Jonathan Azañón
Energy Management Division

Technical article

Efficient management of telecommunications systems

Key aspects for telecommunications companies

Telecommunications companies need to adapt their traditional management systems to other more robust and efficient ones. Nowadays, on-site management in the different centres is no longer sufficient. Success lies in automating the different control systems to obtain high quality installations that are reliable and available.

The most critical point to bear in mind in telecommunications installations is ensuring supply continuity, because any incident of this type leads to serious complaints from users, and also requires human presence to fix the problem. However, another important aspect is controlling energy in a way that managers can remotely monitor and control each station to take immediate actions.

4 key objectives

As a reference in the electrical energy efficiency sector, CIRCUTOR offers telecommunications service companies a wide range of devices for successfully achieving the efficient control of their installations, both remote stations and data processing centres.

There are several objectives that have to be borne in mind to achieve this, for instance:

❶ Supply continuity

Guaranteeing supply continuity with protection and earth leakage self-reclosing systems.

❷ Energy efficiency management

Guaranteeing the installation's energy efficiency (control and reduction of consumption).

❸ Alarm management

Efficiently managing alarms (intruder detection, beacons, unwanted tripping, etc.)

❹ Management system creation

Guaranteeing a robust global management system of the different centres (centralised control).

How to meet the 4 objectives

❶ Supply continuity

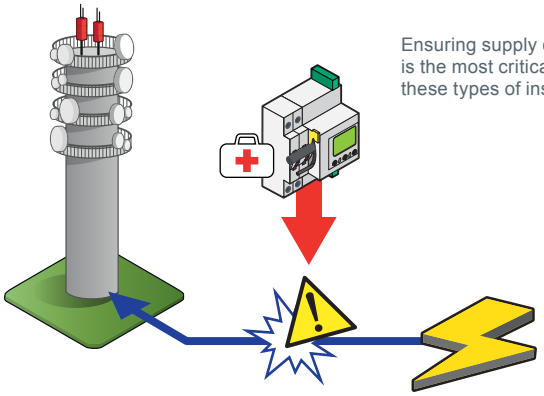
Ensuring supply continuity is the most critical aspect in these types of installations. Any electrical outage leads to enormous economic losses and also requires human intervention to find a solution to the problem.

The solution for mitigating this problem is the installation of **CIRCUTOR's** circuit breakers with ultra-immunised earth leakage protection together with automatic self-reclosing devices such **RECmax**.

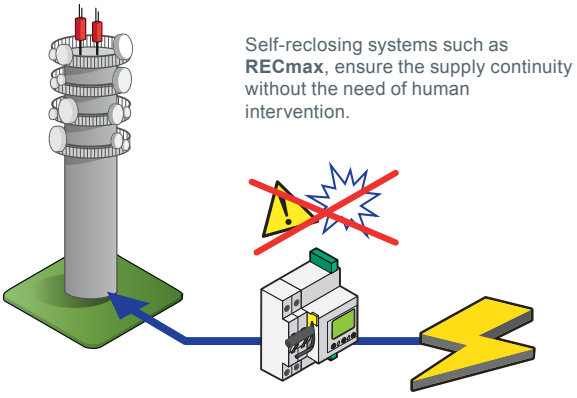
The installation of ultra-immunised earth leakage relays guarantees correct actuation of the protections, which avoids possible unwanted tripping caused by malfunctions. Furthermore, the existence of devices with DC supply, such as UPS's, requires the installation of **type B earth leakage relays** to monitor and protect the installation. **Type B** devices ensure the correct operation when there is a leakage current because they are specially designed to actuate when there is any fault with DC and AC component.
In turn, the self-reclosing system ensures supply continuity during a temporary fault, without the need for external intervention.

It should be pointed out that those devices must be equipped with communications capacity for carrying out actions via remote control, monitoring the status of the protections on real time and acting accordingly when necessary for maintenance or prevention.

Installing control devices for the external beacons, such as **TB-3**, is recommended as an additional element. These are designed to activate a burnt-out light alarm and can be integrated in management and control system.



Ensuring supply continuity is the most critical aspect in these types of installations.



Self-reclosing systems such as **RECmax**, ensure the supply continuity without the need of human intervention.

RECmax

Earth leakage circuit breaker with self-reclosing system and display (LCD)

The **RECmax LPd** connected to the **WGC / WGS** toroidal transformers ensure earth leakage and circuit breaker protection with self-reclosing after an earth leakage, overload or short-circuit trip.

