行政院及所屬各機關出國報告

（出國類別：實習）

需量預約服務控制系統開發技術

服務機關：台灣電力公司
出國人職稱：電機工程師
姓　　名：黃佳文
出國地區：美國、加拿大
出國日期：91 年 9 月 28 日至 10 月 11 日
報告日期：91 年 11 月 29 日

行政院及所屬各機關出國報告提要

出國報告名稱： 需量預約服務控制系統開發技術

頁數 60 含附件：■是□否

出國計畫主辦機關/聯絡人/電話 ：台灣電力公司人事處/陳德隆/0223667685

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關鍵詞：自動讀表、需量預約服務控制、用戶停電事故電話服務中心

內容摘要：(二百至三百字)

赴美國參加 2002 年國際自動讀表年會及赴加拿大安大略電力公司研習需量預約服務控制系統開發技術及用戶加值服務，北美地區自動讀表安裝率已從 1999 年的 6.5% 擴大到 2002 年的 14%，總計安裝了 3620 萬台自動讀表（佔北美地區二億六千萬台計費錶)。電業從服務成本營運模式快速轉變成市場價格營運模式後，自動讀表是留住大用戶的必然手段，實施結果確實有效提供廣泛多元的用戶服務及提供用戶有效用電管理工具，對電力公司面對電業自由化的競爭環境提供了一項重大的利基。建議台電推動大用戶自動讀表服務以及建議台電利用第五配電計劃鋪設光纖到府的機會，積極推動類似加拿大漢彌爾頓電力公司的全光纖通訊用戶停電事故電話服務中心。

電子檔已傳至出國報告資訊網（http：//report.gsn.gov.tw）

出國報告目錄

壹、出國任務內容與過程

一、出國任務內容

(一)赴美國參加2002年國際自動讀表年會

2002年國際自動讀表年會(AMRA 2002 International Symposium) 9月30日至10月1日在美國德州聖安東尼市舉行。本次年會分成六組議題進行論文發表與討論：

A組；用戶服務（Customer Care）

B組；個案研究（Case Study）

C組；工商業用戶之應用（C&I Applications）

D組；讀表技術（Technology Metering）

E組；業務問題解決（Business Solutions）

F組；自動讀表與企業系統整合（What's New in AMR/Enterprise System Integration ）

1. 北美地區自動讀表安裝率擴大到14%：

2002年北美地區一年內共計安裝了554萬台自動讀表，成長率達18%，從1993年至2002年總計安裝了3620萬台自動讀表，佔北美地區二億六千萬台計費錶（電表、瓦斯表、水表合計）14%。

2002年自動讀表安裝的成長率雖然比不上2001年的34%來的耀眼，但與2002年的經濟成長率來比已經難能可貴；2001年內共計安裝了839萬台自動讀表（從1993年至2001年總計安裝了3065萬台自動讀表），佔北美地區二億六千萬台計費錶（電表、瓦斯表、水表合計）12%；2000年內共計安裝了552萬台自動讀表（從1993年至2000年總計安裝了2226萬台自動讀表），佔北美地區二億六千萬台計費錶（電表、瓦斯表、水表合計）8.5%；這3年自動讀表成長最多而且在穩定成長中的是電表。

2. 固定網路與無線電通訊自動讀表依然是電業的最愛：

Chartwell AMR Report於2002年7月至8月間電話訪問全美115家大型電業的總經理調查自動讀表的安裝實際數量、示範計畫、安裝計畫、考慮或不考慮規劃、正在規劃或考慮採用的自動讀表系統供應商、推動自動讀表的主要考量因素（如節省成本、抄表困難、改善用戶服務、提昇

讀表準確度、減少辦公室抄表而不到用戶端抄表的電費估計、讀表人員安全、獲取用戶用電資訊、未來產品及服務、每日或需經常讀表需要)、已規劃或考慮採用的自動讀表技術等深入廣泛調查項目。

(1) 在所調查的全美 115 家大型電業中有超過一半以上(52%)是以節省成本為推動自動讀表的主要考量因素,30% 為改善用戶服務,25% 為抄表困難,15% 為提昇讀表準確度,15% 為讀表人員安全考量,9% 為獲取用戶用電資訊,8% 為未來產品及服務,其他考量因素各為 5% 。因此已有許多電業正在尋找自動讀表的協助以作為改善用戶服務的策略性開端,也有許多電業繼續安裝自動讀表以網際網路提供定時的資料給大型商業及工業用戶供其決定何時轉移負載。

(2) 在所調查的全美 115 家大型電業中有 37 % 電業已將自動讀表的成本分攤在電費內或計劃向電業管制機構訴願在未來採取這項動作。

(3) 在所調查的全美 115 家大型電業中有 54 % 電業已安裝自動讀表系統,21% 已安裝自動讀表示範系統,8% 規劃安裝自動讀表系統,13% 考慮安裝自動讀表系統,只有 4% 不考慮安裝自動讀表系統。

(4) 已經規劃採用的自動讀表技術中,仍然以汽車無線電及固定網路無線電(含 GSM)的 11% 最多,電力線載波有 5% ,寬頻網路 2% ,電話線 1% ,其他 8% 。

(5) 考慮採用的自動讀表技術中,則以固定網路無線電的 31% 及汽車無線電的 20% 最多,無線電 GSM 及 paging 有 16% ,電力線載波及寬頻網路各有 17% ,電話線(撥出式) 11% ,電話線(撥入式) 9% ,其他 3% 。

(6) 到 2002 年為止幾乎有一半(46%)的電業已安裝使用汽車無線電自動讀表系統,有 19% 已安裝使用固定網路無線電自動讀表系統,有 19% 已安裝使用無線電 GSM 及 paging 自動讀表系統,有 15% 已安裝使用電力線載波自動讀表系統,只有 0% 安裝使用寬頻網路自動讀表系統。

(7) 固定網路無線電自動讀表為何依然是電業未來考慮選擇的最愛?有高達 31% 的電業考慮選用固定網路無線電自動讀表技術,主因有許多電業計畫安裝自動讀表系統在全部住宅用戶電表上,而固定

網路無線電自動讀表卻是最適合應用在大規模的低成本自動讀表作業上，由於新型的固定網路無線電自動讀表（Fixed wireless network AMR system）適用範圍較有彈性與伸縮性（scalability），例如 ITRON 公司於 2002 年 9 月推出的新一代 固定網路無線電自動讀表系統"Fixed Network 2.0"，可適用於只有 5 戶電表的迷你系統亦可適用在 500 萬戶電表的超大型自動讀表系統，因為 Fixed Network 2.0 利用固定網路無線電系統讀取及收集每棟大樓內每戶的電表用電資料後，可利用各種通訊網路將電表資料傳送回到電力公司的自動讀表主控中心，也就是可搭配寬頻網路或其他無線電網路，電表資料傳送回到電力公司的通訊網路之選擇可依不同電業的現實條件作最合乎成本效益的通訊網路選擇，較有彈性與伸縮性。

（8）正在規劃或考慮採用的自動讀表系統供應商；

在所調查的全美 115 家大型電業中，正在規劃或考慮採用的自動讀表系統供應商之中，有 44 家電業選擇 ITRON 公司（固定網路無線電系統），有 18 家電業選擇 SchlumbergerSema 公司（固定網路無線電系統），而 ITRON 公司的 2002 年自動讀表市場佔有率仍然高達 54% ，SchlumbergerSema 公司的 2002 年自動讀表市場佔有率 28% （因 SchlumbergerSema 公司把第二大的固定網路無線自動讀表系統供應商 CellNet Data 公司購併 ）。

3. 各大電表廠搭配新一代 固定網路無線電自動讀表系統紛紛推出內含無線電自動讀表模組的電子式電表：

（1）ABB 公司於 2002 年 2 月正式推出四種內含無線電自動讀表組的電子式電表，可適用於單相電子式電表及三相電子式電表，ABB 公司與自動讀表系統第一大廠 ITRON 合作開發出一種可以讀取電子式電表內所有計費用資料的無線電自動讀表模組" 50 ESS ERT" ，這種可利用固定網路無線電、汽車無線電自動讀表、或手提無線電自動讀表器來讀表的電子式電表為" ABB A3 ALPHA Meter "，除了可以讀取電子式電表內用電量 KWH、最大需量 KW、TOU、虛功（KVARH）等四項計費資料外，更可以提供 21

年的每月需量重新設定日期讀表排程。

ABB A3 ALPHA Meter 為 0.2 級高精確度電子式電表，可適用於四種型式的單相電子式電表 1S，2S，3S，4S，及五種型式的三相電子式電表 9S，12S，16S，36S，35S。

（2）SchlumbergerSema 公司與 BlueSpan 通訊公司合作開發出一種可以利用無線電行動通訊 GSM（Global System for Mobile Communications）及第三代 GSM（2.5G，3G）無線電網際網路 GPRS（GSM Packet Radio Service）來讀取工商業用戶的三相電子式電表，這種可利用各種無線電通訊方式來讀取電子式電表內 KWH（購電量、賣電量）、最大需量 KW、TOU、四象限 KVARH（流入、流出、淨流入、淨流出）等四項計費資料外，亦可讀取低電子式電表內儲存的電力品質、相電壓與相電流、向量及算術 VAH 值以供即時配電系統量測與電力品質分析應用，這種低成本的無線電自動讀表方式與搭配的多計費量測分析型三相電子式電表，為電業在工商業用戶市場提供了先進的服務平台。

這種 2002 年 9 月推出的新型" SENTINEL R300"電子式電表為 0.2 級高精確度電子式電表，內含 SchlumbergerSema 的無線電固定網路多功能電表通訊模組（MFMM Module，Fixed network multifunction meter communication module）及 BlueSpan 的 3G 無線電通訊模組 SLB-Mod 及電話數據機自動讀表模組可供電業在通訊系統上有多元化的選擇及提供需求面管理與雙向負載控制功能的界面。

BlueSpan 的 3G 無線電通訊模組 SLB-Mod，其自動讀表所用無線電頻率可選擇 800MHz 及 900MHz 的固定網路無線電或 GSM，亦可選擇 3G 無線電通訊 1900MHz 或 850MHz 的 GPRS。

4. 北美最大規模的固定網路無線電自動讀表系統：

由華盛頓州西雅圖 Puget 灣附近的 Bellevue 市 Puget Sound Energy 配電公司發表之論文" What is Real Time of Use？ Managing the Energy Crisis Through Education，Time-of-Use Billing，and Change " ，Puget Sound Energy 配電公司轄區用戶有 90 萬個電表用戶及 50 萬個天然瓦

斯用戶，以住宅用戶為主，工商業用戶只有 2 萬戶，該公司從 1998 年開始興建全系統級的大規模自動讀表系統，採用 SchlumbergerSema 公司的 CellNet Data 固定網路無線電此自動讀表系統，至 2002 年完工，共計花了 4.3 年時間完成此北美最大規模的自動讀表系統，興建採外包方式（Outsourcing）由 CellNet Data 公司（2000 年被 SchlumbergerSema 公司購併）負擔所有興建費用，CellNet Data 公司與 Puget Sound Energy 配電公司簽訂 15 年期讀表服務合約，以實際讀表數量次數向 Puget Sound Energy 配電公司收費。

此自動讀表系統亦提供其他電業讀表服務，因此實際安裝的自動讀表戶數為 160 萬戶，其中電表 95 萬戶，瓦斯表 65 萬戶，目前已有 146 萬 5 千戶透過此自動讀表系統上線讀表及計費。

（1）Puget Sound Energy 配電公司利用此全系統級自動讀表系統推動三階段的個人化能源管理（Personal Energy Management ），提供 PSE 線上個人化能源管理中心（PSE Online Personal Energy Management Center ）協助用戶外快速完成能源管理規劃及全面完整的個人能源使用曲線，用戶與 Puget Sound Energy 簽約"E-NEWSLETTER"由 PSE 線上提供能源節約資訊給住宅用戶及工商業用戶，用戶如果達成預定的能源節約目標，還可以接到 Puget Sound Energy 配電公司贈送的一筆獎金（tips），而 Personal Energy Management Center 也會提供負載轉移計算程式（Load Shift Calculator）協助用戶評估可以轉移的尖峰負載或節能的潛力，也會提供節能承包商推薦服務（Contractor Referral Service）免費提供能源使用改善計畫的業務指導，或與個人能源顧問（Personal Energy Advisor）洽談，個人能源管理分三階段進行 ；

