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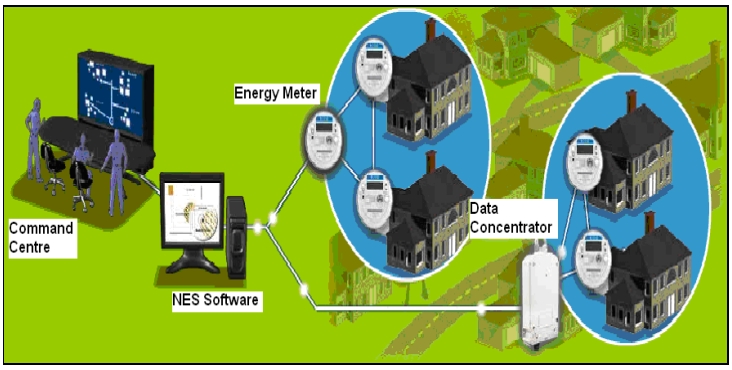
TECHNICAL PROPOSAL



Computerized Smart Electricity Meters

"المقاييس الكهربائية الذكية المحوسبة"

شركة روافد للتكنولوجيا (ذ.م.م): ص.ب. ٤١٨٤٩ أبو ظبي – الإمارات العربية المتحدة
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15-01-2009

"المقاييس الكهربائية الذكية المحوسبة"

منذ إكتشاف أهميتها، كانت الكهرباء ضرورة جوهرية لإي تطور متمدن. وأصبحت الآن جزءاً حتميا لأي ملكية سكنية، تجارية، أو صناعية. ولتنظيم علاقة المنتج والمستهلك تكون المقاييس واحدة من الأصول الواجب تواجدها بنوعية ودقة يعول عليهما بشكل غير قابل للتغيير.

ولقد تطورت تكنولوجيا المقاييس من النوع الميكانيكي (التقليدي) الذي يحسب فقط ما إستهلك من الطاقة الكهربائية ويتطلب موظفين مختصين للتجوال والتنقل من أجل تسجيل قراءات مقاييس المستهلكين وتقديمها إلى جهة المنتج، إلى نوع آخر مؤتمم (AMR) لا يتطلب دخول القارئ/المسجل إلى مكان تواجد أجهزة المقاييس، ويكون التسجيل بصورة تراسلية (عن قرب) بين أجهزة مستقبلة يحملها القارئ (في سيارته مثلا) ومرسلات مثبتة مع المقاييس، وبعد نقل قراءات المقاييس إلى تلك الأجهزة، تنقل الأجهزة إلى دائرة المنتج ويتم نسخها في جهاز حاسوب ينضم باقي العملية نحو إصدار القوائم (المحاسبية) إلى جهة المستهلك. ورغم ما ينسب لهذه التقنية من تقدم في السنوات الأخيرة، فإنها بدأت تتراجع أمام تقنية جديدة تستخدم مقاييس من نوع آخر هي المشار لها بعنوان المقترح المرفق.

إن منظومة المقاييس الذكية هي منظومة خدمية للطاقة، متميزة بصفة التشبيك المحوسب (NES) والتي تعرف أيضا بمنظومة المقاييس المؤتممة بالبنية التحتية (AMI) والتي تضمن إستخدام شبكات الحواسيب من أجل التكامل العملي مع عمل المقاييس دون تدخل لمصدر بشري (عدا المراقبة والتحكم). إن هذا النظام الحديث من المقاييس يمكنه إن يحدد مقادير الإستهلاك بتفاصيل أكثر إضافة إلى تراسله الضمني (عبر خطوط الطاقة الكهربائية) وتراسلات تقنيات الحواسيب (Ethernet, GPRS, GSM) الأنترنتية مع غرفة السيطرة المركزية (لدى سلطة الكهرباء المنتجة للطاقة) ثم المستهلك (e.g., by Email or SMS) لإشعاره بمقدار إستهلاكه أو أي أمر آخر. ومن مواصفات المنظومة الأخرى إضافة للقراءة المؤتممة حاسوبيا كما ذكر أعلاه: تحديد كلف/أسعار مختلفة لفترات الإستهلاك أوتحديد مقدار الطاقة القصوى المسموح بإستخدامها باليوم أو بالشهر مثلا (لترشيد الإستهلاك)، إكتشاف السرقة أو العبث، عدم السماح بفصل المقياس وإعادة توصيله، التعرف على التقادم في أجزاء الشبكة الكهربائية والتسربات فيها، القراءة الآنية، مراقبة النوعية وقياس عوامل الطاقة الكهربائية (Parameters) لموازنة الحمل، تصور إستباقي عن حاجة كل مستهلك، برمجة القطوعات المناطقية، تحديد نوعية التجهيز أو قطعه عن بعد، سهولة التركيب، ومعرفة مدة إستخدام المقياس ودورات إستخدام المستهلك. ولحالة تطبيق عملية يرجى الإطلاع على الملحق المرفق آخر هذا المقترح.