It is a good solution for those infrastructures that are hard to control and monitor because of their location in the following control boards:

- Phone systems
- DTT systems
- IT systems, UPS

Type B

Full range of Type B earth leakage protection and monitoring devices

CIRCUTOR's range of **Type B** earth leakage protection units covers all the protection levels in your installation.

WGC-TB

Type B protection transformers

RGU-10B

Electronic earth leakage current protection and monitoring relay

WGB-35-TB

Transformer with built-in Type B earth leakage relay

IDB-4

Type B RCCB, instantaneous 30 mA and 300 mA

❷ Energy efficiency management

Every system aimed at electrical energy efficiency has to be equipped with devices that can log the electrical magnitudes in order to determine where and how energy is consumed. An analysis is done after said data is gathered to detect inefficiencies and take very specific corrective actions to achieve a higher energy efficiency.

Using **CVM**, electrical power analyzers, makes possible logging, monitoring and the management of electrical consumption and magnitudes in different centres.

For correct management, the measurements must be segmented for measuring at the installation mains and directly on the loads or units.

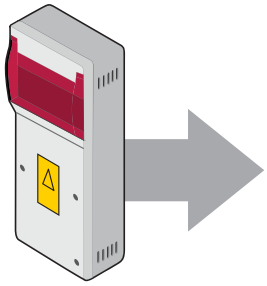
• Mains monitoring

Monitoring the consumption at the main will log how much energy the centre consumes and **whether the contracted power with the utility is adjusted to real usage or not.** Consequently, the possibility of reducing the contracted power is the first piece of data to be assessed.

Another important advantage is that **self-billing** is possible because real-time energy data is always available, and so the manager can **anticipate receipt of the official invoice** of the utility. Thanks to this, the accounting department will be able to **accurately estimate payments.**

The **reactive energy penalties** cannot be ignored, as they may notably increase the electricity bill. This is why analyzers are a basic element for detecting the **need for a capacitor bank installation to avoid unexpected penalties** in the monthly bill.

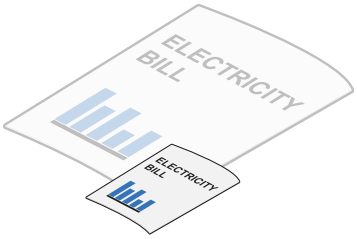
Installing an **Optim P&P (Plug&Play) series** capacitor bank will avoid reactive energy penalties in the centre, which will lower the electricity bill.



Capacitor bank **Optim P&P**

Savings

on the electricity bill as a result of power factor correction



• Monitoring the units

In general, it is possible to estimate 100% of the total energy consumed in stations or data processing centres, 60% of which would be electricity consumed by infrastructure and the remaining 40% by cooling.

• Cooling

This shows that controlling cooling has an extremely important effect on the electricity bill. Temperature and humidity sensors have to be installed for correct management of the air conditioning systems, so as to be able to activate the fan and air-conditioning system.

The key is using the digital outputs of the **CIRCUTOR** electrical power analyzers **CVM** or **EDS** energy managers, depending on the environmental features, for activating/deactivating the fans. When management with fans does not suffice, the air-conditioning systems must be activated until the programmed setpoint is reached. This efficient and rational use of cooling systems enables important savings in this environment which, as we mentioned, makes up 40% of the total.

• Lighting

A global vision of the system cannot overlook lighting consumption management. The analysis of these consumptions is important to be able to estimate future energy savings that could be achieved by changing over to more efficient lighting systems. Historical data can be used for comparing energy savings in each centre based on the type of lighting system installed.

• IT devices

We can calculate the energy efficiency of any production system by comparing the useful energy with the total energy needed by the system. With this information and knowing where the inefficiencies are, we can achieve substantial savings and more environmentally-friendly operations.

The energy factor is so critical in data processing centres that it has its own indicator: the **Power Usage Effectiveness (PUE)** defined by the Standard issued by **The Green Grid**, a global environmental agency comprised of over 175 internationally renowned companies.

The **European Commission** also has a code of conduct for reducing the impact of data centres' growing energy consumption.

→

The Commission has established the specific formula for calculating the PUE:

$$PUE = \frac{\text{Total energy supplied}}{\text{Energy for IT equipment}}$$

Moreover, the Environmental Protection Agency of the United States (EPA) provides the following **PUE values as a reference**:

•History log 2.0
•Current trend 1.9
•Optimised operations 1.7
•Best practices 1.3
•State-of-the-art 1.2

Therefore, one of the keys to success in an energy improvement project lies in measuring the consumption of each device (air conditioning, communication units, UPS power supply, lighting, temperature, etc.) with electrical power analyzers **CVM**, in order to take appropriate action and achieve a higher performance.