第一階段：2000 年 9 月，40 萬個目標用戶計畫，推動四段式時間電價。

第二階段：2001 年 5 月，有 30 萬個住宅用戶接受並參加四段式時間電價，而用戶只要電話通知 Puget Sound Energy 配電公司即可取消時間電價。

第三階段：2001 年 9 月，2 萬個工商業用戶參與。

（2）Puget Sound Energy 配電公司資訊科技（IT）系統建構：

自動讀表系統：SchlumbergerSema

用戶資訊系統：Connex/Alliance Data

Puget Sound Energy 公司網站：SchlumbergerSema

資料倉儲系統：WACS

工商業用戶資料網站：Silicon Energy

（3）住宅用戶反應：

- 67% 認為 TOU 是一項好的概念
- 66% 認為要降低電廠需求
- 64% 認為 TOU 的電價是公平合理
- 72% 認為 TOU 的觀念是仍容易瞭解
- 37% 認為任何時刻皆應同一電價

（4）用戶對 TOU 可能提供的五種利益之認知：

- 控制能源使用（聰明的用戶）
- 選擇費率（讓我決定）
- 善盡社會責任（做正確的事）
- 能源安全（延遲蓋電廠）
- 改變用電行為減少電費支出

（5）重要的發現（major findings）：

- 90% 以上 TOU 電價用戶已經採取動作改變用電行為
- 大部份用戶認為選用 TOU 電價後他們的電費支出已減少
- 85% TOU 電價用戶滿意此 TOU 計畫而且會推薦給他人
- TOU 電價對用戶的好處 10 倍於對 Puget Sound Energy 的好處
- 每戶平均每月轉移 13kwh 尖峰用電
- 總計轉移尖峰負載 20MW 至 25MW

（6）結論：用戶對 TOU 電價的反應呈壓倒性的正面反應

5. 自動讀表對於大用戶的需量讀取與重設定最合乎成本效益：

由美國麻州最大的投資人擁有的上市電業 NSTAR Electric & Gas Corp.電力公司電表營運處長 Thomas Converse 先生發表之論文「An economical AMR solution for demand metered C & I accounts」，NSTAR 電力公司供電給麻州東部 100 個社區的 130 萬用戶，針對大用戶需要派員前往讀取需量電表及重新設定需量，經成本效益評估結果，大型工商業用戶採用自動讀表系統最合乎成本效益，大型工商業用戶佔所有工商業用戶的 20~30% ，而佔所有工商業用戶 70~80% 的小型工商業用戶則尚不符成本效益。

（1）由於 NSTAR 電力公司評估認為製造工商業用戶電子式電表的大廠 ABB 公司與自動讀表系統第一大廠 ITRON 合作開發的 ABB-ITRON 整合型需量電子式電表對該公司大用戶自動讀表的部署工作上，如何填補電表與自動讀表之間的間隙提供了一種有效的解決方案，因為 NSTAR 電力公司只要在大用戶的 ABB A3 ALPHA 電子式電表內加裝一片 ITRON 的無線電自動讀表模組”50 ESS ERT”，除了可以讀取電子式電表內用電量 KWH、最大需量 KW、TOU、虛功（KVARH）等四項計費資料外，更可以提供 21 年的每月需量重新設定日期讀表排程，因此就可藉由手提式、汽車無線電及固定網路無線電讀表系統解決讀取需量電表及重新設定需量的問題，而且一個無線電自動讀表模組”50 ESS ERT”相當於三個標準的 ERT 可分別讀取每個用戶電表 ID 的確用電量、最大需量、需量重新設定日期並可儲存於 CIS 系統上而不需更改 NSTAR 電力公司的 CIS 系統，因此也對用戶及電表的歷史系統改變最小。

（2）現有讀表系統整合與固定網路無線電自動讀表系統安裝：

NSTAR 電力公司現有 ITRON、ENSCAN、RADIX 三種讀表系統，在 2002 年利用 ITRON 的 Premuerplus4 讀表系統將三種讀表系統整合成一套可共用的讀表系統。

2003 年第一季完成 9500 個大用戶自動讀表系統安裝，初期以一次設定一年每月需量重新設定日期讀表排程，中期則以一次設定三年每月需量重新設定日期讀表排程，長期則以一

次設定 21 年每月需量重新設定日期讀表排程。

6.電業從營運模式轉型後，自動讀表是留住大用戶的必然手段：

在工商業用戶的應用議題上，由洛杉磯電力事業處的自動讀表計畫經理 George Chen 先生發表的論文"Real Time Electric Metering System" 說明電業從服務成本（cost-of-service）營運模式快速轉變成市場價格營運模式（market price business model）後，佔電費收入一大半但用戶數卻很少數的大型工商業用戶直接成本計費（direct cost billing）與計費爭議仲裁及提供及時用電資料的強烈需求 ，採用自動讀表系統是必然的手段。

（1）以直接成本計費取代平均電價成本計費;服務成本營運模式假設每個同一電價類別的用戶其用電型態相同，用平均電價成本來計費可能是公平的，但在新的市場價格營運模式下，用戶應該以直接成本反映電價。

（2）洛杉磯電價分成四類；住宅、小型工商業、中型工商業、大型工商業等四類電價。

（3）電業自由化後，大用戶的需求；電費單上更詳細的說明各項計費之計算及用電型態曲線資料，工廠工程師想要追蹤用電即時資料，會計人員想要依公司現金週轉週期來支付電費 ，管理人員想要以各別單位用電來監督營運成本，為解決大用戶的需求以及改善用戶服務，因此洛杉磯電力事業處(LADWP)著手推動自動讀表計畫。

（4）自動讀表提供大用戶直接遭遇成本計費及小用戶統計平均市價計費；

洛杉磯電力事業處(LADWP)在用電需量超過 200KW 以上的 3000 個大用戶 端安裝自動讀表電表，並且對 1000 個用電量最大的用戶以用戶直接成本計算電費，而在 120 萬個住宅用戶中以 90%信賴水準統計抽樣抽選 1000 個住宅用戶安裝自動讀表電表以提供動態負載造型(Dynamic Load Profiling)而能夠準確的代表低用電量用戶的用電行為，根據住宅用戶動態負載造型來決定統計平均市價及用以計算住宅用戶電價。而 200KW

以下的工商業用戶也是以此 90%信賴水準統計抽樣抽選安裝自動讀表電表，以平均市價來計算此類工商業用戶電價。

（5）自動讀表系統提供大用戶每小時及時用電資料，節省 5% 全系統用電量；

大用戶可利用上網取得每小時及時用電資料，洛杉磯電力事業處並且針對 1000 個人用電量最大的用戶提供每小時電價資訊，這 1000 個用電量最大的用戶佔總電費收入的 30%，洛杉磯電力事業處也利用此自動讀表系統編製其用戶的負載造型以及提供"接近市場"(close-to-market)的電價資訊給立法機構、能源服務供應商、及用戶。洛杉磯電力事業處也利用此自動讀表系統發展出一套彈性電費付款規劃、停電通知系統、提供用戶更完善的成本管理與電力品質服務。洛杉磯電力事業處目前已經安裝 3200 戶自動讀表電表，而且因此節 5% 系統用電量。

（6） 獲得加州能源委員會獎勵及補助 480 萬美元擴建無線電傳呼型自動讀系統：

＊組成自動讀表評估小組尋找最具成本效益自動讀表系統；

洛杉磯電力事業處經過深入研究各種自動讀表科技、數位通訊與決策系統(Decision making system)、網際網路、用戶資訊倉儲、電子式電表、營運分析軟體、各種通訊媒介(電話線數據機、固定網路無線電、行動數據網路無線電系統 (又稱蜂巢式數位封包數據網路系統，CDPD,Cellular Digitl Packet Data wireless system)、雙向電力線載波、雙向詞無線電傳呼系統), 洛杉磯電力事業處想要利用此自動讀表系統提供給用戶電力品質改善、停電通知、能源資訊系統等用戶服務，而且給用戶這套工具供用戶監視其用電、抑制用電、最終達到降低電費的目標，因此洛杉磯電力事業組成自動讀表評估小組尋找能夠提供上述用戶服務又能讓公司增加生產力及維持低成本電力供應商地位的一套最具成本效益、可靠及有效率的自動讀表系統，該小組最後選定一套雙向無線電傳呼型自動讀表系統。

＊ 實施結果確實有成效，獲加州能源委員會獎勵補助擴建；

由於經過推動實際在用電需量超過200KW以上的3000個大用戶端安裝自動讀電表，實施結果確實有效提供廣泛多元的用戶服務及提供用戶有效用電管理工具，而且因此節省 5%全系統用電量，加州能源委員會已將此套無線電傳呼型自動讀表系統認可並且採用為加州的自動讀表系統標準，加州能源委員會並且獎勵及補助 480 萬美元給洛杉磯電力事業用以擴建此套無線電傳呼型自動讀表系以供更多的用戶能夠參與納入此自動讀表系統服務。

(7)將原有靜態負載調查系統擴充升級為動態負載特性調查系統:

洛杉磯電力事業處原本早已有一套負載特性調查系統，在全系統各類抽樣用戶端安裝 2000 台電子式調查電表，記錄儲存每 15 分鐘用電資料，現在有了這套自動讀表系統可將原有之靜態負載特性調查系統擴充升級成為動態負載特性調查系統(Dynamic LoadProfiling System)，而且這套動態負載造型系統可提供資料被用來支援新的市場價格營運模式下七項作業：

＊ 各類電價用戶每日負載模型(Daily Load Profile):

加州公用事業委員會(CPUC)規定要求投資者擁有的公用事業(IOU)必須提報各類電價用戶每日負載模型，以確保能源服務供應商能夠利用每日負載模型來確定耗電極限值而得以限制其在財務決算應負的義務，此外洛杉磯電力事業處也需要此動態負載造型系統提供即時計費(Real-Time Billing)能夠應用於競爭電業環境。

＊ 大用戶各別契約電價費率的特別計費服務

＊ 電力費率設計：洛杉磯電力事業處利用 MV90 軟體系統的負載研究分析程式，將自動讀表系統提供的時刻區間資料解讀後建立各類電價用戶的每小時日負載模型，而此負載研究分析程式提供一項重要資訊為四類電價用戶對系統尖峰負載組成的貢獻度。

＊ 特高壓大用戶電費爭議的仲裁：自動讀表系統提供的每 15 分鐘時段區間資料對於解決特高壓大用戶電費爭議的仲裁是一項非常貴重的資料，而且建立的每日、每週、每月的每 15 分鐘時段區間用電圖形資料是傳統 TOU 電表所無法辦得到的事。

＊ 增進用戶關係：洛杉磯電力事業處派往用戶端的用戶代表 (Account Representatives)的手提電腦可以存取自動讀表資料，可現場即時協助用戶分析用電情形。

＊ 能源效率查核與負載管理及行銷的研究規劃：自動讀表系統可以及時的支援更有效率與效用的可停電力與負載抑低作業。

＊ 尖峰時刻成本分攤方法與費率研究

7.二十一世紀 2G-3G 行動數據網路應用於工商用戶自動讀表：

（1）由佛羅里達電力公司（Florida Power Corp）自動讀表計畫經理 Robert I. Singh 先生發表的論文「AMR for C&I Customers」；

＊工商用戶自動讀表的需求：

★準時讀表　　★上網存取負載曲線資料

★用戶存取其他資料　　★服務成本研究

★提早偵測問題及解決問題　★隨選讀表

★ 按曆月天數計費　　★遙控檢修故障、相角校正

＊工商用戶自動讀表系統最常用的通訊科技：

★公用電話線（POTS）；

★先進行動電話系統（AMPS）

★數位通訊（行動數據網路系統）；

●分時多重存取（TDMA，Time Division Multiple Access）

●分碼多重存取（CDMA，Code Division Multiple Access）

●蜂巢式數位封包數據（CDPD，Cellular Digital Packet Data）

●2G 全球行動通訊系統（GSM，Global System for Mobile Communication）（使用頻道寬 200KHz，分割成 8 個時間

槽，是一種分頻多重存取 FDMA 與分時多重存取技術）

＊佛羅里達電力公司的行動數據網路自動讀表系統佈署：

佛羅里達電力公司依據通訊涵蓋範圍考量，選用分碼多重存取（CDMA）行動數據網路系統，於 2002 年開始進行行動數據網路自動讀表系統示範計畫，已安裝 75 戶 CDMA 自動讀表，已規劃在 2003 年安裝 1000 戶 CDMA 自動讀表，並且考慮未來應用第 2.5 代（2.5G）無線電網際網路 GPRS-GSM 及第三代無線電網際網路（3G）。

