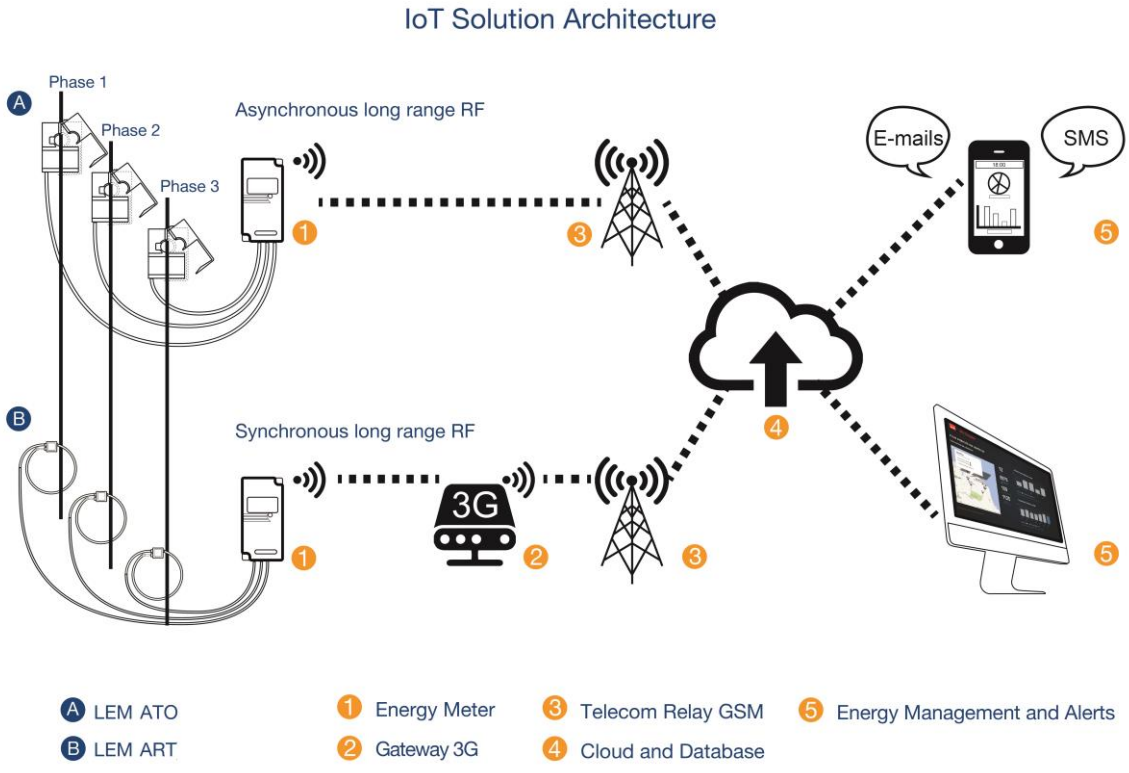
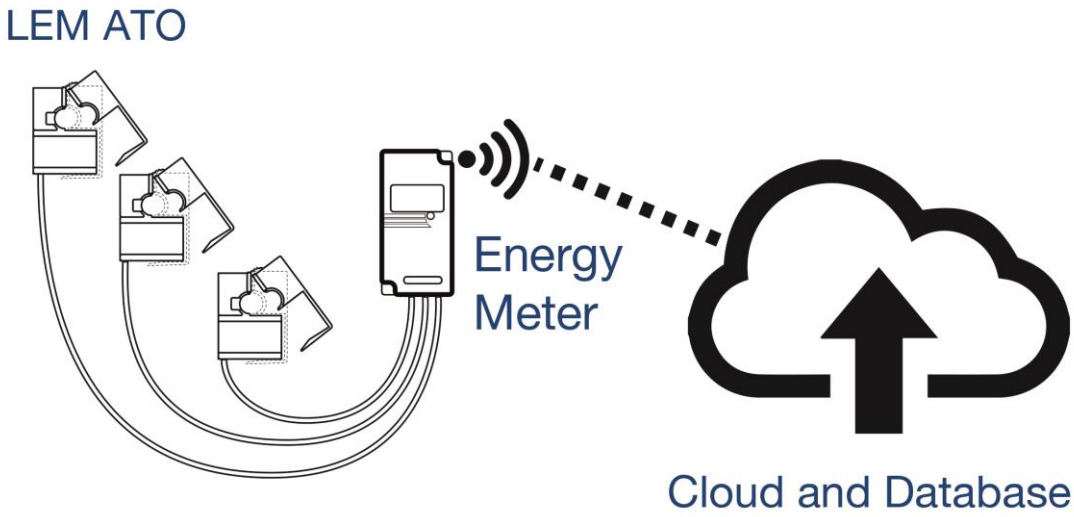
IoT remote energy monitoring using LEM Split-Core CT (ATO) following the IEC 61869-2 Smart Grid standard