إن كلفة إمتلاك وتركيب وتطبيق المنظومة (التي لا تحتاج إلى تسليك خاص) لا تتعدى بضع مئات من الدولارات لكل موقع وإن مردودها المالي مسترد في فترة قصيرة وهي تطبيق مستقبلي أكتملت تطبيقاته في عدة دول متقدمة (كالولايات المتحدة واقطار أوربا). وترحب روافد للتكنولوجيا بأي إتصال أو إستفسار حول توفير وتركيب هذه التكنولوجيا.

للإطلاع على المقترحات الأخرى لشركة روافد للتكنولوجيا: تصفح الموقع الألكتروني

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1. Introduction:

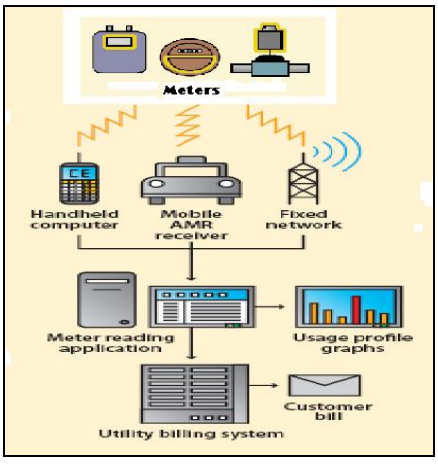
Since its important discovery, electricity has been always one of the fundamental requirements for any modern civilization and its development. It is now at the heart of any property, whether it is residential, commercial, or industrial. For many decades, studies in the field of electrical energy used to concentrate on electricity generation, power transmission, line loses etc. Nevertheless, in all generations of electrical power technologies, no significant changes in electrical energy meters were remarked. It is used to be the very basic and traditional meter either in its shape or functionality and it had nothing to do as a part of the system except electrical energy consumption calculation.

A power grid is usually thought of as the electricity distribution infrastructure that's owned and operated by the electrical authorities: generation plants, transmission and distribution infrastructure, and meters. Adding intelligence and communications to these assets can make electrical utilities more efficient, reduce their cost of operations, increase the quality of service they deliver, and improve system reliability.

For further understanding of this technology, a case study for a private application is included in the appendix that follows the last section of this proposal.

2. Automated Meter Reading (AMR) System:

Meters are supplier authorities' most important asset: They must provide uncompromising quality, accuracy, and reliability. Therefore moving from conventional meter system that requires human reader to attend the locations of meter installations at homes or buildings (where the customers' consumption are recorded), up to the Automated Meter Reading (AMR) was considered a major advanced step, since data collection became more efficient. AMR refers to the technology used for automating collection of energy consumption data for the purposes of real-time billing and consumption analysis. At any given time, the AMR system gathers real-time data and transfers the information gathered to a handheld device and later, the collected data is downloaded to the office PC.



The primary benefit of this technology is more accurate and precise measurement of energy consumption. Consumers will be billed the amount that exactly corresponds to what they have consumed. On the other hand manpower and resources are still needed in meter reading and data gathering.

AMR operations are simple on the surface but rather complex underneath. First, the meter must be read by the meter interface. After that, this same interface has to translate the data into digital information to facilitate transmission, and then collected data is downloaded in the office. There must also be a code added to the meter data reading so that the data can be attributed to the correct subscriber.

An AMR system has a meter interface apparatus. This is generally an integrated component containing power supply, sensors, control electronics, and communications programming. At its heart, the AMR meter interface module aims to translate data gathered from the movement of mechanical dials into digital data as well as to properly identify data for the purposes of correct billing.

An AMR system also has a transmission and communication protocol in place for transferring or transmitting data from the meter to the central office. Among the systems developed for AMR are handheld devices (authority personnel merely have to touch or point their stylus to the meter interface for data to be 'read') or vehicle-mounted devices (the meter readers need to pass by the meter on such distance for data to be picked up and received). Data is temporarily stored in the receiving device until it's downloaded at the office. Data transmission may also be sent to the office through wires (data is transmitted through Ethernet cables, broadcasting cable, or power lines). Finally, the central office must have the software and hardware for transmitted meter data reception, allocation, analysis and automatic billing.