（2）由 BlueSpan 自動讀表通訊公司執行副總經理 Bill Kirby 先生發表的論文「Wireless Communications for the 21st Century-Emerging Technologies」；

自動讀表通訊技術在二十一世紀初的時空環境下，對於讀表功能的解決必須讓電業供得起，而且在現有作業環境下提供高度的共通性、可靠度、彈性、規模適應性（Scalability）。

目前能符合上述五點要求而較被廣泛使用的新進通訊技術為短距離無線電區域網路（WLAN，Wireless LAN）與長距離廣域網路 WAN（如 Internet 網際網路）搭配組成的多重通訊系統，能夠較為容易的與電業據既有系統整合：

＊ 短距離無線電區域網路：藍芽（Bluwtooth），無線電傳真標準 WiFi（The Standard for Wireless Fidelity，即 IEEE 802.11b）。

＊ 藍芽（Bluwtooth）：一種全球新興通用於電子設備之間的短距離無線通訊條款、一般有效距離為 10 公尺、使用 2.4Gz 免執照頻道（ISM band，Industrial/Scientific/Medical band）、使用跳頻式展頻訊號、資料傳輸速率大於 600 Kbps。已廣泛應用於個人電腦的無線滑鼠（wireless mouse）、無線耳機(cordless headset)、無線遙控印表機（remote printer）

＊ 無線傳真標準 WiFi（IEEE 802.11b）：一種全球新興通用於電子設備與網路之間的中短距離無線電通訊條款、有效距離為 300 公尺、使用 2.4Gz 免執照頻道（ISM band）、使用直接序列式展頻訊號、資料傳輸速率約 11Mbps。已

廣泛應用於無線乙太網路存取（wireless Ethernet）或無線存取連結、公用無線網際網路存取等。

＊短距離無線電區域網路可用存取設備（Access Facility）：IEEE 802.11a、GSM、GPRS、EDGE、UMTS 等第二代與第 2.5 代及第三代無線數據網路。

＊ IEEE 802.11a：一種全球新興通用於電子設備與網路之間的中短距離無線電通訊條款、使用 5 Gz 免執照頻道、使用直交分頻多工（Orthogonal frequency division multiplexed）訊號、資料傳輸速率約 54Mbps。

＊ GSM：第二代行動數位通訊網路，全球有 170 個國家 6 億 5 千萬人使用

＊ 無線電網際網路 GPRS（GSM Packet Radio Service）：第 2.5 代行動數位通訊網路，可用於現有的 450、850、900、1800、1900MHz 頻道，低成本軟體升級，資料傳輸速率 30-40Kbps 最大至 115Kbps。

＊ 第三代高速行動數據網路：EDGE（Enhanced Data for GSM Evolution），可用於現有的 450、850、900、1800、1900MHz 頻道，中成本軟硬體升級，資料傳輸速率 80-150 Kbps 最大至 473Kbps。

★ UMTS(Universal Mobile Telecommunication Service)，高成本硬體升級，資料傳輸速率行動網路可至 384Kbps，固定網路可至 2Mbps。

★ CDMA-2000 1xEV、Wideband-CDMA、TD-SCDMA (Time-division synchronous code-division multiple -access)等三種行動網路資料傳輸速率最大至 2Mbps。

＊ 長距離廣域網路 WAN：由於 Internet 網際網路已發展出適當的安全加密技術，而且可與多種無線及有線通訊技術相容，容易作成最合乎成本效率的通訊系統搭配，因此 Internet 網際網路已經成為當今能源資訊應用上最理想的廣域網路。

＊ 愈來愈多的公用網路無線通訊技術被應用於自動讀表：

★ 針對電業的變化環境能獲得想要的特點與成效，而且兼顧短期與長期的需求

★ 包含多重通訊技術與應用功能的混合型自動讀表系統

將被運用於收集、傳送、及處理電表讀表資料

★ 如何設計與部署建構一套能與電業現有系統輕易整合的多重通訊技術混合型自動讀表系統，是一項挑戰。

8. 推動工商業用戶自動讀表的十大理由（動機）：

由加拿大 Automated Communication Links Inc. 公司總經理 Carolyn M. Kinsman 先生發表的論文「10 Top Reasons for C&I AMR---Incorporating Logic and $ into your Business Plan」：

（1）5MW 以上的大型工業用戶；

這一類型大用戶是最優先已被電業利用電話線自動讀表系統讀取其用電資料的用戶類別，但 5MW 以上的大型工業用戶還需要更多的用戶即時用電資訊及用戶電費資訊。而電業則需要為此類用戶設計特別的電價費率，及運用用戶即時用電資訊精確作負載預測以供購電與送電作業之依據。

（2）1MW 以上的大型商業及工業用戶；

用戶端：用戶結帳要求、用戶特殊要求

電業端：負載曲線、自由化、用戶能源服務、零售計畫

（3）聯合購電用戶（Load Aggregation &Consolidation）；

提供能源服務的可能性、多樣化（Multi-valued）價值用戶、自由化、用戶向替代能源供應商（AEP，Alternate Energy Provider）購電的風險、用戶特殊要求、提供應電價費率資訊與負載資訊

（4）醫院、大學、政府機構與學校（HUGS）；

普遍要求提供用電設備管理上的協助：負載控制與設備測試、與電業服務代表維持良好的關係、新電價費率測試、分享電業的光纖網路

（5）個別用戶的收益性（profitability）；同一類電價費率用戶其個別用戶的收益性不同、用戶負載曲線可確保電價費率與行銷計畫已否能夠準確的發展與傳達、獲利的用戶能夠轉移負載、而且從這類獲利的用戶群買回轉移電力為最具潛力

（6）建構新費率結構；

較有彈性的電價費率契約與電價費率選擇、用戶滿意度與忠誠度的擔保、長期用電契約意指取得負載預測

（7）負載預測；供電量與購電合約

（8）網路化資訊與強化服務價值；

價值環境（The Value Environment）的悄悄來臨、新興的收入與獲利必定來至於服務、電業服務獲利百分比可能遠比售電獲利百分比高

（9）因為資訊科技時代的悄悄來臨；

某種方式的自由化、計費仲裁、替代能源供應商（AEP，Alternate Energy Provider）、能源服務供應商（ESP）、能源管理系統、用電設備討論會、製造業討論會

（10）因為大用戶需要自動讀表；大用戶數量少，但其電費收入佔比幾乎超過一半，自動讀表系統安裝較易符合投資成本正當性（Cost-justification），電業可掌握大用戶即時用電資料作經濟電力調度與較準確負載預測及購電預測，而且電業可提供即時用電資料供大用戶線上查詢及創新計費服務

(二)、赴加拿大安大略電力公司研習需量預約服務控制系統開發技術及用戶加值服務

1.安大略電力公司自由化與公司改組：

安大略省通過電業法(Electricity act)及公司法(Ontario Business Corporation Act）規定所有電力公司必須在 2000 年 7 月 1 日起開始自由化，安大略電力公司（Ontario Hydro ）因此 1998 年 12 月 1 日改組完成並且正式改名為 Hydro One Inc. ；

安大略電力公司（Ontario Hydro ）分割成發電公司（Ontario Power Generation Inc.）、IEMO（Independent Electricity Market Operator）、及輸配售電公司（Hydro One Inc）。

Hydro One 輸配售電公司目前仍為安大略省所有，本來預計於 2002 年民營化，但因股市不振而暫緩，Hydro One 目前擁有六家子公司：

Hydro One 輸配電網路公司（Hydro One Network Inc.）

Hydro One 輸配電網路服務公司（Hydro One Network Service Inc.）

Ontario Hydro 零售服務公司（Ontario Hydro Energy Inc.）

Hydro One 躉售購電及仲裁服務公司（Hydro One Marketing Inc.）

Hydro One 光纖通訊系統公司（Hydro One Telecom Inc.）

Hydro One 偏遠地區發配電公司（Hydro One Remote Communities Inc.）

2.用電成本透明化、價格商品化、創造新的服務利益

（1）用電成本透明化、價格商品化：

發電與零售開放競爭市場後，導致電力價格可以商品化與用電成本透5000KW Demand)的用戶電費帳單上都會明列出那些費用是歸屬於開放競爭後的成本，那些費用又是歸屬於管制部份的成本，例如實際用電量的流動電費（Energy Charge）是以加權平均現貨市價（Weighed Averged Spot Market Price）或每小時現貨市價（Hourly Spot Market Price）計價，屬於管制部份成本的電費項目包括輸電連結成本、輸電網路成本、變動配電成本、每月固定配電成、每月躉售市場管理成本、

原電力系統退役後套牢負債　成本(Stranded Cost of retiring debt of the former provincial electricity system）.

（2）創造新的服務利益：

例如提供所有能源服務的一站商店（One Stop Shop for Energy Service）；

Ontario Hydro 零售服務公司為了提供住宅用戶及工商業用戶各項能源服務以及為了用戶的方便而設計的單一窗口能源問題服務解決 One Stop Solution），設立一個產品服務網站 "ONSOURCE"，；各項能源服務產品及服務（Products & Services）選項，包括熱水器出租業務，線上簽訂保證電價費率合約（Guaranteed Electricity Rate），免費的家庭能源查核　（Free Home Efficiency Audit），工商業用戶的能源問題解決服務（Business Solutions）。

（3） 安大略電力的發電配比：

水力發電：26%

核能發電：37%

火力發電（煤、油）：29%

天然氣發電：7%

替代（再生）能源發電（Alternative Power Sources）：1%

3. 單一窗口線上能源服務系統（One Stop Source Energy Service，SOURCE）

Ontario Hydro 零售服務公司（Ontario Hydro Energy Inc.）配電及零售服務轄區包括 96 萬個一般用戶及 38 個大工業用戶及 124 個都市電力公用事業（Municipal Electricity Utilities）員工有 4468 人（1999 年時為 5632 人），系統尖峰負載為 2342 萬 KW。

Ontario Hydro 零售服務公司針對住宅用戶及工商用戶分別提供了非常便利的單一窗口線上能源服務（One Stop Solution）,例如用戶只需上 Ontario Hydro 零售服務公司的 ONSOURCE 網站,就能在 20 分鐘內完成免費的家庭能源查核報告（Home Audit Energy Report）,提供家庭能源效率改善服務（Home Energy Efficiency Improvement Service）,歷年用電量及電費計算與更新（Update Your Bill History）, ONSOURCE 網站也提供能源圖書館（Energy Library）及能源專家諮詢服務解答用戶經常問到的各項疑難雜症問題 FAQ（Frequently Asked Questions）。

4.用戶停電事故電話服務中心

位於安大略省多倫多東邊市郊的漢彌爾頓市都市電力公用事業（ Hamilton Municipal Electricity Utilities）於 2000 年 7 月改組為漢彌爾頓電力公司（ Hamilton Hydro Inc.），漢彌爾頓電力公司的電力系統運轉中心擁有一座目前最先進的自動化監控資訊系統（State-of-the-art Supervisory Control And Data Acquisition System），利用該公司遍佈全市 8 座二次變電所 100 條饋線的光纖通訊網路，從 1995 年開始興建到 2001

年完成這座具有用戶停電事故電話處理系統（Trouble Call Management System）的全光纖通訊 SCADA 系統，由於裝設在 100 條饋線上的 RTU 會立即將停電事故傳回電力系統運轉中心，運轉中心值班人員在 3 秒鐘內就能在電腦螢幕上或位於運轉中心 牆壁上由 5 架背式投影機投射組成的 5 張大型投影顯示幕顯示 100 條饋線上所有饋線開關及斷路器上所標示的線路故障點。