Companies like Google have gotten the average PUE of their DPCs down to 1.22, and sometimes as low as 1.15.

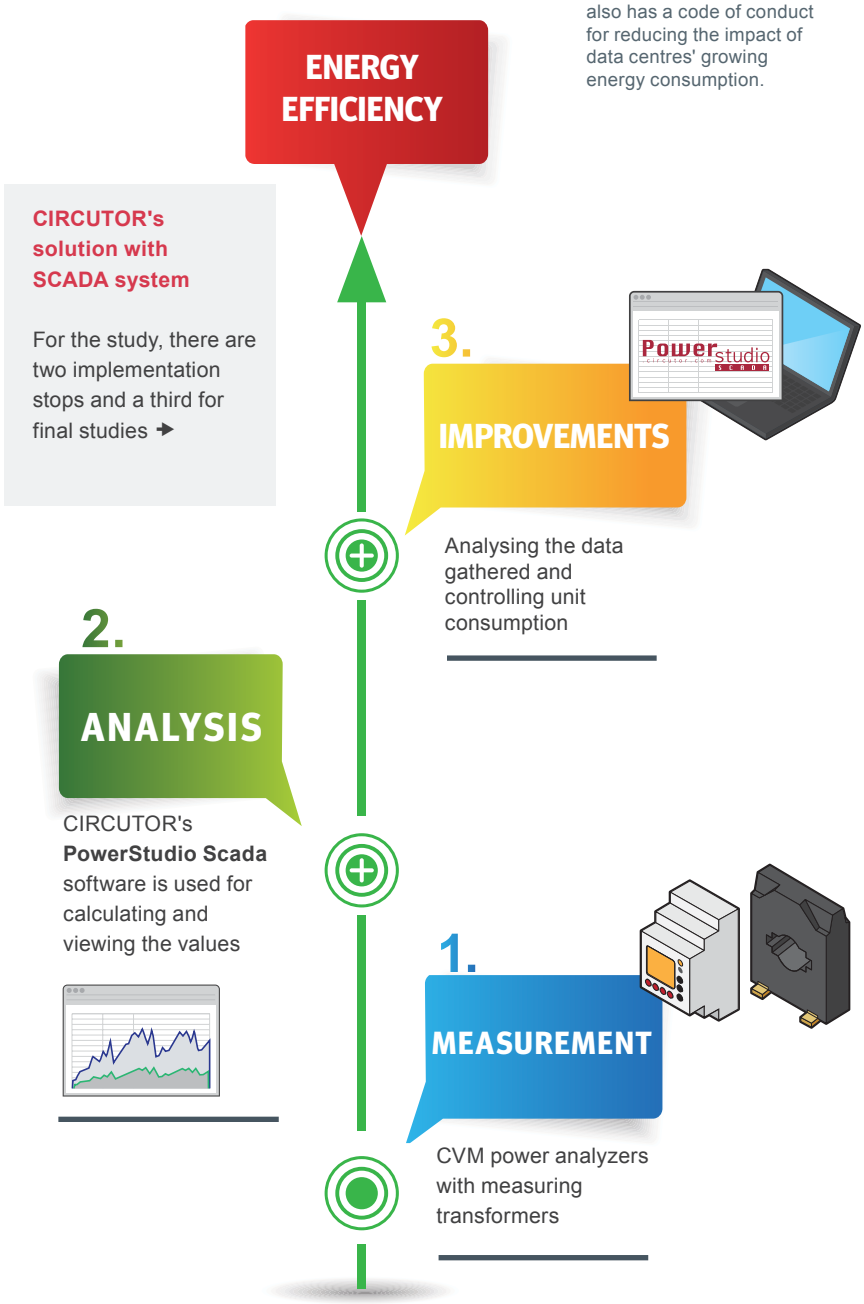
❸ Alarm management

Any time there is an alarm in a centre or station, it may involve the intervention by maintenance staff. There has to be a fast, safe and effective alarm system to be able to react on time and minimise operating costs. Telecommunications companies usually have their own alarm systems that send alerts via **SNMP** messages (Simple Network Management Protocol), which means that any system management has to be able to send different programmed alarms directly to the server.

