



**"SGE"**  
**Software presentation**

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## SGE: it means?

- > In French: **Systeme de gestion Énergétique**  
pour les bâtiments CI
- > In English: **Energy Management system**  
for CI buildings
- > Project goal  
*increase energy efficiency in Commercial  
and Institutional Buildings  
using information provided by BAS*

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## **Why SGE software is needed?**

- > Increase energy efficiency in Commercial and Institutional Buildings**
- > Optimize HVAC systems operation (Power demand and energy consumption)**
- > Simplify and assist building operators**

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## **What is the context?**

- > 10 to 30% of energy waste due to improper use of the automated control**
- > Availability of information and measurements by BAS systems**

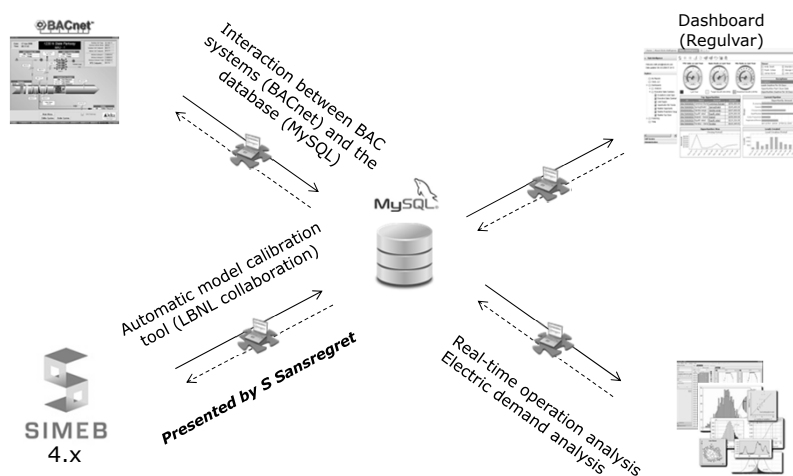
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## What is SGE software?

- > Energy information system
- > Simplified installation and usage
- > Free product for CI Hydro-Quebec customers
- > Partnership between Hydro-Quebec and Regulvar
- > Collaboration with LBNL for model calibration

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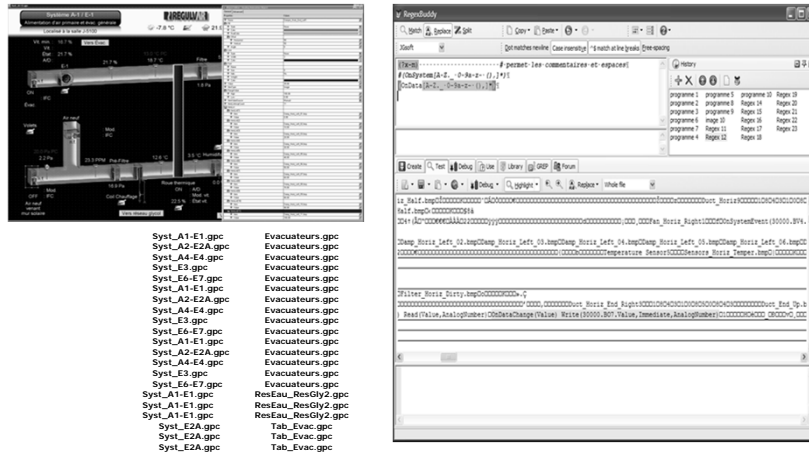
## What is SGE software?



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## Interaction between BAC systems (BACnet) and the database (MySQL)

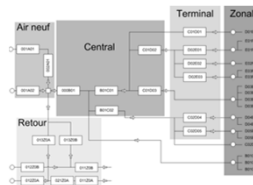
System Mapping (Existing buildings)



## Interaction between BAC systems (BACnet) and the database (MySQL)

> Semi-automatic mapping of HVAC equipments and control devices

> New naming convention developed for SGE software



> Storing control data in a structured database : suitable to do energy calculations and analysis

## Dashboard : Real-time operation analysis

### > Real-time operation analysis

- Based on the calculations of operation and performance indicators
- Expert analysis of indicators for a global behavior of HVAC system real-time operation
- Convivial presentation for building operators

### > Electric demand analysis

- Based on 15min electric consumption
- Using PRISM algorithm to analyze the daily electric consumption vs. daily mean temperature
- Using Fuzzy clustering to identify reference daily electric demand profile (compare with actual profile)
- Both methods requires a minimum of 1 year of historical data

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## Dashboard : Real-time operation analysis

### > What are operation indicators?

- Value calculated from combination of measurements, set points or others operation indicators
- Comparables values with power units or no unit
- 30 fixed defined indicators for all types of systems what makes them comparable

### Example:

Total heat produced in the HVAC central system  $Q_{cents}$

Total heat produced in the HVAC terminal system  $Q_{terms}$

Total cool produced in the HVAC terminal system  $Q_{cterms}$

Number of zones with heating demand  $N_h$

Value of maximum terminal heating system intensity  $I_{hterms}$

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## Dashboard : Real-time operation analysis