因此用戶只要撥一通 24 小時緊急服務電話告知用戶姓名、地址、電話號碼、停電時間，或是想要熱心告知親眼見到的線路掉落或路燈倒塌的現場位置，運轉中心值班人員會立即告訴用戶停電事故原因、何時恢復供電，而且也會告訴用戶立即派員前往搶修並保證在最短時間內恢復供電，如果用戶緊急電話太擁擠，用戶停電事故電話服務中心的錄音訊息也會告知用戶到目前為止停電緊急原因及搶修的進展情況，而且每一通用戶緊急電話都會被記錄在電腦化緊急事故記錄器上。

漢彌爾頓電力公司計畫將此用戶停電事故電話服務中心推廣到另外兩個區處服務中心的 24 座二次變電所 200 條饋線上，以涵蓋轄區 331 平方公里內的全體 17 萬用戶及 45 萬都會市民。

漢彌爾頓電力公司的全光纖通訊 SCADA 系統除了可以執行饋線負載轉供外，運轉中心值班人員可依據用戶告知電話號碼或地址，立即在主控中心的工作站電腦上所建立的饋線圖資系統找到相對映的饋線所在區域，再 zoom in 至饋線附近，找到相對映的饋線斷路器及饋線分段開關，因此這座具有用戶停電事故電話處理系統能夠讓運轉中心值班人員快速掌握停電事故發生地點、迅速派員前往搶修、並且能夠在第一時間內回答用戶詢問停電事故的緊急電話，漢彌爾頓電力公司擁有這座最先進的用戶停電事故電話服務中心（Call Center）而能自豪的在公司願景上保證讓用戶說他們得到最佳的服務。

5.工商業用戶能源服務

提供四項能源服務：

（1）用戶電費帳單分析；

協助用戶聊瞭解電費計計算細節與主要設備用電分析、線上查詢電費帳單與曆年用電記錄。

（2）電力品質資訊及服務；

協助用戶尋找及確定用戶內部電力干擾來源，分別提供用戶三種解決方案：

方案一（低成本解決）；由電力公司的技術服務處（Technical Services Department）專業工程師負責告訴用戶如何檢查各項用電設備接線的合適線徑及用電設備接地線的安裝與合適線徑、對電力

干擾敏感的設備安裝一條專線供電以免與易穿產生電力干擾的設備共用一條配線。

方案二（中成本解決）；由電力公司的技術服務處委託專業顧問或專業承包商前往用戶端協助安裝突波抑制器（Surge Suppressors）及隔離變壓器。

方案三（高成本解決）；由電力公司的技術服務處委託專業顧問或專業承包商前往用戶端協助安裝線路電力調整器（Line/Power Conditioner）與不斷電裝置，徹底解決電壓驟降 sag、突波、不規則電壓等電力干擾問題）。

（3）功率因數分析服務；

由電力公司的技術服務處委託專業顧問或改善專業承包商前往用戶端協助改善功率因數及提供改善功率因數所需成本與效率分析。

（4）用電設備監測服務；

由電力公司的技術服務處委託專業顧問或改善專業承包商前往用戶端協助安裝能源管理系統：包括需量預約服務控制系統、電力監測與負載曲線、即時電價能源控制系統（Real-time electricity pricing energy controller）、空調系統控制器（HVAC controller）、照明系統控制器（Lighting controller），協助用戶在尖峰電價時刻降低用電成本。

6. 需量預約服務控制系統開發技術及用戶加值服務

加拿大 Energy Saving Centers 於 1990 年開始針對工業及商業用戶原研製開發數位式需量預約服務控制系統（Energy Smart Modules），由加拿大 EG Energy Controls 公司研究發展出高品質、高可靠度、又有競爭價格的最先進的需量預約服務控制系統：包含最大需量控制器、照明系統控制器、空調系統控制器、即時能源控制器。並且針對大用戶研製開發一套具有完整功能的能源管理系統，除了涵蓋需量預約服務控制功能外更增加環境溫度監測及警告系統功能。目前已安裝應用於 2 萬個以上各行各業的用戶。

（1）最大需量控制器；

平均可節省 15 至 30％的最大需量電費，安裝成本大多數皆能夠在 2 年內回收，有許多案例在 12 至 15 個月之內就能回收。

** 使用其創新的最先進之自動化最大需量限制技術 AMDL（Automatic Maximum Demand Limit Technology），容許最大需量限制可以依據電力使用的變化來自動調整，而調整是由控制器內部所儲存的用電資料庫及程式編寫的判斷標準來決定。

** 與計費電表連線，可控制 8 到 64 組負載
** 可透過內建之電話數據機及網際網路與主控站個人電腦連線作遠端操控
** 可執行定時器控制、週期控制、輪流控制等三種控制方式
** 可計算及儲存每天實際節省的用電量資訊，及負載曲線
** 可擴充加裝空調系統控制器模組及照明系統控制器模組
** 使用通用的功率轉換器（KW Transducer）
** 控制線路之通訊及有效距離：RS232-R485，1.2 公里

（2）照明系統控制器（Lighting controller）；

照明系統控制器利用自耦變壓器以最有效的步進電壓控制方法（Step voltage control）多段降壓（80-100%電壓輸出）後送電至照明配電盤， 每月平均可節省 15 至 25%的最大需量及流動電費，安裝成本大多數皆能夠在 2 年內回收，有許多案例在 12 至 15 個月之內就能回收。

** 模組化設計，控制器模組容量可搭配 25KW, 37KW, 50KW, 75KW, 100KW, 150KW 模組，50KW 以上小型商業用戶至幾 MW 的大用戶皆可適用。
** 安定器日光燈可降低 15%用電, 照度降低 12%；
最多可降低 20%電力而不影響照明輸出設計原來標準
** 高強度放電燈具 HID（High Intenity Discha Lamp fixture）可降低 15%用電, 照度降低 20%, ；
高強度放電燈具每具耗電 430W 最多可降低 25%電力而不影響照明輸出設計原來標準
** 提供照明計算器程式（Light calculator）供用戶填寫每個照明區域的燈具數量及燈具型式，再填寫燈具全年使用時間及降低用電目標等控制資料後，再輸入需量及流動電價，此照明計算器程式會計算出全年可節省的總電費。
** 體積小、只需安裝於照明配電盤上、燈具不需重新繞線、照明燈具的翻修改善或新裝設皆適用。

（3）推動能源績效合約（Energy Performance Contract）

加拿大天然資源部能源效率署從 2000 年開始推動加拿大能源效率獎（Canada Energy Efficiency Awards），並且推動能源績效合約制度，鼓勵業界從事於積極開發及應用需量預約服務控制系統及用戶加值服務技術，例如 Fredericton 市政府與需量預約服務控制系統業者簽訂一項能源績效合約，針對 Fredericton 市政府的 18 棟辦公大樓翻修改善照明系統、建

築物外殼、配電系統、及安裝大樓自動化系統，能源績效合約金額為加拿大幣 2 百萬元，保證每年節省用電 27%。

二、出國公務過程

1、 91 年 9 月 28 日~29 日:行程(台北~西雅圖~聖安東尼)

2、 91 年 9 月 30 日~10 月 01 日: 參加二〇〇二年國際自動讀表年會

3、 91 年 10 月 02 日~08 日: 實習安大略電力公司需量預約服務控制系統開發技術

4、 91 年 10 月 09 日~11 日: 返程（ 多倫多~ 溫哥華~ 台北 ）

貳、出國公務的心得與感想

一、電業從營運模式轉型後，自動讀表是留住大用戶的必然手段：

1. 洛杉磯電力事業處的自動讀表計畫；

電業從服務成本（cost-of-service）營運模式快速轉變成市場價格營運模式（market price business model）後，佔電費收入一大半但用戶數卻很少數的大型工商業用戶直接成本計費（direct cost billing）與計費爭議仲裁及提供及時用電資料的強烈需求，採用自動讀表系統是必然的手段。

（1）以直接成本計費取代平均電價成本計費;服務成本營運模式假設每個同一電價類別的用戶其用電型態相同，用平均電價成本來計費可能是公平的，但在新的市場價格營運模式下，用戶應該以直接成本反映電價。大型工商業等四類電價。

（2）電業自由化後，大用戶的需求；電費單上更詳細的說明各項計費之計算及用電型態曲線資料，工廠工程師想要追蹤用電即時資料，會計人員想要依公司現金週轉週期來支付電費 ，管理人員想要以各別單位用電來監督營運成本，為解決大用戶的需求以及改善用戶服務，因此洛杉磯電力事業處(LADWP)著手推動自動讀表計畫。

（3）自動讀表提供大用戶直接遭遇成本計費及小用戶統計平均市價計費；洛杉磯電力事業處(LADWP)在用電需量超過 200KW 以上的 3000 個大用戶端安裝自動讀表電表，並且對 1000 個用電量最大的用戶以用戶直接成本計算電費，而在 120 萬個住宅用戶中以 90%信賴水準統計抽樣抽選 1000 個住宅用戶安裝自動讀表電表以提供動態負載造型(Dynamic

Load Profiling)而能夠準確的代表低用電量用戶的用電行為，根據住宅用戶動態負載造型來決定統計平均市價及用以計算住宅用戶電價。而200KW以下的工商業用戶也是以此90%信賴水準統計抽樣抽選安裝自動讀表電表，以平均市價來計算此類工商業用戶電價。

（4）大用戶可利用上網取得每小時及時用電資料，洛杉磯電力事業處並且針對1000個人用電量最大的用戶提供每小時電價資訊，這1000個用電量最大的用戶佔總電費收入的30%，洛杉磯電力事業處也利用此自動讀表系統發展出一套彈性電費付款規劃、停電通知系統、提供用戶更完善的成本管理與電力品質服務。洛杉磯電力事業處目前已經安裝3200戶自動讀表電表，而且因此節 5% 系統用電量。

（5）實施結果確實有成效，獲加州能源委員會獎勵補助擴建；

由於經過推動實際在用電需量超過200KW以上的3000個大用戶端安裝自動讀電表，實施結果確實有效提供廣泛多元的用戶服務及提供用戶有效用電管理工具，而且因此節省 5%全系統用電量，加州能源委員會已將此套無線電傳呼型自動讀表系統認可並且採用為加州的自動讀表系統標準，加州能源委員會並且獎勵及補助480萬美元給洛杉磯電力事業用以擴建此套無線電傳呼型自動讀表系以供更多的用戶能夠參與納入此自動讀表系統服務。

2. 二十一世紀2G-3G行動數據網路應用於工商用戶自動讀表：

佛羅里達電力公司（Florida Power Corp）行動數據網路自動讀表計畫；

（1）工商用戶自動讀表的需求為：準時讀表、上網存取負載曲線資料、用戶存取其他資料、服務成本研究、提早偵測問題及解決問題、隨選讀表、 按曆月天數計費、遙控檢修故障、相角校正

（2）工商用戶自動讀表系統最常用的通訊科技：公用電話線（POTS）、先進行動電話系統（AMPS）、數位通訊（行動數據網路系統）、分時多重存取（TDMA，Time Division Multiple Access）、分碼多重存取（CDMA，Code Division Multiple Access）、蜂巢式數位封包數據（CDPD，Cellular Digital Packet Data）、2G全球行動通訊系統（GSM，Global System for Mobile Communication）（使用頻道寬200KHz，分割

成 8 個時間槽，是一種分頻多重存取 FDMA 與分時多重存取技術）

（3）佛羅里達電力公司的行動數據網路自動讀表系統佈署：

佛羅里達電力公司依據通訊涵蓋範圍考量，選用分碼多重存取（CDMA）行動數據網路系統，於 2002 年開始進行行動數據網路自動讀表系統示範計畫，已安裝 75 戶 CDMA 自動讀表，已規劃在 2003 年安裝 1000 戶 CDMA 自動讀表，並且考慮未來應用第 2.5 代（2.5G）無線電網際網路 GPRS-GSM 及第三代無線電網際網路（3G）。

（**4**）自動讀表通訊技術在二十一世紀初的時空環境下，對於讀表功能的解決必須讓電業供得起，而且在現有作業環境下提供高度的共通性、可靠度、彈性、規模適應性（Scalability）。目前能符合上述五點要求而較被廣泛使用的新進通訊技術為短距離無線電區域網路（WLAN，Wireless LAN）與長距離廣域網路 WAN（如 Internet 網際網路）搭配組成的多重通訊系統，能夠較為容易的與電業據既有系統整合：