The energy data server **EDS**, responsible of managing the devices installed in the centre, will automatically send any alarm to the telecom SNMP main server. So immediately, the device will perform the appropriate action to mitigate the impact, whether acting directly or via remote management.

CODE OF CONDUCT DATA CENTRES

The European Commission also has a code of conduct for reducing the impact of data centres' growing energy consumption.



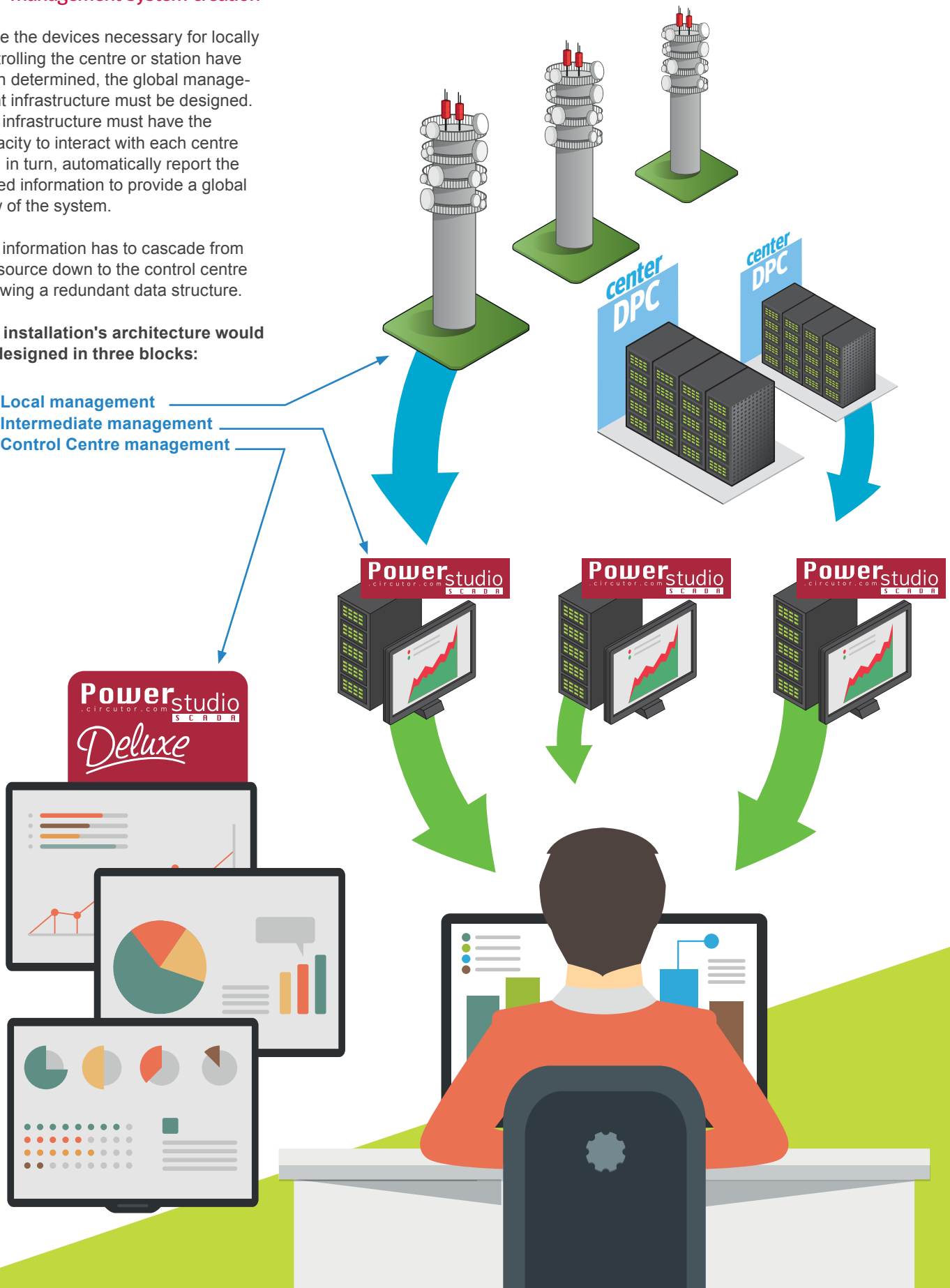
❹ Management system creation

Once the devices necessary for locally controlling the centre or station have been determined, the global management infrastructure must be designed. The infrastructure must have the capacity to interact with each centre and, in turn, automatically report the stored information to provide a global view of the system.

The information has to cascade from the source down to the control centre following a redundant data structure.