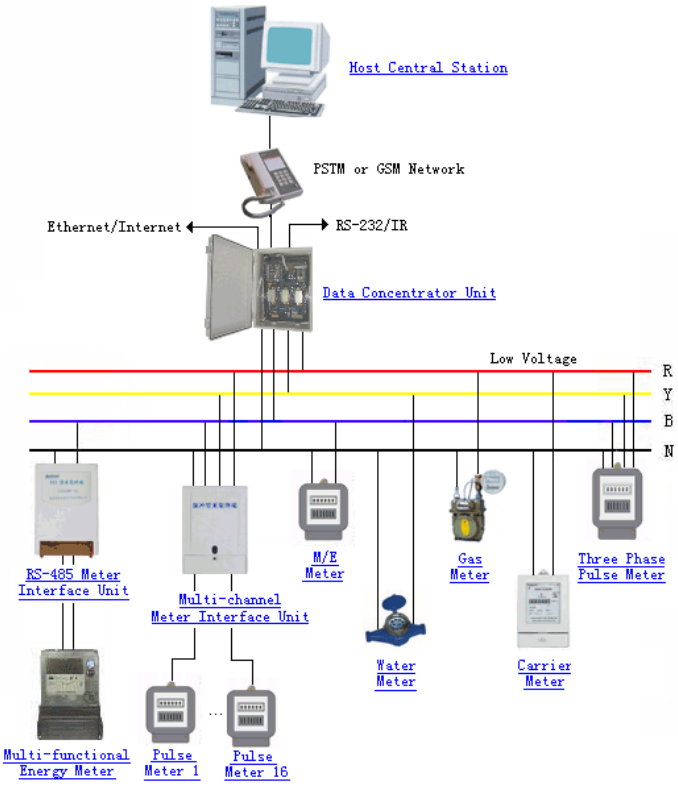
Technological advances have expanded the scope of AMR activities. Examples include monitoring for leaks, theft, and meter tampering, consumer’s consumption profile, and providing empirical data on the effects of energy saving devices.

3. Networked Energy Services (NES) System:

As an advanced and more sophisticated than AMR, recent technology introduced the Networked Energy Services (NES) system, also know Advanced Metering Infrastructure (AMI) that consists of a tightly integrated set of components which provide the infrastructure to deliver networked energy services. The system architecture includes intelligent communicating digital electricity meters, powerful IP-connected data concentrators, and scalable system software.

The NES system is designed to let the authority uses a variety of communications media within electrical system to minimize cost and complexity, in addition to maximize reliability, and ensure security. At the core of this flexibility are data concentrators, which provide the connectivity infrastructure between meters at customer sites and the NES system software at the authority's central office.

Data concentrators communicate with meters over the low-voltage power line network. Communication between data concentrators and the NES system software (which usually resides in the authority's data center) occurs usually over any IP-enabled WAN. The flexible data concentrators can use any convenient WAN technology (such as CDMA, GPRS, GSM, and broadband) i.e., authorities can take advantage of today's diverse range of wide area communication possibilities, as well as new options offered in the future.



The hybrid architecture of the NES system cost-effectively serves a variety of geographic terrains — from densely populated urban and suburban areas to thinly populated distant rural locations — while retaining all of its functionality. The design is intended to replace the methods of gathering data from meters that is old conventional or new AMR way. The introduction of NES system led to the concept of smart meter system.

4. Smart Meter System:

A smart meter is NES technology based, generally refers to a type of advanced meter that identifies consumption in more detail than a conventional meter; and communicates that information via some network, back to the power supply authority for monitoring and billing purposes. Smart meters usually involve a different technology mix.

Smart meters provide an economical way of measuring this information, allowing real-time automatic reading, power outage notification, power quality monitoring, price setting agencies to introduce different prices for consumption based on the time of day and the season. It is believed that billing customers by how much is consumed and at what time of day will force consumers to adjust their consumption habits to be more responsive to market prices. Regulatory and market design agencies hope these "price signals" will delay the construction of additional generation or at least the purchase of energy from higher priced sources thereby controlling the steady and rapid increase of electricity consumption. Other features are mentioned in the following sections.

5. Proposal Objectives:

With the introduction of smart metering, smart systems (in homes, buildings, and cities) are linked with pricing and other information through a modern, advanced metering infrastructure. Therefore, the efficiency of the smart grid becomes apparent:

- Consumers and businesses can intelligently and automatically reduce and manage their load in ways that work best for them.
- Authorities can promote automatic demand response programs that empower their customers to actively participate in energy management.