短距離無線電區域網路：藍芽（Bluwtooth），無線電傳真標準 WiFi（The Standard for Wireless Fidelity，即 IEEE 802.11b）。

藍芽（Bluwtooth）為一種全球新興通用於電子設備之間的短距離無線通訊條款，一般有效距離為 10 公尺，使用 2.4Gz 免執照頻道（ISM band，Industrial/Scientific/Medical band），跳頻式展頻訊號，資料傳輸速率大於 600 Kbps。已廣泛應用於個人電腦的無線滑鼠（wireless mouse）、無線耳機(cordless headset)、無線遙控印表機（remote printer）。

無線傳真標準 WiFi（IEEE 802.11b）為一種全球新興通用於電子設備與網路之間的中短距離無線電通訊條款，有效距離為 300 公尺，使用 2.4Gz 免執照頻道（ISM band），用直接序列式展頻訊號，資料傳輸速率約 11Mbps，已廣泛應用於無線乙太網路存取（wireless Ethernet）或無線存取連結、公用無線網際網路存取等。

短距離無線電區域網路可用存取設備（Access Facility）：IEEE 802.11a、GSM、GPRS、EDGE、UMTS 等第二代與第 2.5 代及第三代無線數據網路。

IEEE 802.11a 為一種全球新興通用於電子設備與網路之間的中短距離無線電通訊條款，使用 5 Gz 免執照頻道，使用直交分頻多工（Orthogonal frequency division multiplexed）訊號，資料傳輸速率約 54Mbps。

GSM：第二代行動數位通訊網路，全球 170 個國家 6 億 5 千萬人使用

無線電網際網路 GPRS（GSM Packet Radio Service）為第 2.5 代行動數位通訊網路，可用於現有的 450、850、900、1800、1900MHz 頻道，低成本軟體升級，資料傳輸速率 30-40Kbps 最大至 115Kbps。

第三代高速行動數據網路 EDGE（Enhanced Data for GSM volution），可用於現有的 450、850、900、1800、1900MHz 頻道，可中成本軟硬體升級，資料傳輸速率 80-150 Kbps 最大至 473Kbps。

UMTS(Universal Mobile Telecommunication Service)，高成本硬體升級，資料傳輸速率行動網路可至 384Kbps，固定網路可至 2Mbps。

其他最高速之第三代高速行動數據網路有★ CDMA-2000 1xEV、Wideband-CDMA、TD-SCDMA (Time-division synchronous code-division multiple -access)等三種行動網路資料傳輸速率最大至 2Mbps。

長距離廣域網路 WAN：由於 Internet 網際網路已發展出適當的安全加密技術，而且可與多種無線及有線通訊技術相容，容易作成最合乎成本效率的通訊系統搭配，因此 Internet 網際網路已經成為當今能源資訊應用上最理想的廣域網路。

（5）愈來愈多的公用網路無線通訊技術被應用於自動讀表：

針對電業的變化環境能獲得想要的特點與成效，而且兼顧短期與長期的需求；包含多重通訊技術與應用功能的混合型自動讀表系統將被運用於收集、傳送、及處理電表讀表資料；如何設計與部署建構一套能與電業現有系統輕易整合的多重通訊技術混合型自動讀表系統，是一項挑戰。

二. 加拿大安大略電力公司單一窗口線上能源服務系統與用戶停電事故電話服務中心值得台電跟進推動

1. 單一窗口線上能源服務系統（One Stop Source Energy Service，SOURCE）：

Ontario Hydro 零售服務公司（Ontario Hydro Energy Inc.）配電及零售服務轄區包括 96 萬個一般用戶及 38 個大工業用戶及 124 個都市電力公用事業（Municipal Electricity Utilities）員工有 4468 人（1999 年時為 5632 人），系統尖峰負載為 2342 萬 KW。

Ontario Hydro 零售服務公司針對住宅用戶及工商用戶分別提供了非常便利的單一窗口線上能源服務（One Stop Solution）,例如用戶只需上 Ontario Hydro 零售服務公司的 ONSOURCE 網站,就能在 20 分鐘內完成免費的家庭能源查核報告（Home Audit Energy Report）,提供家庭能源效率改善服務（Home Energy Efficiency Improvement Service）,歷年用電量及電費計算與更新（Update Your Bill History）, ONSOURCE 網站也提供能源圖書館（Energy Library）及能源專家諮詢服務解答用戶經常問到的各項疑難雜症

問題 FAQ（Frequently Asked Questions）。

2.用戶停電事故電話服務中心：

位於安大略省多倫多東邊市郊的漢彌爾頓市都市電力公用事業（ Hamilton Municipal Electricity Utilities）於 2000 年 7 月改組為漢彌爾頓電力公司（ Hamilton Hydro Inc.），漢彌爾頓電力公司的電力系統運轉中心擁有一座目前最先進的自動化監控資訊系統（State-of-the-art Supervisory Control And Data Acquisition System），利用該公司遍佈全市 8 座二次變電所 100 條饋線的光纖通訊網路，從 1995 年開始興建到 2001 年完成這座具有用戶停電事故電話處理系統（Trouble Call Management System）的全光纖通訊 SCADA 系統，由於裝設在 100 條饋線上的 RTU 會立即將停電事故傳回電力系統運轉中心，運轉中心值班人員在 3 秒鐘內就能在電腦螢幕上或位於運轉中心牆壁上由 5 架背式投影機投射組成的 5 張大型投影顯示幕顯示 100 條饋線上所有饋線開關及斷路器上所標示的線路故障點。

因此用戶只要撥一通 24 小時緊急服務電話告知用戶姓名、地址、電話號碼、停電時間，或是想要熱心告知親眼見到的線路掉落或路燈倒塌的現場位置，運轉中心值班人員會立即告訴用戶停電事故原因、何時恢復供電，而且也會告訴用戶立即派員前往搶修並保證在最短時間內恢復供電，如果用戶緊急電話太擁擠，用戶停電事故電話服務中心的錄音訊息也會告知用戶到目前為止停電緊急原因及搶修的進展情況，而且每一通用戶緊急電話都會被記錄在電腦化緊急事故記錄器上。

漢彌爾頓電力公司計畫將此用戶停電事故電話服務中心推廣到另外兩個區處服務中心的 24 座二次變電所 200 條饋線上，以涵蓋轄區 331 平方公里內的全體 17 萬用戶及 45 萬都會市民。

漢彌爾頓電力公司的全光纖通訊 SCADA 系統除了可以執行饋線負載轉供外，運轉中心值班人員可依據用戶告知電話號碼或地址，立即在主控中心的工作站電腦上所建立的饋線圖資系統找到相對映的饋線所在區域，再 zoom in 至饋線附近，找到相對映的饋線斷路器及饋線分段開關，因此這座具有用戶停電事故電話處理系統能夠讓運轉中心值班人員快速掌握停電事故發生地點、迅速派員前往搶修、並且能夠在第一時間內回答用戶詢問停電事故的緊急電話，漢彌爾頓電力公司擁有這座最先進的用戶停電事故電話服務中心（Call Center）而能自豪的在公司願景上保證讓用戶說他們得到最佳的服務。

3.需量預約服務控制系統開發技術及用戶加值服務：

加拿大 Energy Saving Centers 於 1990 年開始針對工業及商業用戶原研製開發數位式需量預約服務控制系統（Energy Smart Modules），由加拿大 EG Energy Controls 公司研究發展出高品質、高可靠度、又有競爭價格的最先進

的需量預約服務控制系統：包含最大需量控制器、照明系統控制器、空調系統控制器、即時能源控制器。並且針對大用戶研製開發一套具有完整功能的能源管理系統，除了涵蓋需量預約服務控制功能外更增加環境溫度監測及警告系統功能。目前已安裝應用於 2 萬個以上各行各業的用戶。

4. 推動能源績效合約（Energy Performance Contract）：

加拿大天然資源部能源效率署從 2000 年開始推動加拿大能源效率獎（Canada Energy Efficiency Awards），並且推動能源績效合約制度，鼓勵業界從事於積極開發及應用需量預約服務控制系統及用戶加值服務技術，例如 Fredericton 市政府與需量預約服務控制系統業者簽訂一項能源績效合約，針對 Fredericton 市政府的 18 棟辦公大樓翻修改善照明系統、建築物外殼、配電系統、及安裝大樓自動化系統，能源績效合約金額為加拿大幣 2 百萬元，保證每年節省用電 27%。

二、建議：

1. 建議台電推動大用戶自動讀表服務：

綜觀上述美國美國麻州最大的投資人擁有的上市電業 NSTAR Electric & Gas Corp.電力公司 9500 個大用戶自動讀表系統及洛杉磯電力事業處(LADWP)在用電需量超過200KW以上的3000個大用戶端安裝自動讀表電表，並且對 1000 個用電量最大的用戶以用戶直接成本計算電費，以及加拿大 Hydro Quebec 電力公司安裝 40000 個工商業用戶自動讀表推動加值服務，實施結果確實有效提供廣泛多元的用戶服務及提供用戶有效用電管理工具，而且因此節省全系統用電量，對電力公司面對電業自由化的競爭環境提供了一項重大的利基，值得台電借鏡。

大用戶自動讀表系統可利用低成本的無線電固定網路或短距離無線電區域網路（WLAN，Wireless LAN）讀取及收集每棟大樓內每戶的電表用電資料後，可利用各種長距離廣域通訊網路（WAN）將電表資料傳送回到電力公司的自動讀表主控中心，也就是可搭配電業已經鋪設之光纖網路或其他寬頻網路或其他無線電網路，而電表資料傳送回到電力公司的通訊網路之選擇可依不同電業的現實條件作最合乎成本效益的通訊網路選擇，較有彈性與伸縮性。

台電推動大用戶自動讀表服務之利基：

（1）本公司現有 100KW 以上用戶共約 22500 戶，用電量及電費收入佔比卻高達 50% ，以本公司 90 年電費收入 3000 億其中即 1500 億元來自大用戶，因此為提升用戶服務品質，留住大用戶及確保市場競爭力與公司生存，有必要建立大用戶自動讀表系統，建立大用戶即時用電資料庫，除了可以提供用戶上網查詢用電記錄收費服務外，亦可提供客

製化計費資料傳送給本公司計費開票系統，提供創新計費服務，本公司亦可提供大用戶各種電費選擇及附加價值的行銷服務，以增進公司的營收。再者，配合未來電業自由化自動讀表亦可提供一項電力交易平台給民營電力公司（提供ISO即時電網輸電計量資料），抽取一定比例之交易費用。

（2）由於目前本公司大用戶採電已逐漸改子式電表，未來可在大用戶的電子式電表上的光學通訊口外加一個數位讀取界面，可將電表的數位資料透過用戶寬頻網路或台電光纖網路或電話MODEM或無線電傳回本所MV-90主控中心，利用本所已建立之MV-90自動讀表測試系統及中文化界面系統解讀後產生用戶時段用電資料，可透過MV-WEB供用戶在網路上存取。

台電推動大用戶自動讀表服務業務內容：

（1）本公司計費開票需求：

◎大用戶時段間隔用電計費資料

◎創新計費服務----大用戶客製化計費資料

＊每月前三大尖峰用電需量值

＊每月用電量比較分析

＊電費資料透明化

（2）大用戶能源管理需求：

◎直接上網下載每15分鐘時段用電資料

◎上網查詢負載曲線圖（如日線、週線、月線、年線圖）

◎線上試算電費

◎提前知道用電量以規劃用電模式

（3）能源供應商（ESP）：

◎電力市場買賣交易----每天用電資料

◎減少購電成本，改善行銷策略

（4）公共事業配電公司：

◎出售大用戶每天每小時用電資料----能源服務公司（ESCO）

◎提供大用戶各種電費選擇及附加價值的行銷服務，增進公司的營收

（5）電力交易市場交易平台：

◎提供ISO即時電網輸電計量資料，做為交易仲裁（Settlement）之依據，可抽取一定比例之交易費用

◎零售交易市場每小時電費結算

2. 建議台電積極推動用戶停電事故電話服務中心：

加拿大安大略省漢彌爾頓電力公司（ Hamilton Hydro Inc.）系統運轉中心擁有一座目前最先進的自動化監控資訊系統，利用該公司遍佈全市8座

二次變電所 100 條饋線的光纖通訊網路，從 1995 年開始興建到 2001 年完成這座具有用戶停電事故電話處理系統（Trouble Call Management System）的全光纖通訊 SCADA 系統，由於裝設在 100 條饋線上的 RTU 會立即將停電事故傳回電力系統運轉中心，運轉中心值班人員在 3 秒鐘內就能在電腦螢幕上或運轉中心 5 張大型投影顯示幕上顯示 100 條饋線所有饋線開關及斷路器上所標示的線路故障點。