The installation's architecture would be designed in three blocks:

❶ **Local management**
❷ **Intermediate management**
❸ **Control Centre management**

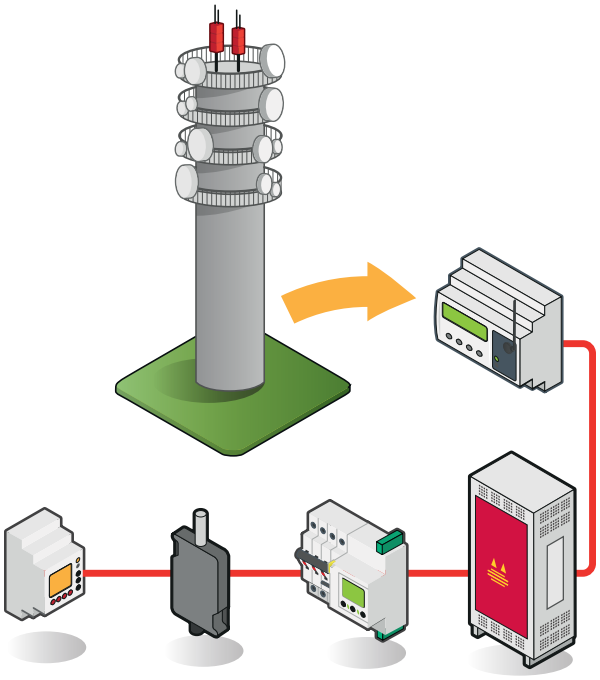


❶ Local management

As explained in the previous points, different types of devices need to be chosen in order to achieve higher effectiveness in the electric energy management environment. Once the units have been chosen, they have to be connected to an energy manager equipped with communications and a database, such as the **CIRCUTOR** Efficiency data server (**EDS**).

The **EDS** device uses Scada software for monitoring and storing in real time the different devices variables, and for the management of inputs/outputs for controlling the station. It also uses Ethernet or 3G communications (depending on the model) for connecting to an intermediate management system.

It should be noted that the **EDS** has the capacity to manage any alarm that appears in the centre, sending messages via SNMP to the telecommunications company's central control server.



Local management system
Different types of devices must be selected, previously, to achieve the energy improvement

EDS

Real-time management and control of associated units by creating a database and communicating with an higher system.

Power analyzers

Control electric energy consumption

Temperature and humidity sensors

Control the centre's heating and air conditioning variables

Earth leakage protection and reclosing system units

Ensure continuity of the electric supply

Capacitor banks

Avoid charges for reactive energy consumption

❷ Intermediate management

Data transmission and treatment is one of the most important aspects that need to be defined. For the system to work properly, each centre or station has to be able to connect to a higher system with the capacity to centralise the control of the different centres. This system automatically requests all the data stored in the **EDS** managers, and also displays/manages the status of each device.

To do so, each local centre sends data to an intermediate server with **PowerStudio Scada** energy analysis software installed for centralising the control of each associated local centre.

The **PowerStudio Scada** platform receives and stores all the regional information and subsequently sends it to the management system in the control centre. Therefore, a large amount of information is sectored without saturating the central server,

which makes subsequent management more efficient whilst ensuring data redundancy, as the data is stored in the **EDS** manager and the **PowerStudio Scada** system.

The associated devices in each centre or station can be remotely configured, controlled and monitored using the Scada application.

❸ Management Control Centre

Managing the entire communications infrastructure must be handled from a central server to obtain a global vision of the installations.

This requires installing a server that uses the **PowerStudio Scada Deluxe** platform. This global platform will add the different **PowerStudio Scada** installed in intermediate management sites so that it can feed from their databases and centralise the management of the entire infrastructure.