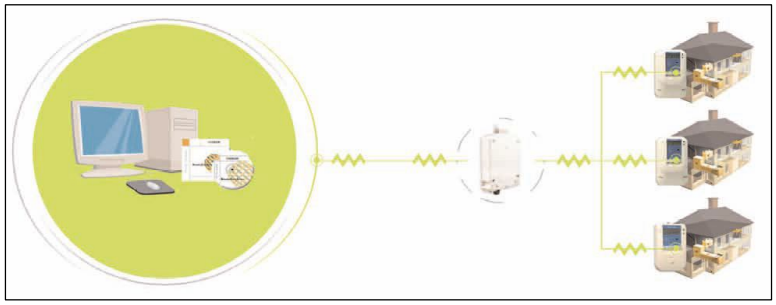
6. Technology Overview and Benefits:

Smart system with NES system offers a number of features and benefits, including:

- Support for multiple tariffs, which automatically adapt for holiday, weekend, and seasonal changes. Extends the use of flexible tariffs (available to commercial accounts) to residential customers, allowing new tariff structures to be remotely downloaded into meters.
- Remotely configurable meter-reading capabilities by time, period, or service area to comply with changing regulations.
- Power quality information — such as power outages, sags, swells, and frequency measurements — which enable predictive repairs and optimizations.
- Extensive load-profiling capabilities to understand customer consumption.
- Real-time scheduled or remote load control to prevent brownouts or blackouts.
- Remote disconnect of main load, for managing vacant or high-turnover premises (such as vacation homes or apartments) without on-site visits.
- Superior tamper and fraud detection, which increase compliance and revenue. The NES system can detect electricity theft and system tampering in real time, providing both incident specific and location based data. Software overrides in the meters prevent customers from reconnecting meters or using too much electricity during peak demand periods.
- Full remote configuration capabilities, which eliminate the need to visit meters to change tariff schedule, display, or load control.
- Standard digital meter installation — no special skills or tools required.
- Measures active power, active energy, reactive power, reactive energy, RMS voltage, RMS current, and power factor. Therefore load-balancing of meters and transformers.
- Time of use metering and custom billing cycles.
- Power quality measurements including outage detection and duration.
- Maximum power limiting to disconnect load when configurable power threshold is exceeded.
- Data concentrators work with the meters to make sure that allocated energy is delivered to its intended destination, protecting from gross line loss and other factors that can reduce revenue.
- Enables complete and very accurate automated scheduled readings for data collection.
- Eliminate costs associated with manually managing service connections.
- Increase customer satisfaction through improved response times.
- Improved energy forecasting and conservation.
- Eliminates re-bills caused by incorrect reads or data entry errors.
- Improves cash flow by reducing read-to-bill turnaround and uncollectible.
- Reduces unnecessary service calls and field investigations through remote monitoring.

7. System Components:

The NES system consists of a tightly integrated set of components that provide the infrastructure to deliver networked energy services. The NES system is designed to let the authority uses a variety of communications media within the system to minimize cost and complexity, and maximize reliability and security.



The NES system components provide the infrastructure to deliver networked energy services. The system architecture includes:

- Intelligent, communicating digital electricity meters.
- Powerful IP-connected data concentrators.
- Scalable system software.

7.1 Intelligent, Communicating Digital Electricity Meter:

The meter is designed to meet:

- Intelligent, fully featured electronic metering with integrated disconnect and information display.
- Time-of-use metering with different classes of tariffs and custom billing cycles.
- Power quality measurements and extensive tamper detection features.

7.2 Powerful IP-Connected Data Concentrator:

At the core of the NES system are data concentrators, which provide the connectivity infrastructure between meters at customer sites and the NES system software at the authority's central office.

Data concentrators communicate with meters over the low-voltage power line network. Communication between data concentrators and the NES system software (which usually resides in the authority’s data center) occurs over any IP-enabled WAN.

Data concentrators in general can:

- Manage up to 1,024 NES meters.
- Collect and reports meter data, including consumption and power quality.
- Be installed at any point in the low-voltage network topology, e.g., behind poly-phase, transformer-operated, and single-phase meters, to allow minimal installation costs.
- Communicate with NES system software using any IP-capable network, whether it's wired or wireless, public or private, wide area or local area, including traditional analog telephone service.
- Be equipped with plastic enclosure tested to IP56; weather-proof plastic enclosure optional.

7.3 Scalable System Software:

NES system software can communicate with NES data concentrators and meters to deliver services and events. The software acts as an edge or access server into the NES system. It can:

- Collect and report consumer data, such as consumption, load profiles, power quality, and other events.
- Easily integrates with applications using standards-based design such as XML, .NET, and TCP/IP.
- Enables remote control, remote firmware upgrades, and remote configuration of NES meters and data concentrators.

- Software override in the meters to prevent delinquent customers from reconnecting meters or using too much electricity during pre-pay or peak demand periods.
- Scale from small projects to millions of meters.

8. NES to AMR Comparison:

AMR System:

- One-way and very slow communication.
- Communication modules bolted (retro-fitted) onto or inside meters.
- Provides only meter reading.
- Built-in disconnect switch unavailable or an expensive add-on.
- Parallel infrastructure needed for demand response.
- No value-added services possible.
- Must visit each meter to upgrade software.
- Prepay requires a service call and a meter replacement.
- Post-installation changes require a service call.