因此用戶只要撥一通 24 小時緊急服務電話告知用戶姓名、地址、電話號碼、停電時間，或是想要熱心告知親眼見到的線路掉落或路燈倒塌的現場位置，運轉中心值班人員會立即告訴用戶停電事故原因、何時恢復供電，而且也會告訴用戶立即派員前往搶修並保證在最短時間內恢復供電，如果用戶緊急電話太擁擠，用戶停電事故電話服務中心的錄音訊息也會告知用戶到目前為止停電緊急原因及搶修的進展情況，而且每一通用戶緊急電話都會被記錄在電腦化緊急事故記錄器上。

漢彌爾頓電力公司計畫將此用戶停電事故電話服務中心推廣到另外兩個區處服務中心的 24 座二次變電所 200 條饋線上，以涵蓋轄區 331 平方公里內的全體 17 萬用戶及 45 萬都會市民。

建議台電利用第五配電計劃鋪設光纖到每棟大樓或鋪設到線路開關（Fiber-to-the-house,FTTH；Fiber-to-the curb，FTTC）的機會，積極推動類似加拿大漢彌爾頓電力公司的全光纖通訊用戶停電事故電話服務中心，屆時台電就能夠自豪的在公司願景上保證讓用戶說他們得到最佳的服務。

About This Publication

This is a special publication for all AMRA 2002 attendees, and includes key points derived from Chartwell's all-new AMR research report.

SPECIAL EDITION

The Chartwell AMR Report

Informing you on tomorrow's metering technologies today.

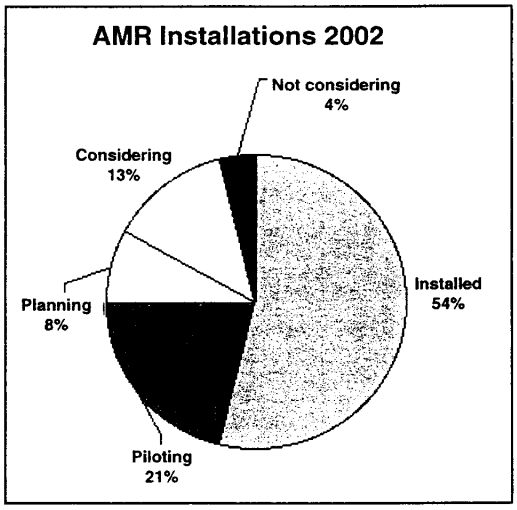
The State of the Industry 2002

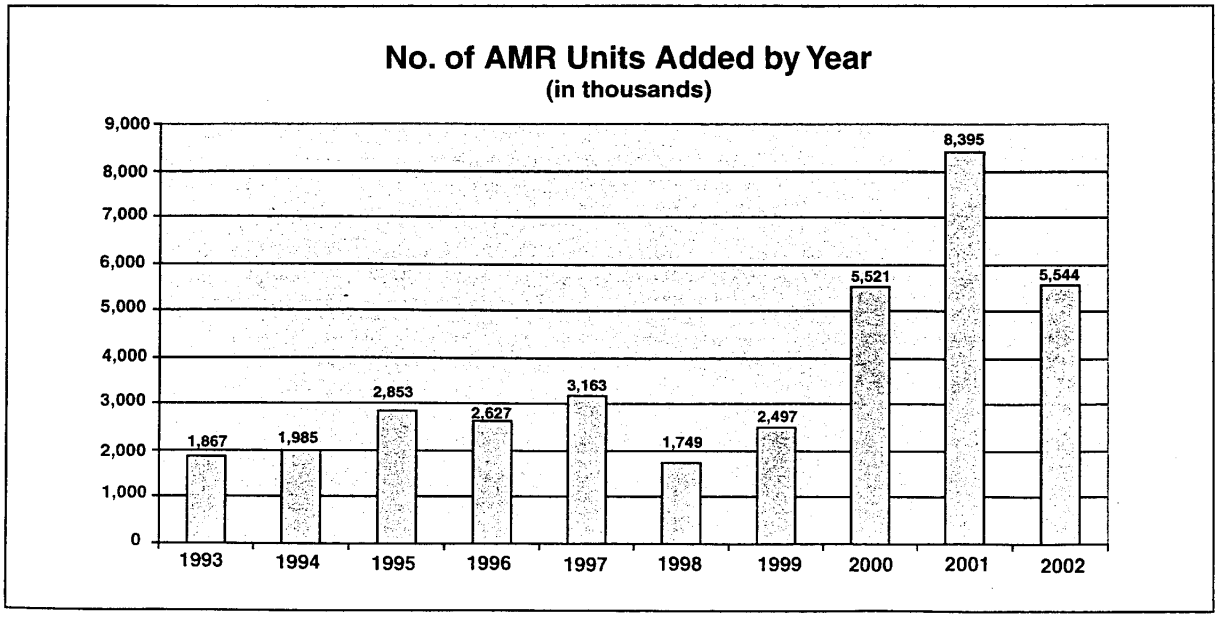
AMR growth slows, but remains strong

Editor's Note: This is a special publication of the AMR report research series. Members receive monthly analysis and news updates as well as survey data from more than 100 utilities. The conclusions and analysis included in this publication are from the just released Chartwell AMR Report 2002, 7th Edition.

Utilities are gradually incorporating AMR into their plans at a slow and steady rate, according to a new survey of 115 utilities from Atlanta-based Chartwell. The number of utilities using or at least considering AMR has increased from 85% to 96% over the past four years. This includes utilities using, testing, planning or considering the technology.

Chartwell surveyed 115 utility executives and managers via telephone in July and August 2002. Survey respondents were chosen at random to get a qualified





and representative sample of the industry. Of those only 4% said they were not considering AMR. (Please see graph on right of previous page.) Overall, the number of utilities that have installed or are installing or piloting AMR has remained near 80% over the past two years.

Most utilities see some need for AMR, whether for a full deployment or for niche applications, such as hard-to-read and commercial/industrial meters.

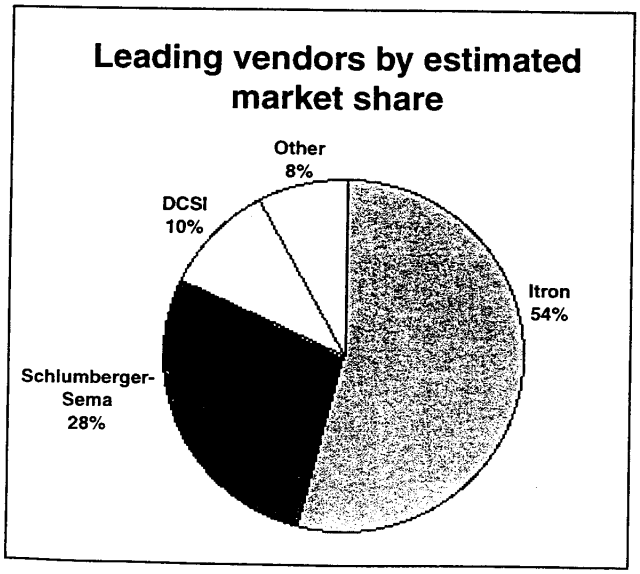
Although the industry's growth rate in 2002 apparently slowed from its breakneck speed of 34% in 2001, Chartwell's latest research survey shows that AMR deployments still increased by a healthy growth rate considering the state of the economy during that period. (Please see graph at bottom of previous page. For specific growth numbers, please see the AMR Report 2002, 7th Edition.) Nearly 14% of meters are expected to be AMR-enabled by year's end, a 2% increase over last year.

The projected growth numbers for 2002 are not the blockbuster increases seen in the past two years when a number of very large AMR installations ramped up, however. Instead, the industry seems to have stabilized — at least in the electric and water markets — from the previous years. Natural gas AMR installations continued to be slower than their counterparts.

Itron stays at the top; DCSI enters elite group

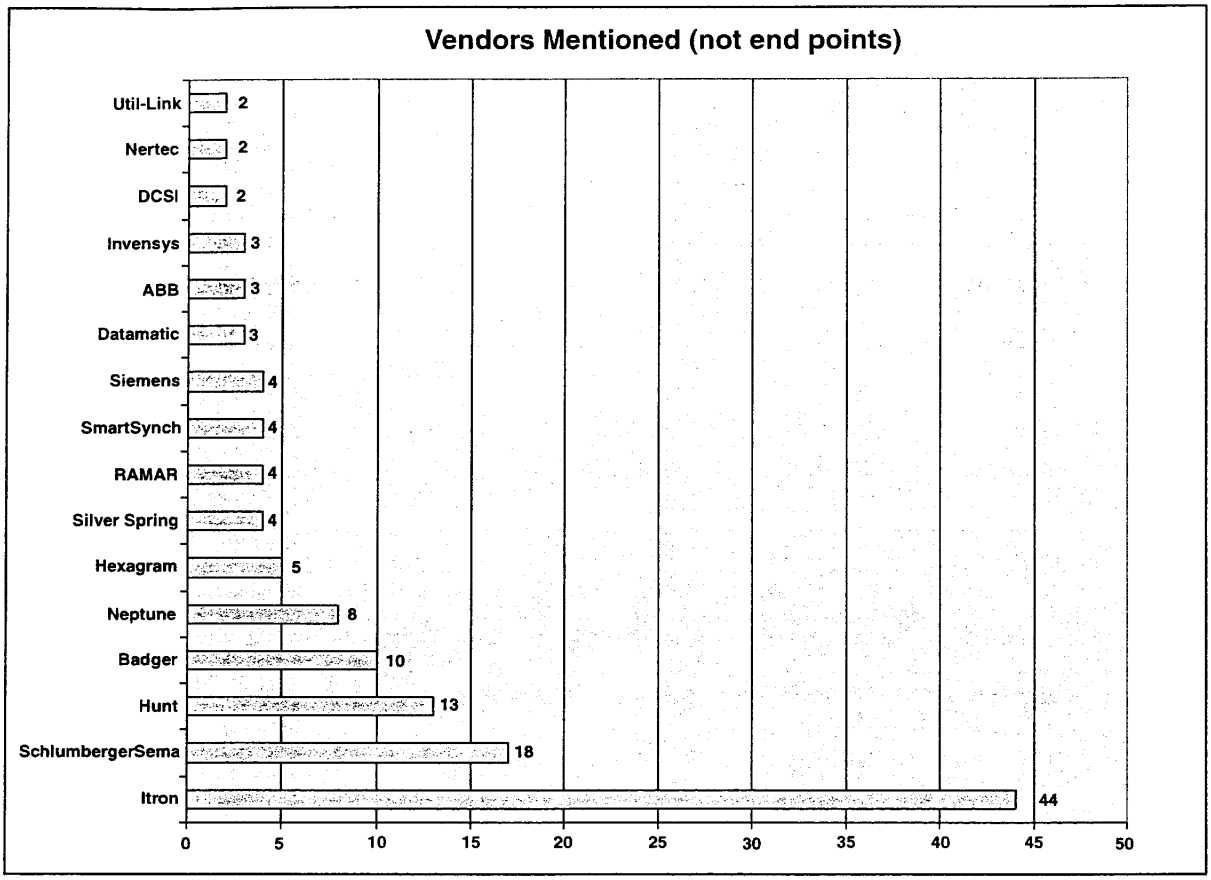
As for vendors, Itron's overall marketshare slipped slightly in 2002, but the Spokane, Wash.-based vendor still maintains a strong leading share. (Please see chart at bottom.) SchlumbergerSema increased its share of the pie by 4% from Chartwell's 2001 estimates as it still rides its large network buildouts inherited from the now-defunct CellNet coupled with additional contracts signed in the past two years. SchlumbergerSema would have grown by about two more percentage points, but the vendor sold off its water industry assets, which was renamed Neptune — its orignial moniker before being acquired by SchlumbergerSema — after the sale.