IoT Remote Energy Monitoring for the Smart Grid

IoT is perfectly suited for smart grid roll-out, thanks to the long range requirements and the small data size needed for transmission. Using narrow-band RF, the standard for long-range communication, an innovative remote energy monitoring solution is now possible. The solution consists of wireless energy meters for the remote monitoring of electrical equipment with hardware, M2M connectivity (LORA, SIGFOX, 3G/GPRS…) and web services to manage the collected data (history, alerts, graphs, statistics, etc.). This IoT solution simplifies the implementation of the network and installation by the end-user, reduces infrastructure costs (no repeaters) and is typically compatible with existing solutions. This approach is ideal for IoT due to the small power payload, the long range requirements and the small data size needed for transmission. The IoT star network configuration is typical for smart grid deployment.



Remote Energy Monitoring



The typical application for energy monitoring is to identify energy consumption balance and overconsumption analysis to pin point the areas to repair. Each wireless energy meter (1), using LEM ATO (A) or LEM ART(B), is connected to the RF long range internet (2) and transmits (3) maintenance data to a secure web server (4). End-users can follow equipment usage remotely (cycles, working time, consumption, etc.) or receive alerts when an anomaly is detected, such as loss of power or power peaks (5). The typical devices that have their energy measured are items with electrical motors, ventilators, pumps and compressors. The advantages of this solution are the simplicity of installation of the LEM ATO or LEM ART, the connection over the internet, the real time measurements and the autonomy of the energy meter. The operating mode is RMS current acquisition of 1s every 10s and sends current consumption statistics every 10 minutes or 15.

The advantages of IoT based Remote Energy Monitoring are:

- No need for deploying a local network infrastructure
- Outdoor and indoor equipment monitoring
- Wide area coverage
- Very low energy consumption resulting in long lasting autonomous energy meters
- Affordable and deployable with LEM ATO or LEM ART sensors

LEM ATO following IEC 61869-2

Split-core current transformers are not new, but conventional technologies used in these transformers have presented numerous shortcomings - among these were solutions using either expensive materials or providing poor performance. In this case, inaccuracy refers not to the readings themselves, but to the linearity, the sustainability of a reading over time and the accuracy of the current compared to the voltage (phase shift). The new Smart Grid IEC 61869-2 standard requires both accuracy AND phase shift to be within Class 1.

The LEM split-core current transformer “ATO” with Ferrite dramatically improves the magnetic permeability enabling such transformers to have high accuracy and excellent linearity even at very low current levels following IEC 61869-2. The hardness of the solid material (consider Ferrite as a ceramic) allows very fine machining, providing air gaps down to a few microns that are stable over many years. Laminated materials such as FeSi or FeNi do not allow air gaps smaller than 20 or 30 microns, and these are more sensitive to ageing and temperature changes. Add the small air gaps to the better linearity of the Ferrite at low magnetic excitation (i.e. for low current), and the Ferrite offers a better performance than FeNi-80%, and at a lower cost.

Name	LEM ATO	LEM ART
Type	Split-Core Current Transformer	Flexible Rogowski Coil
Range	10-125A	10-10000A
Material	Ferrite	Winding (no magnetic core)
IEC class	Class 1 and 3	Class 0.5
Output	Inst Ma (1:1000), 225-333mV	22.5mV/kA
Diameter	10-16mm	35, 70, 125, 175, 200, 300 mm
IP class	IP 30	IP 57

Conclusion

IoT based remote energy monitoring has an average amortization period of less than one year. Maintenance operators spend 30% of their work time on the road and any repair needs usually two to three trips, so this LEM solution saves time. Some sites or plant equipment are difficult to access (waste of time and risk to the operator) and there is no way to add solid core transformers without a costly shut-down of the system. The LEM contactless split-core self-powered current transformer ATO can simply be snapped over a cable, without the need to screw or weld on complex brackets, making installation and maintenance straightforward.

The IoT set-up combined with the IEC Smart Grid LEM ATO allows for immediate retrofitting of high-performance and cost-effective remote monitoring, energy metering and facility supervision systems.

About LEM

LEM is the market leader in providing innovative and high quality solutions for measuring electrical parameters for a broad range of applications. LEM City answers the demand for an accurate, reliable and easy-to-install energy sensor for future Smart Cities.

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