The NES System:

- Open, bidirectional, and high-bandwidth communication.
- Meter and communication functionality on one board.
- Extensive range of services.
- Built-in disconnect switch.
- Metering infrastructure delivers demand response.
- Remote upgradeability.
- Economical upgrade path for value-added services.
- Multiple suppliers of NES meters.
- Meter can be remotely converted to a prepay meter.
- Tariffs and load profiles can be remotely changed.

9. Feasibility and Cost Estimation:

While every market has its own unique attributes, most economies worldwide are facing similar challenges of rising costs, disparities between supply and demand, and the need to better modernize the energy infrastructure -- all factors driving utilities to deploy a 'smart grid'. Authorities have begun to look beyond meters as simple cash registers, to making them intelligent nodes in their smart grid network. As a result, there is a growing opportunity for authorities to demonstrate to their customers and the regulators the value and power that the NES system can bring.

Many electrical authorities (e.g., in USA and Europe), are adopting smart meters to cut power bills and unnecessary consumption of power by a considerable percentage, as it is stated in a study of some households released by the U.S. Energy Department. Widespread adoption of the systems would save $70 billions in costs for new power plants and lines over 20 years, in the USA. It is estimated that the number of smart meters installed in North America rose 26 percent last year to 15.8 millions, which will surge to 61 millions by 2013.

It was found that cost of installing a poly phase NES system with its complete components for homes and small business metering does not go beyond few hundreds of US$ (e.g. if $250 for each location the result would be $250,000 for 1000 locations). This amount is back payable in a short term and could be proved a rewarding future investment for consumers and for electrical authorities.

10. Summary:

The NES advanced metering system consists of a family of highly integrated, advanced electronic electricity meters accessed via a web services based network operating system over an IP networking infrastructure. Unlike systems with a dedicated radio per metering point, multiple NES meters can share a single IP connection through the use of power line networking technology. This drives down the per-point connection cost and enables the system to easily and cost-effectively incorporate new wide area networking technologies over the life of the system. The system's open interfaces allow the system to be cost-effectively expanded, adapted, and customized in ways unlike any competing system.

Smart meters offer the industry's best value for a digital communicating meter, turning each metering point into a wealth of readily available information that can be used not only to generate bills but also to monitor network health, reduce or eliminate on-site visits, improve customer service, and optimize the distribution network.

Since NES system provides a complete, always-on, two-way network, each meter is remotely accessible at any time for both data reading and, with proper authorization, remote configuration and control. Because these meters have no serviceable parts, they may never need to send personnel to the field again to service them after installed.

The NES system's powerful web services based network operating system provides a cost effective standards-based platform for enterprise applications and integration that enables applications to be quickly and cost-effectively deployed. Open interfaces within NES meters enable a market for third-party add-ons that can expand and enhance the functionality of the meters, much as open interfaces in personal computers have lead to an explosion of plug-in and external devices that transform the functionality of PCs.

It will be clear to realize that this system can be modified or even simplified to match other similar purposes such as water or gas consumption metering. For further information, please contact Rawafid for Technology (R4T). Electronic copy of this proposal is available at R4T web site.

For other R4T Technical Proposals: Browse the web site

Appendix

Case Study For Smart Metering Solution

A1. The Customer:

A Building renting service provider owners in Ajman, UAE approached R4T for Automated Meter Reading system for their building located in Ajman. General description of the building are as detailed below:

Building Location: Ajman.
Type: Residential + Commercial.
Details: 160 Flats + 17 Shops + Service area.

Owners produce electricity to these building using generators and need to know the consumption/usage of electricity by its users (tenants).

A2. Customer Requirements:

Customer is looking to acquire:

a) Automated meter readings.
b) Automatic recording of tenants' electricity consumption and backing up in the system software.
c) Future accessibility to the meters via web services i.e. operating system an IP networking, Internet… etc.
d) Remotely or automatically disconnection of electric supply in case of over dues or non-payment of billed amount.
e) Full remote configuration capabilities that can eliminate the need to visit the site for meter-readings, disconnection on non payments, change in tariffs schedules and for all such things required physical presence of the mankind.
f) E-payment service for the tenants to pay their electric bills by a kiosk machine at present, with keeping the option for online payment in the future.

A4. R4T Solution:

R4T has proposed a below detailed solution that targets the following automated services for the above requirements:

a) Automation of the reading process in electric meters.
b) Real time operations including remote settlements in cutting/resuming power supplying.
c) Elimination of most meter reading costs.

d) Reduction in billing errors.
e) E-Payment System.