### > What are performance indicators?

- Indicate good or improper operation of the HVAC system
- Three possible values: 1 – green (good operation), 2 – yellow (possible fault detected), 3 – red (real operation problem)
- Determined by comparison between operation indicators, comparison between operation indicators and system data

### Example

Simultaneous heating and cooling: central vs. terminal

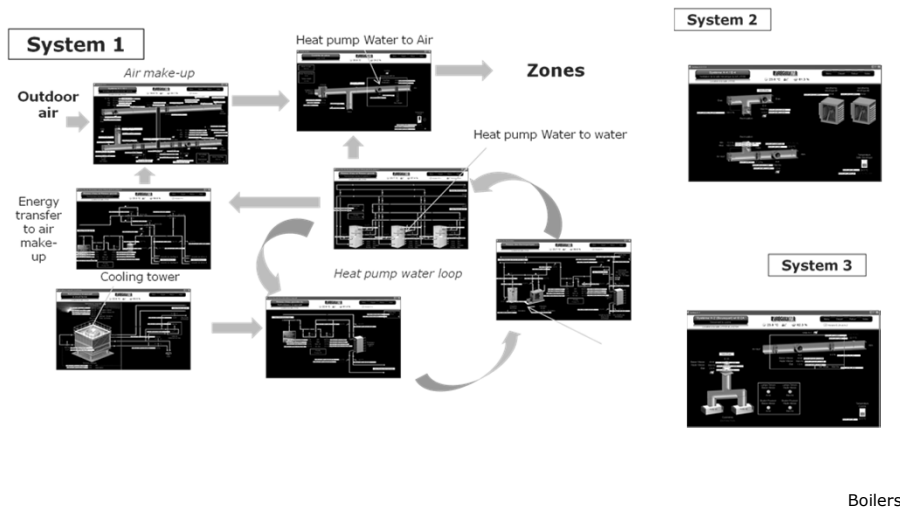
$Q_{hcents} > 0$ 
{


. If  $Q_{cterms} = 0$  then Performance Indicator is **GREEN**

. If  $Q_{cterms} < 0$  and  $I_{hterms} = 1$  then Performance Indicator is **YELLOW**

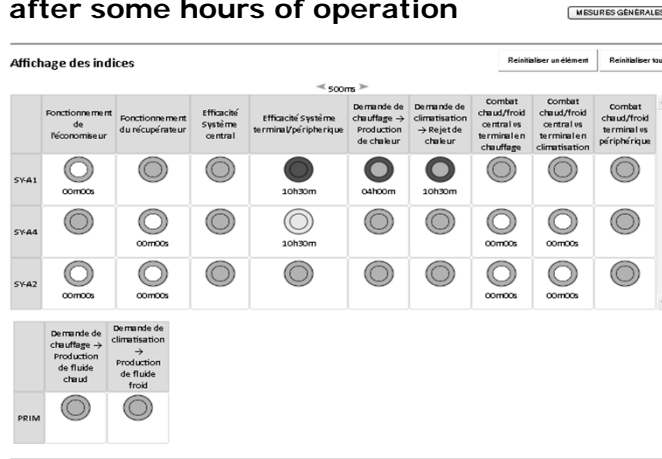
. If  $Q_{cterms} < 0$  and  $I_{hterms} < 1$  then Performance Indicator is **RED**

## Dashboard : Real-time operation analysis -> Case study



# Dashboard : Real-time operation analysis -> Case study

View after some hours of operation

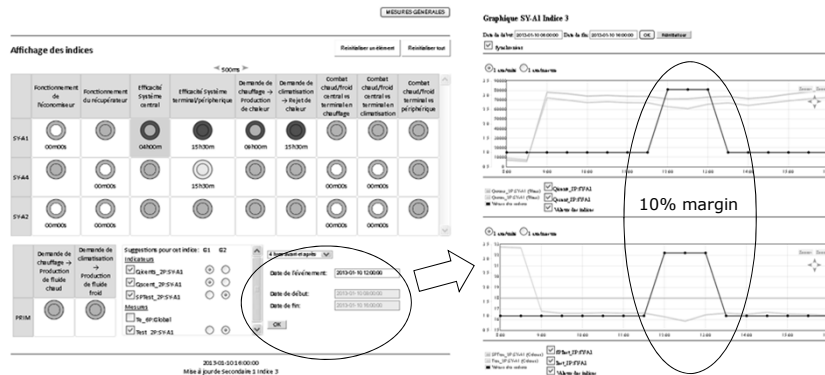


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# Dashboard : Real-time operation analysis -> Case study