DCSI is the fastest growing vendor in the overall AMR market, though. The Hazelwood, Mo.-based subsidiary of ESCO Electronics has taken PLC technology to the next level with its two-way communications system dubbed TWACS. DCSI is no newcomer to the industry, but it seems as if more utilities are intrigued by the powerline carrier system now that it is proven. DCSI scored a number of large system buildouts — including installations of over one million end points at Puerto Rico Electric Authority, which is nearly complete, and PPL Electric Utilities, a contract signed earlier this year.



Other notable vendors rounding out the pie include Hunt Technologies, AMCO, Badger, Neptune and Invensys.

In addition, survey respondents said they are planning or considering Itron than any other vendor. (Please see graph on left.) Not surprisingly, DCSI, which is stretching into



Note: The graph above indicates the number of surveyed utilities that reported they were planning or considering certain vendors.

the investor-owned utility market, was among the next tier of hot vendors. DCSI, SchlumbergerSema and Datamatic — which is popular among water utilities — were each mentioned by six respondents in Chartwell's 2002 survey.

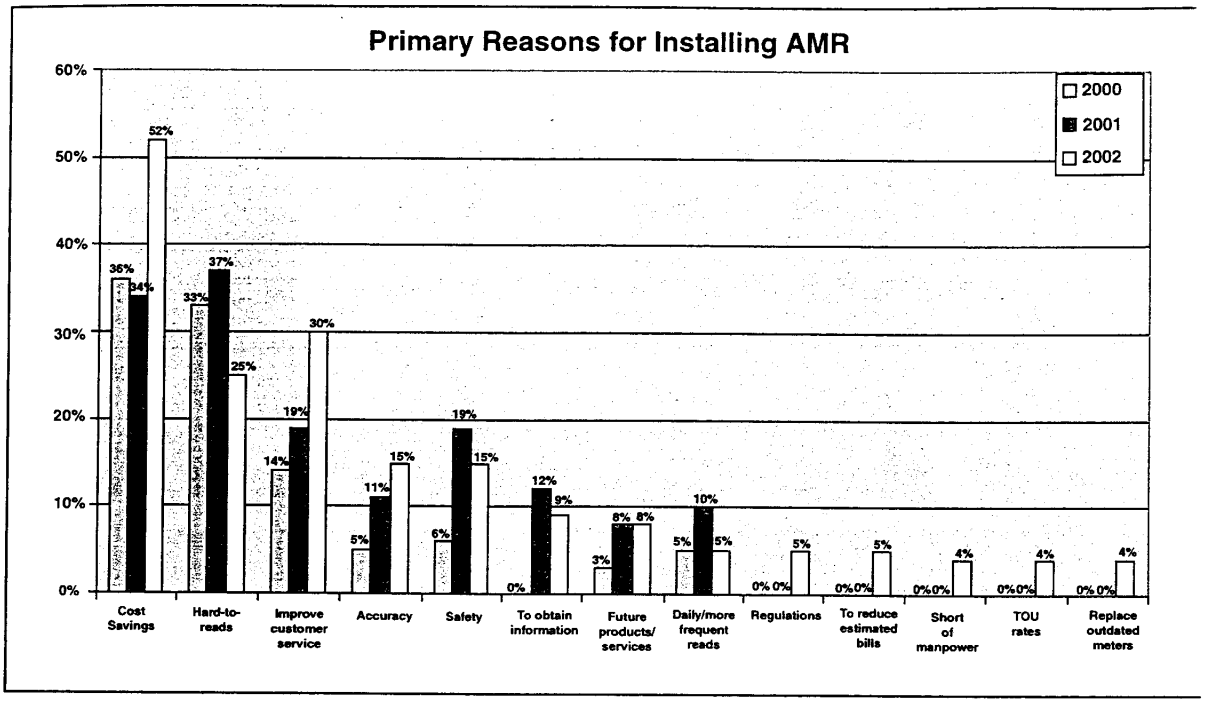
Five utilities are planning or considering Neptune, while three utilities said they were planning or considering Hunt. MuNet, NERTEC, Nexus-Data and RAMAR each received two mentions.

Despite the collapse of Coactive Networks, residential gateway vendors may be making headway. muNet continues to keep hope alive for utilities looking to offer Internet, cable and other additional services. The vendor is now getting follow-on orders for its technology. Meanwhile, Gulf Power of Pensacola, Fla. plans to use technology from Florham Park, N.J.-based Comverge Technologies to provide nanny-cam service to customers.

It should be noted that when Chartwell asked survey respondents which vendors are under consideration, some refused to answer the question for proprietary reasons.

A return to basics: Cost remains biggest driver

Tightening budgets and an increasing focus on customer service improvements coupled with a lull in the western energy crunch is leading utilities to take a back-to-basics approach to AMR. Utility officials are



again looking at AMR for its core drivers — saving money and improving service. (Please see graph above.)

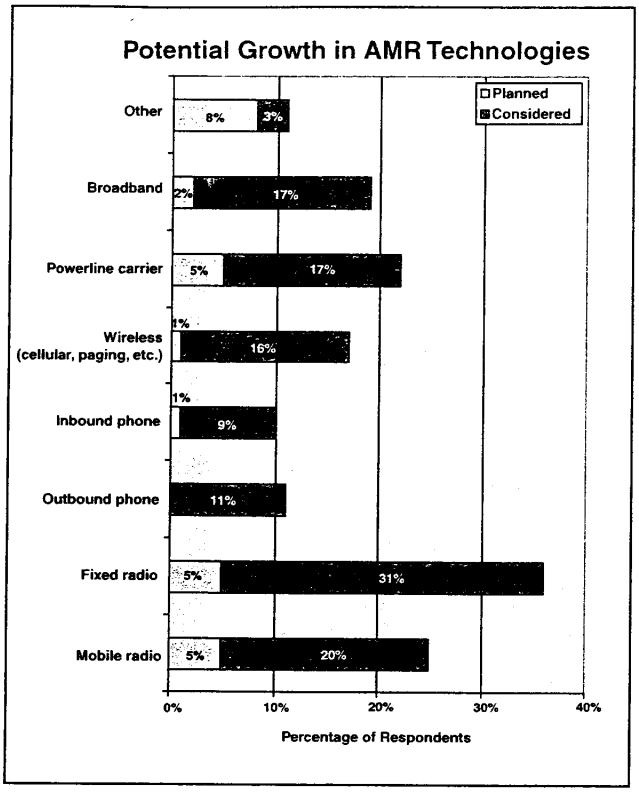
Utility budgets are becoming increasingly tight, and cost is top of mind for utility executives. With commissions making it tougher to get rate increases, utilities have to find some way to balance budgets — and many see AMR as one road to that end. The most basic premise for implementing AMR has always been to save money on reading meters.

Cost savings is far and away the primary reason many utilities are installing AMR. More than half of utilities surveyed in 2002 cited cost savings as a primary reason to install AMR — an 18% increase from 2001.

Additionally, many utilities are looking for AMR to help with strategic initiatives to improve customer service. Utilities also continue to implement AMR in small doses to provide timely, Internet-based data that can help large commercial and industrial customers decide when to shift loads. Other reasons for installing AMR include improving accuracy and safety conditions for meter readers, reducing the cost of transient reads, eliminating estimated reads and replacing outdated meters.

Worth noting is that many utilities hope to pass the hard costs of AMR systems on to their customers, with 37% of utilities reporting they have included AMR costs in their rate base or plan to petition regulators for such action in the future. Of the 72 utilities who responded with whether or not they planned to include AMR costs in their rates, those who do made up the majority of responses. Thirty-eight respondents said they did not know.

The biggest obstacle facing AMR vendors are not their competitors, but a do-nothing approach by utilities. But the good news is the number of utilities doing nothing with AMR continues to decline.



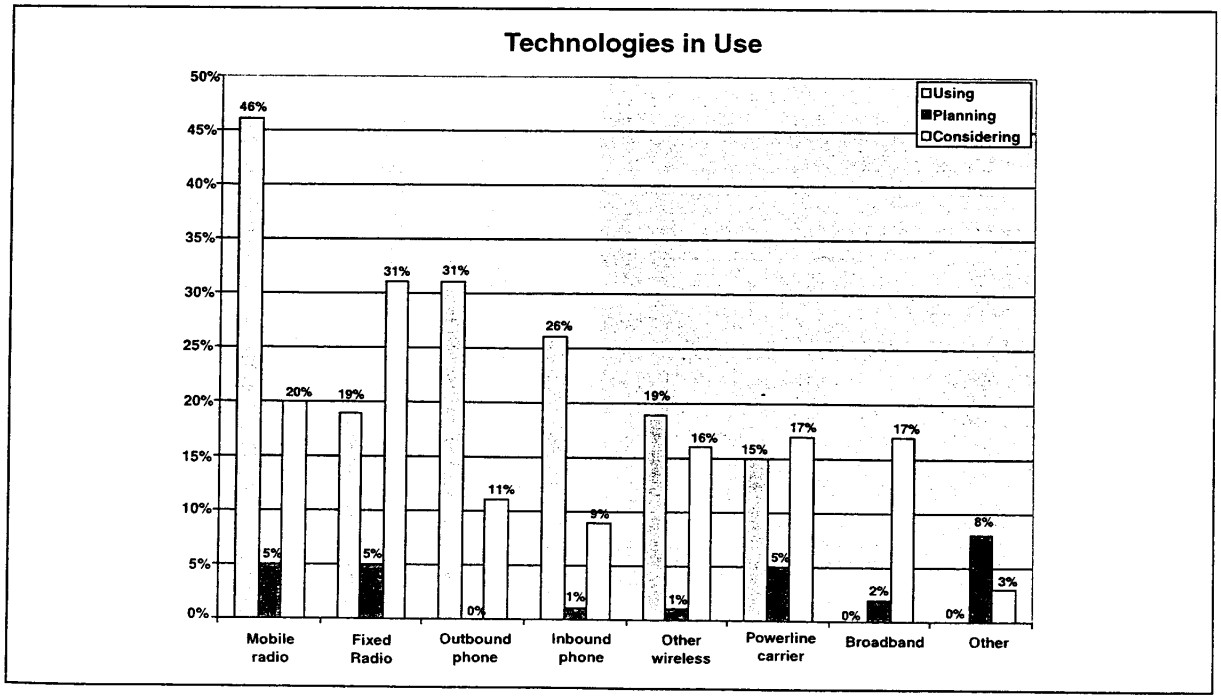
Fixed networks and wireless devices gaining in popularity

In regards to AMR technology, three major themes developed over the past year:

1. Mobile technology continues to dominate the market.
2. Wireless networks, whether proprietary of fixed, are poised for growth.
3. Powerline carrier is no longer just for cooperatives.

Mobile, or drive-by, point-and-shoot technology, is not sexy, but it is effective for many utilities looking to simply reduce the cost of reading meters. It is no wonder that more utilities use mobile systems than any other AMR technology. Almost half of utilities surveyed — 46% — have mobile AMR systems installed, a rise of 5% from 2001. (Please see graph below.)

But fixed radio and other wireless devices — both those tapping proprietary networks and public communication channels as a means of transmitting data — are by far the hottest technologies. Fixed radio alone had the strongest growth of any technology over the past year and is poised to continue that in 2002 and beyond. (Please see chart at left.)



About 31% of utilities are considering fixed radio technology, while 17% of utilities are planning or considering other wireless technologies. Fixed networks can provide the type of daily data that vendors push as the main benefit of AMR. This data can be used in a variety of ways, including load management.

Further evidence that the use of fixed networks will rise is that many utilities plan to install AMR on all residential meters. Utilities installing AMR throughout their service territory often opt for fixed networks.

Traditionally seen as a large-scale solution, fixed networks are also moving into niche applications. Austin Energy will use the SchlumbergerSema fixed network on about one-third of the utility's meters, mostly at apartments. By using the network's on-demand capabilities, the utility wants to eliminate costly off-cycle reads associated with students at the University of Texas.