A5. Project Scope:

The project scope is divided into different parts:

a) Supply of Smart metering system consisting of Electricity meters, Data Concentrators, Load Management Modules, Relays, Display Units, and Kiosk e-payment Machine.
b) Installation of Electricity Meters, Data Concentrators, Load Management Modules, Relays, Display Units, and Kiosk e-payment Machine.
c) Software configuration for the operation of complete system.
d) Commissioning and Start-up of the system.
e) Maintenance of the system for a period of I year.

A6. Solution Details:

The solution is based on smart solution system, a tightly coupled set of components that work together to provide the core infrastructure for delivering networked energy services to electricity. It consists of a set of intelligent communicating digital electricity meters, powerful IP connected data concentrators, Load Management Modules, Relays, Display Units, Kiosk e-payment Machine, and System Software. Echelon products are the backbone of this smart metering solution.

A6.1 Product BOQ:

ITEM	DESCRIPTION	QTY
Metering Parts		
1.	Electricity Meter Polyphase meter With M-Bus, MEP, 2A Relay, S0 Output	178 Nos.
2.	Data Concentrator	1 No.
3.	Ethernet Terminal Including Mounting Kit, power and serial cable.	1 No.
4.	Load Management Module with M-Bus interface	160 Nos.
5.	Load Management Module with A-Band PL units	23 Nos.
6.	40A Relays Normally open latching contact	214 Nos.
7.		1 No.

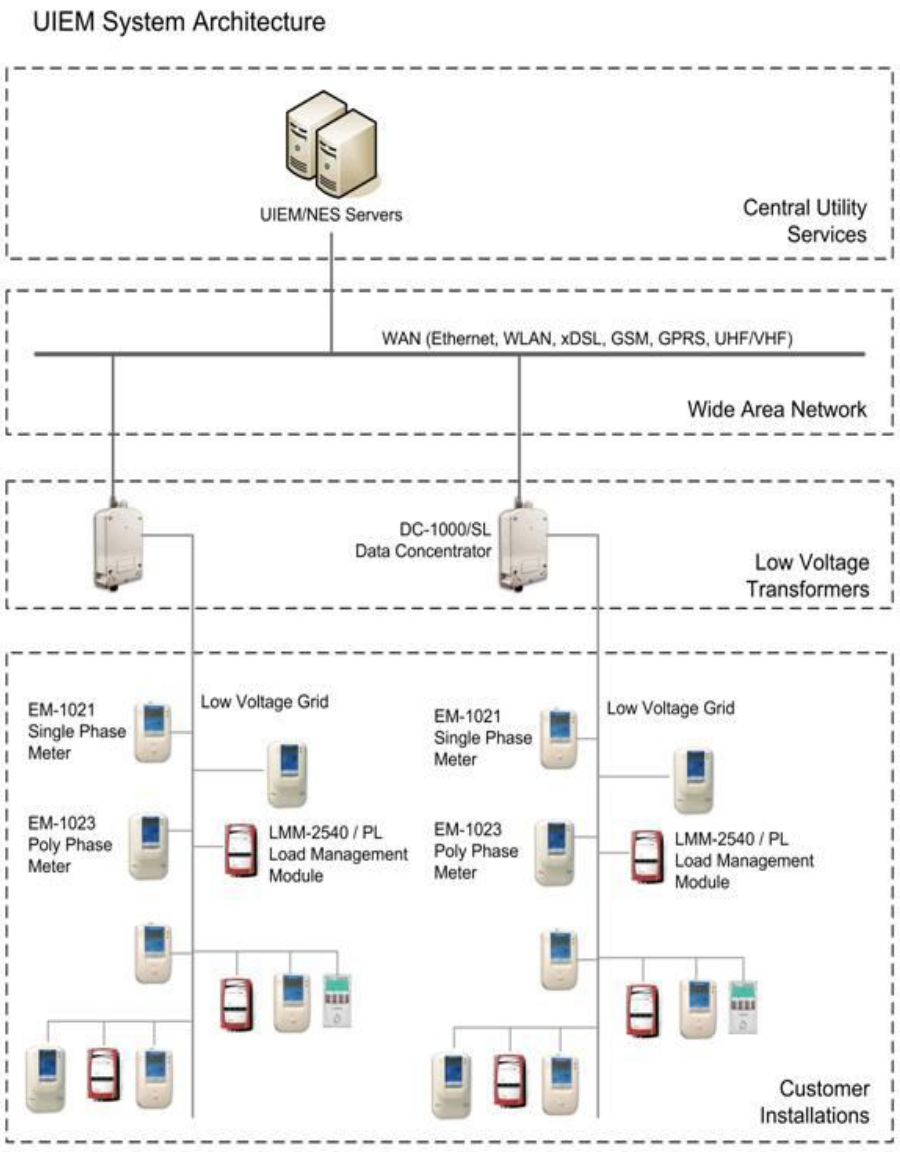
	UIEM Software for Max.800 devices	
E-Payment Parts		
8.	Meter Kiosk Payment collection machine with cash collection (on local currency) and/or credit card reader and token printer	1 No.
9.	Settlements Engine Extension module to UIEM Software suite, Token processing. It can be used for banking interface for online payment service (e.g. Paypal) Hint: Financial services such banking/Paypal not included in this offer.	1 No.
10.	UIEM Extended Support Service One Year Service	1 No.
11.	Display Unit With A-band PLC interface, linked into the e-meter via MEP interface, keypad for token input	178 Nos.