Performance indicator #3

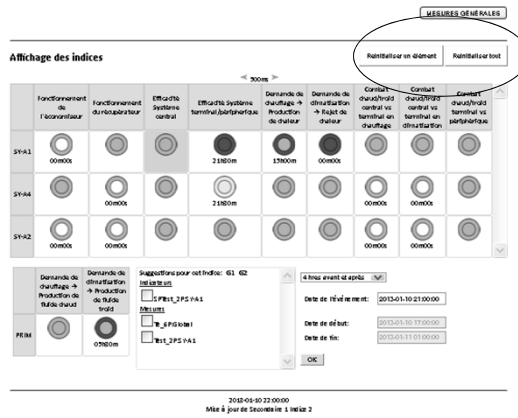


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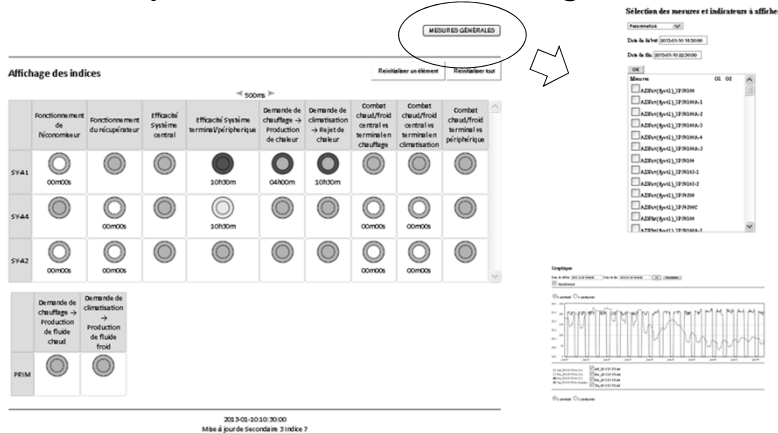
# Dashboard : Real-time operation analysis -> Case study

## Performance indicator #3 after initialization



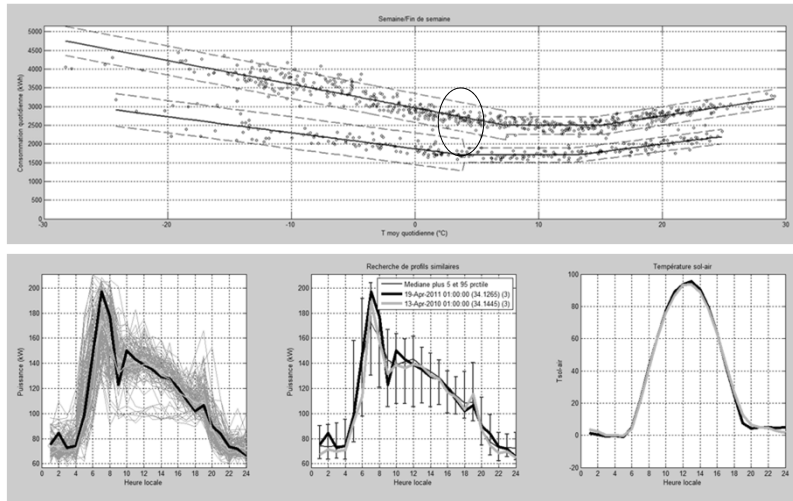
# Dashboard : Real-time operation analysis -> Case study

## Data and operation indicators trend log



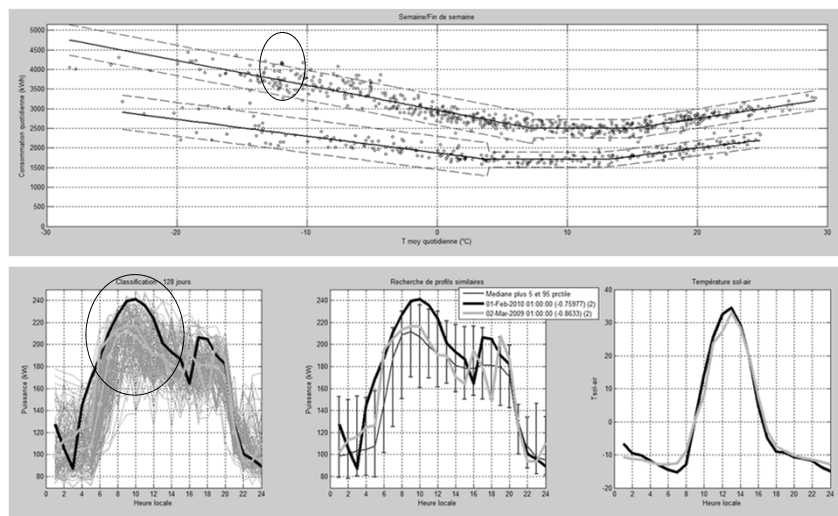


## Dashboard : Electric demand analysis -> Case study



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## Dashboard : Electric demand analysis -> Case study



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## Future developments

- > **Improving automatic mapping of the HVAC system**
- > **Improvement of UI with Regulvar collaboration**
- > **Including HVAC system component efficiency analysis**
- > **Using calibrated model to optimize HVAC system operation**

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