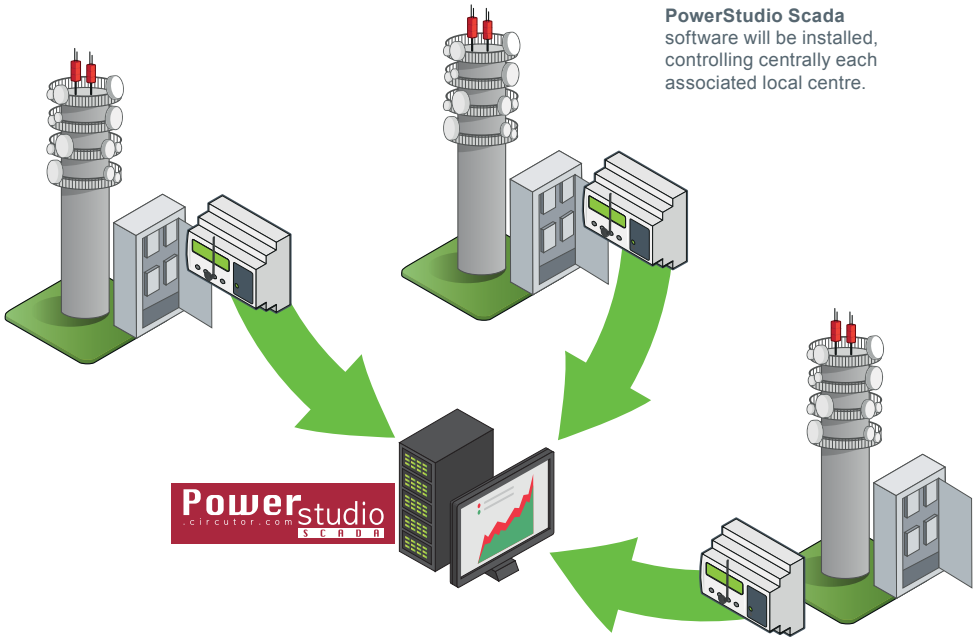
In other words, the central application will be able to see the different intermediate servers, which in turn will allow the display and control of the local system controlled by different **EDS**' with their own management and control devices.

After the central platform has been set up, data will be saved automatically in its server, and the entire database can be transmitted to other systems that are already installed. The application enables sending data directly from SQL, web service, XML (using a conversion module for this format).

As mentioned above, the **EDS** units will also be able send alarms directly to the telecommunication company's central alarm server via SNMP, perfectly integrating these devices in the existing infrastructure.

Intermediate management system

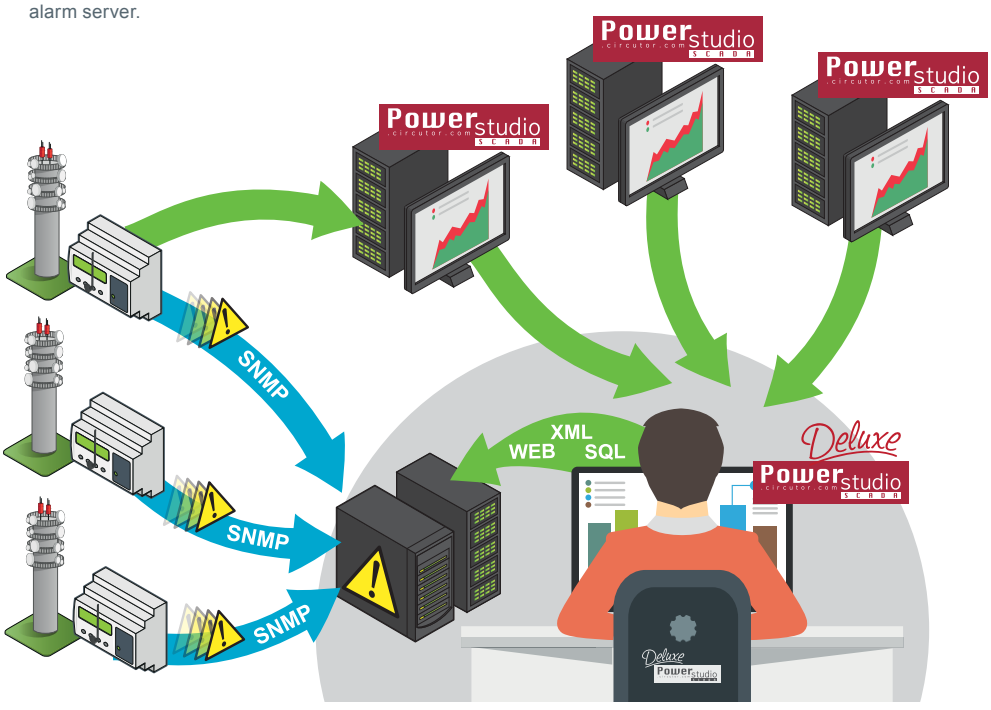
Each local centre/station will send the data to an intermediate server where **PowerStudio Scada** software will be installed, controlling centrally each associated local centre.



Control centre architecturel

The application allows to directly serve data in SQL format, XML or via web service.

EDS devices will automatically send all the alarms via SNMP to the telecommunication main alarm server.