The systems topology configures the meters to be installed in the apartments/shops then connected through Power Line Carrier (PLC) to a data concentrator device that is linked to the PC terminal with Ethernet link. In addition, there are many numbers of load management modules and relays for protection are included.

The operation of the system can be understood as each tenant is required to check his power consumption from a display unit that is installed adjacent to his apartment/shop meter then has to go for a lobby located kiosk e-payment station to pay the required amount in cash to get a printed receipt that has a code number to be fed to the display unit using the display unit keypad. The system uses power line cables for communication except for the Ethernet link between the data concentrator and the PC that requires UTP cable as a medium example. Internet-online payment services were not included in this job, but it is possible to include when configuration arrangements are taken to affect through certain coordination with banks that offer the service of online e-payment. Additional software installation to the UIEM system is not required but further configuration/licensing/modification is must. In either case, the owners have complete control on the system from the workstation PC system.

A6.2 Technical Details:

System Set-up:



The depicted System set-up comprises of four distinct layers:

a) Layer 1: Customer Installations.
b) Layer 2: Low Voltage Transformer Stations.
c) Layer 3: Wide Area Network.
d) Layer 4: Central Utility Services.

Layer 1: Customer Installations

Layer 1 incorporates all components of the System that are usually installed at the tenant sides. These components are:

i) Single Phase Electricity Meters (optional).
ii) Poly Phase Electricity Meters.
iii) Load Management Modules / PL (*Power Line*).
iv) Relays.
v) Display Units.

Layer 2: Low Voltage Transformer Stations

The low voltage transformer stations represent layer 2 of the System Architecture. This layer incorporates following components:

i) Data Concentrators in which can manage up to 1024 electricity meters on customer sides. Communication between concentrators and customer side devices goes on PLC medium.
ii) Communication equipment that is used to connect the data concentrator to a Wide Area Network (e.g. GSM/GPRS terminals, Ethernet terminals, UHF/VHF modems,). Communication may go on UTP lines as medium example.

Layer 3: Wide Area Network

This layer specifies all communication paths that may exist between a transformer station (in particular the Data Concentrator) and the central utility service and covers Ethernet or optional UHF/VHF radio links, GSM/GPRS links, etc.

Layer 4: Central Utility Services

Layer 4 incorporates the UIEM Control Center which operates the UIEM Software Suite.

A7. System Components:

A7.1 Echelon Electricity Meter

Poly phase meter (Single Phase and Current Transformer Meters can also be used) permits reading of energy consumption at customer installation and low voltage transformer stations.

The electricity meter is equipped with a Module Expansion Port (MEP) that allows installation of a so called Local Operation Network (LON) module. The LON module permits transfer of meter data and control information to distant Home Displays and

Load Management Modules (The LMM serves as Appliance Control Units) on basis of the well established and open LON protocol from Echelon Corporation. This protocol allows for peer-to-peer communication and it also supports a very simple installation in the field. Another advantage belongs to the communication distance between the different components which is about several hundred meters. Since the communication itself is realized over the low voltage grid no additional cables need to be installed.

Furthermore, it also possible to provide a so called Wireless M-Bus Bridge (WMB-868) which permits wireless reading of water, gas, heat and cooling meters on basis of the EN 13757-4 protocol. Telegrams received by the WMB-868 are transferred to the electricity meter via the M-Bus interface.

A7.2 Load Management Module (LMM)

Used for street lighting as well as replacement of conventional ripple control receivers. Different versions of the LMM are offered:

i) Integrated M-Bus interface: allows for connecting the Load Management Module to the electricity meter directly.
ii) Power line interface: Load Management Module can be operated independent of metering infrastructure.

Load-Management Modules may be either equipped with a LON interface or a PLC interface. When equipped with a LON interface, the Load-Management Module must be linked with the electricity meter.

When equipped with a PLC interface, the Load-Management Module may be used without an electricity meter. In that case, the Load-Management Module may be directly controlled via data concentrators. This solution is intended for situations where the AMM/AMR-infrastructure differs from the appliance installation (e.g. control of not metered applications, such as outside lightning, HVAC for lobbies/stair rooms, etc.).

