HPP Dubrovnik
**HYDRO SOUTH**

## References

1. Generation Centre Dalmatia for Hydro South area (1400 MW), Croatia, 2009-2013
2. Generation Centre North for Hydro North area (250 MW), Croatia, 2013-2016
3. Generation Centre West for Hydro West area (500 MW), Croatia, 2016-2019