PowerStudio Scada is the energy management software from CIRCUTOR

PowerStudio Scada
For the INTERMEDIATE CENTRES control

PowerStudio .circutor.com SCADA

- Real-time display of variables
- Creation of databases
- Graphical representation
- Representation with data tables
- Creation of SCADA screens
- Creation of personalised reports
- Sending and reporting alarms (incidents)
- XML server
- Exporting data (.txt, and .cvs)

PowerStudio Scada DELUXE
for the management from the main CONTROL CENTRE

PowerStudio .circutor.com SCADA Deluxe

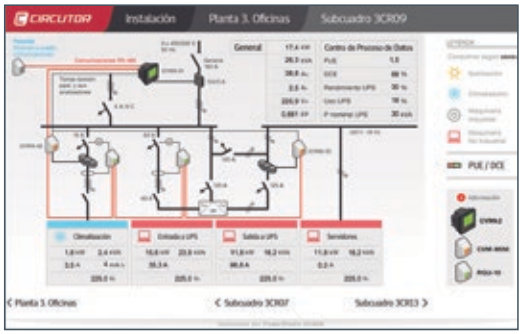
Power Studio Scada Deluxe + :

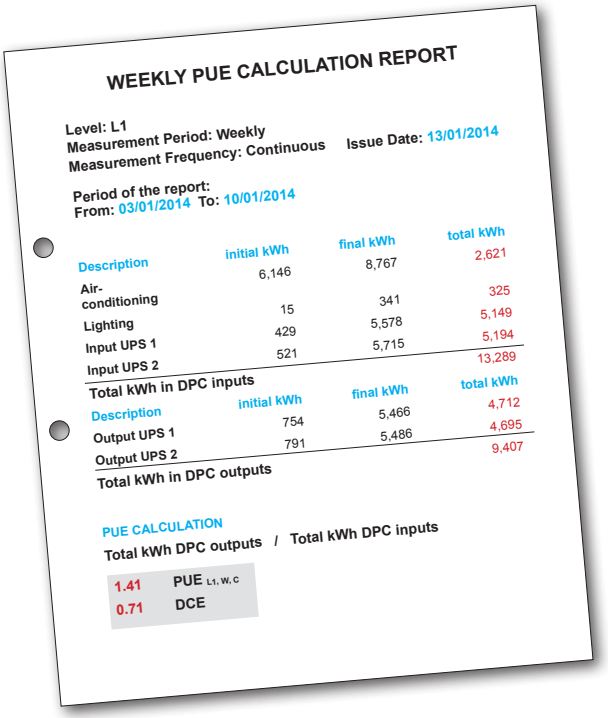
- Modbus generic driver (can be used to add any unit in the market with the Modbus protocol)
- OPC Client (Serves data to OPC systems)
- Multipoint PSS (Adds other PSS to a single control and management system)

SQL DATA EXPORT

- Converts the database to SQL and automatically exports it to third-party systems

Application examples of the Scada PowerStudio/Deluxe software





WEEKLY PUE CALCULATION REPORT

Level: L1
Measurement Period: Weekly
Measurement Frequency: Continuous
Issue Date: 13/01/2014

Period of the report:
From: 03/01/2014 To: 10/01/2014

Description	initial kWh	final kWh	total kWh
Air-conditioning	6,146	8,767	2,621
Lighting	15	341	325
Input UPS 1	429	5,578	5,149
Input UPS 2	521	5,715	5,194
Total kWh in DPC inputs			13,289

Description	initial kWh	final kWh	total kWh
Output UPS 1	754	5,466	4,712
Output UPS 2	791	5,486	4,695
Total kWh in DPC outputs			9,407

PUE CALCULATION
Total kWh DPC outputs / Total kWh DPC inputs

1.41 PUE L1, W, C
0.71 DCE

Example of the system's global architecture

❶ Local management

EDS + control and management devices.