A7.3 Echelon Data Concentrator

Used for reading and configuring of electricity meters and load management modules via the low voltage power grid. A data concentrator manages up to 1024 meters and load management modules.

A7.4 UIEM Control Center

Used to operate the UIEM Solution. UIEM defines a series of server roles that have to be mapped to the IT infrastructure of a central utility service. This approach supports full scalability which allows for running the overall system on one physical server supporting several hundred UIEM-devices or by using several different physical servers to handle several 100k UIEM-devices.

A8. Minimum system requirements for operating the UIEM Software

A8.1 Software Requirements

Windows Server 2008 (Standard or Enterprise Version), Service Pack 1, U.S. English, 32 Bit.
Microsoft SQL Server 2005 (Standard Edition or Enterprise Edition), Service Pack 3, U.S. English.
Microsoft Internet Information Services (IIS) 7.0.
Windows Data Access Components (WDAC) Version 6.0.
Microsoft .NET Framework Version 3.5 Service Pack 1.

A8.2 Hardware Requirements

A server should at least provide following configuration: 2 x 3.0 GHz/800MHz front side bus Intel Xeon Processor, 4 GB RAM, 2 x 120GB SCSI hard drive (RAID) with 320 MBps data transfer rate, and GBit Network Interface Card.

The number of servers that are required to operate the UIEM system will vary greatly from utility to utility and are impacted by several factors including the number of meters, load management devices and data concentrators, WAN type, how often data is collected etc.

A9. E-Payment System

The technical concept as specified must be seen as an embedded part of the entire metering solution submitted with original quotation.

The concept includes two alternatives. One alternative is based on a meter kiosk for payment collection and in-home display units as the customer interface. The other alternative is a web-based solution without additional hardware or infrastructure. Both are working independent, but can be combined to a unique payment infrastructure with different payment channels as an extension to the basic metering infrastructure. In functions, they comprise a sale point for the following procedures:

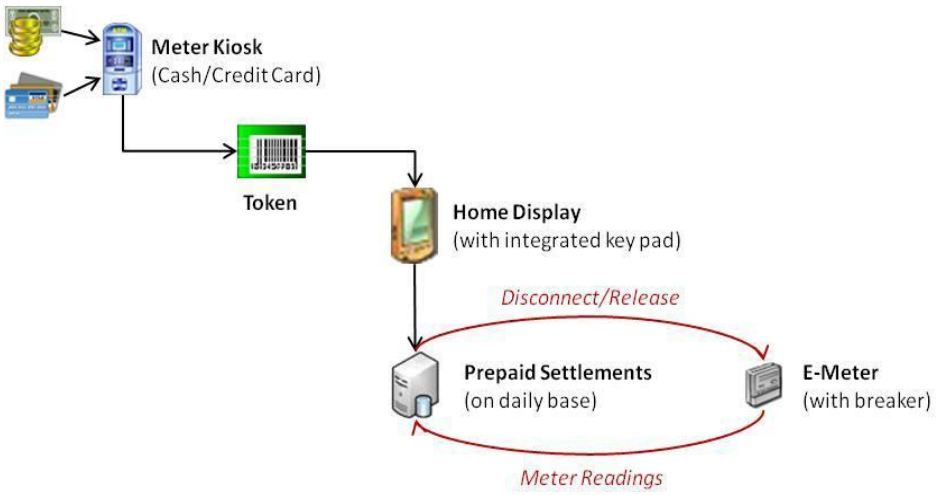
1. The customer pays a dedicated amount of money (cash or credit card) at a central located meter kiosk or through an online service. If payment was through the meter kiosk money transaction, a printed token is generated to authenticate and settle the credit.

2. The customer types in the obtained token to his personal interface unit on the key pad of his in-home display unit (does not apply in combination with web application).

3. The settlements engine: On daily base this engine balances the authenticated credits against the correlating energy consumption as provided by the meter readings. Expired credits will cause a disconnection; new credit causes immediate release for supply

The metering infrastructure does not require any special equipment. The basic e-meter (Echelon Gen. 3.1 Poly Phase Meter) in combination with the UIEM Software Suite is capable to process and execute all related business processes.

A10. Configuration



Payments are collected at a meter kiosk, ideally placed in a central area like the building lobby. The meter kiosk is capable to collect either cash or charge a credit card (when properly connected to bank services). The amount of kWh to buy can be defined by the customer; default values are pre-set in the meter kiosk. After verification of the financial transaction a token is printed.

Each customer gets a personal in-home display, linked via the MEP interface to the e-meter. Tokens provided by the meter kiosk are to be entered into the integrated key pad of the display unit. Token and display unit ID in combination are submitted to the settlements engine to authenticate the credit with the related customer. After credit validation the settlements engine generates the release command for the UIEM system.