❷ Intermediate management

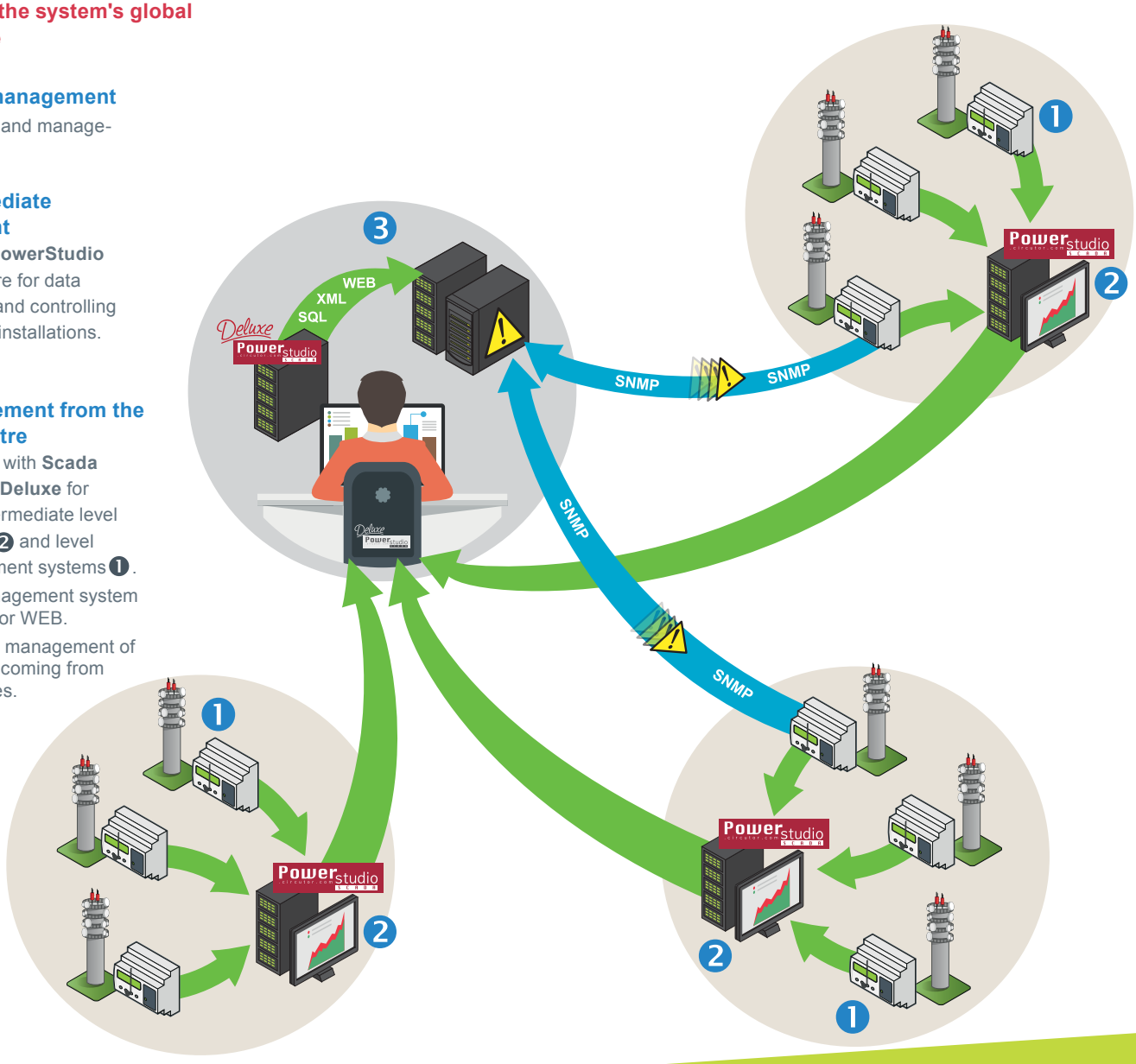
Servers with **PowerStudio Scada** software for data management and controlling level ❶ local installations.

❸ Management from the Control Centre

Central server with **Scada PowerStudio Deluxe** for controlling intermediate level management ❷ and level local management systems ❶.

Database management system for SQL, XML or WEB.

System for the management of SNMP alarms coming from ❶ **EDS** devices.



Conclusions

As a company specialised in the energy efficiency sector, **CIRCUTOR** provides telecommunications companies the architecture they need for the management and control of all their centres or stations, and offers a large portfolio of devices, ALL of them dedicated to improving energy efficiency.

Summarizing, with the installation of the proposed system, telecommunications companies will be able to improve the following areas:

- **Security in supply continuity.**
- **Correct management and reduced consumption of cooling systems.**
- **Reduced electrical costs through measurements and preventive actions of the different loads.**
- **Reduced electricity costs through power factor correction.**
- **Improved power usage effectiveness (PUE) indicator, adapted to the levels recommended by the European Commission.**
- **Critical alarm control.**
- **Self-billing to be able to anticipate receipt of the utility bill**
- **Global and centralised management of the communication infrastructures (remote stations or data processing centres).**