Itron officials say the vendor's new fixed network, which was slated for roll out in late September 2002, is a more scalable and flexible solution.

Powerline carrier systems used to be almost exclusively aimed at rural electric utilities. Not anymore. DCSI's two-way automatic communications system (TWACS) has changed that. The system is being installed at two large utilities in the United States — PPL and Wisconsin Public Service.

PPL officials adopted DCSI's system because they said it provided the best solution for the utility diverse territory that included urban, suburban and rural settings. "Some of our more rural areas have rather low population density and some places where wireless signals wouldn't be very effective," PPL spokesman George Lewis told Chartwell.

Even Hunt Technologies, which has long dominated the rural electric cooperative scene with its basic, but reliable powerline carrier system, is targeting the IOU market. In 2002, the vendor rolled out a two-way PLC technology aimed at investor-owned utilities.

IMServ North America keeps options open, hopes for alternative solution to salvage Atlanta Gas Light deal

Editor's Note: *The next two stories are samples from the latest news issue of The AMR Report Research Series. Chartwell subscribers receive monthly news updates in addition to a monthly analysis of a specific AMR-related issue. The first story below is a follow-up to a story that Chartwell broke and reported to its members through an issue alert in August. The story reported how and why Atlanta Gas Light Co. had pulled out of a contract that called for the deployment of a fixed network on 1.3 million meters.*

We have regular ongoing conversations about meter reading and the role of AMR in that. We're hopeful we can have a relationship with them in the future.

Legal action is still a possibility, but for now the company that was to manage and operate a wireless fixed network system on 1.3 million meters at Atlanta Gas Light Co. still hopes to provide services to AGL, even though AGL has scrapped its plans for deploying the system.

In the summer of 2001, AGL tapped IMServ North America to manage and operate a fixed network from NexusData of Grapevine, Texas. But AGL pulled out of the contract in August after the Georgia legislature made metering competitive, a utility spokesperson says.

The utility did not want to risk the possibility of installing an AMR system for meters that it may not read, and exercised a contractual option to opt out of the deal if deregulation rules in Georgia changed, according to AGL spokesman Nick Gold.

However, IMServ North America president and general manager

Mike Jordan says he still he is still talking to AGL in hopes of working out a deal. "The conversations are ongoing about exactly how to deal with their concerns and situations of the project," says Jordan. "We have regular ongoing conversations about meter reading and the role of AMR in that. We're hopeful we can have a relationship with them in the future.

"If they get more comfortable with the energy marketers' role and maybe things become a little clearer to them, we'd love to entertain the opportunity to complete the project as planned or some variation thereof," says Jordan.

IMServ has not yet determined if it will sue the utility over its withdrawal from the deal, and Jordan was reluctant to discuss that possibility.

"It's not appropriate at this point to directly answer that. We'd prefer not to. Our preference would have been to carry the project forward as planned, but certainly our legal department at some point could make a decision on that. ... That's not our desire," says Jordan.

The vendor has not yet set a timetable for its next move, says Jordan. "We just continue to talk with them, and try to come up with a plan that both of us are happy with and can accommodate both of our needs," says Jordan. "And I assume both parties will be happy with what we come up with."

When it was signed, the deal appeared to be a trendsetter in the industry. Atlanta Gas Light, which operates in the only deregulated natural gas market in the U.S. in which all customers switched to other providers, was to install a fixed network in order to provide customers and energy marketers' more timely data.

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The deal was important to the AMR industry because AGL is one of the only utilities operating as a pipes company in a truly deregulated environment. AGL was a pioneering AMR utility that already has 600,000-plus Itron mobile AMR units on much of its meter base, and the planned fixed network was to be a second-generation system.

"We had no other option but to do so," AGL spokesman Nick Gold told Chartwell in August when asked about the utility's exit from the contract. "[With the opening of the meter market and the] new marketers that have entered the Georgia market, it was not possible and economically feasible to move forward."

The installation was also seen as a potential building block for NexusData. Many utilities consider the vendor's technology promising because it is designed to have fewer data collection points and cost less than other wireless fixed networks. However, the technology has yet to be proven in a large-scale installation, a concern for utilities considering the system.

Currently, the largest implementation of NexusData's technology is at Nicor Gas, where there are 10,000 units installed. Other utilities also plan to pilot it. Officials at NexusData declined comment on the collapse of the AGL deal.

Itron rolls out new fixed network designed for small and large applications

Flexible, scalable and inexpensive.

In previous years, those would be the last words associated with wireless fixed networks. But that is how Itron officials are describing the vendor's newest technology.

A look at some other vendors offering wireless fixed networks:

SchlumbergerSema
Hexagram
Datamatic
NexusData
SilverSpring Networks
Ramar

Itron officials say the vendor's new fixed network, which was to be rolled out in late September 2002, is more scalable and flexible solution than other similar solutions. Fixed networks are being increasingly used for smaller, more strategic applications such as high transient areas, and Itron officials wanted to make sure the system — dubbed Fixed Network 2.0 — could be used for a variety of services.

"We like to say it can be used for five meters or 5 million meters so to-speak," says Tim Wolf, Itron's marketing manager. "That means you can deploy it to automate data collection from a small, geographic area or population of meters cost effectively, but you can also do it from a larger area because the data from the local collection device goes over public networks."

The system collects data from each meter over a fixed wireless system, but the data can be sent back to the utility using a variety of communications networks, including wireless and broadband. The choice of networks will depend on the available communications networks, cost and other variables, say Itron officials.

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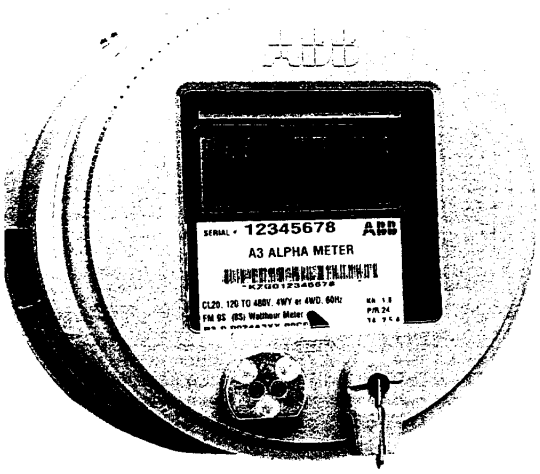
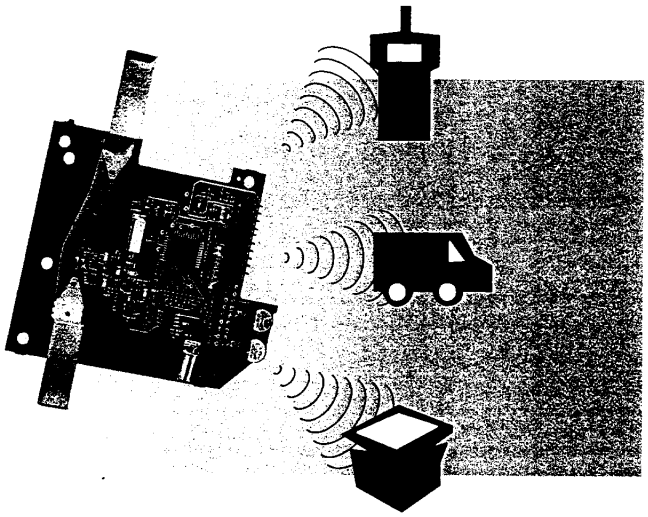
CHARTWELL
The Energy and Utility Information Source™

A3 ALPHA® Meter with 50ESS ERT®





Introduction

For many years, Itron ERT® devices have provided an economic method to collect consumption data from electricity meters. Until now, however, there has been no similar solution for collecting billing data from demand or TOU metered accounts. An ABB A3 ALPHA meter equipped with an "under the cover" Itron 50ESS ERT is an ideal solution to this problem.

The 50ESS ERT is designed to fit within the A3 ALPHA meter electronic assembly to simplify installation and reduce costs. The 50ESS ERT retrieves all billing data directly from the meter registers and transmits it to any of the following Itron data collection and software systems:

- Reading devices: Handheld OMR, Mobile AMR, MicroNetwork, and Fixed Network
- Reading software: PremierPlus4, MV-RS, and Integrator

The 50ESS ERT is similar to the Itron 41ER-1 ERT in that no wake-up tone is required. The 50ESS ERT, however, self-initiates transmission of three standard consumption messages (SCM), each containing a different value.

Metering Applications

Demand. The 50ESS ERT requires a TOU-enabled A3 ALPHA meter to collect demand data. The A3 ALPHA meter's calendar features are used to schedule automatic monthly demand resets. The 50ESS ERT retrieves and transmits the previous billing period data. This provides a full billing cycle to collect the data.

TOU. There are numerous options available in collecting simple TOU data with the A3 ALPHA meter with 50ESS ERT. Configuration and data collection options vary depending on the TOU rate.

Reactive measurement. When installed in A3K or A3R meters, the 50ESS ERT provides options for collection of energy and demand data, including reactive measurements.

Energy only. The 50ESS ERT can be used to collect energy data for simple consumption–only rates, including the ability to collect reactive energy on A3K and A3R meters.

Numerous configuration options are available depending on the A3 ALPHA meter type and the desired billing data. The 50ESS ERT can provide the following values based on meter type:

Meter Type	Energy	Demand	TOU	Reactive
A3D	✓			
A3T	✓	✓	✓	
A3K	✓	✓	✓	✓
A3R	✓	✓	✓	✓

Note. In all cases, data collection is limited to 3 values. Contact ABB or Itron for details on data collection options.

Meter Status

Two counters in each of the SCMs provide a total of six unique status indicators that provide important information about site conditions, including detection of possible tampering.

SCM	Counter	Indicates
SCM 1	1	Meter has been inverted
	2	Meter has been removed
SCM 2	3	Meter detected a button–press demand reset (possible tampering)
	4	Meter has a low battery warning or an end–of–calendar warning
SCM 3	5	Meter has an error or a warning that can affect billing data (for example, carryover error)
	6	Meter has a warning that may or may not require a site visit, depending on utility practice (for example, reverse energy flow warning)

Itron

ABB

asy Integration

ron system software automatically handles the association of the ıree billing values from each 50ESS ERT to a single primary ERT). This eliminates costly modifications to the utility CIS system.

ead Schedules

he A3 ALPHA meter provides an extensive and flexible calendar ermitting the use of both recurring and nonrecurring dates. This lendar is used to define the read schedules (demand reset dates) r meters with a 50ESS ERT. ABB's Metercat™ software can be ed to create and define a calendar schedule for each read cycle.

- If the read cycle is completely defined using recurring dates, then a perpetual calendar will exist and no calendar updates will be necessary.
- If no recurring dates can be defined, the A3 ALPHA meter can provide up to 21 years of scheduled nonrecurring monthly resets.

3 ALPHA Meter

he A3 ALPHA meter is the newest addition to ABB's line of LPHA electricity meters. The A3 ALPHA meter builds upon the rengths of existing ALPHA meter designs. Like its predecessors, ıe A3 ALPHA meter users ABB's patented digital measurement chniques that offer high accuracy, repeatability, and low owner- ıip costs. In support of open architecture standards, the 3 ALPHA meter is the first ABB meter with full ANSI C12.18, 12.19, and C12.21 support.

ll A3 ALPHA meters support the 50ESS ERT. Should your AMR eds change in the future, the A3 ALPHA meter can be upgraded support the functionality and communication options that you quire. The A3 ALPHA meter with 50ESS ERT is available in the llowing forms:

- single phase: 1S, 2S, 3S, 4S
- polyphase: 35S, 36S, 9S, 12S, 16S

he A3 ALPHA meter supplies many standard features such as:

- self reads (up to 15 self reads may be stored)
- over 50 different instrumentation display quantities
- system service checking
- Class 0.2 accuracy for transformer rated and self-contained meters

ABB A3 ALPHA Meter Specifications

Operating Ranges

Voltage	Nameplate nominal range	Operating range
	120V-480V	96V-528V
Current	0 to Class amperes	
Frequency	Nominal 50 or 60Hz ±5%	
Temperature range	-40° to +85°C inside meter cover	
Humidity range	0 to 100% noncondensing	

General Performance Characteristics

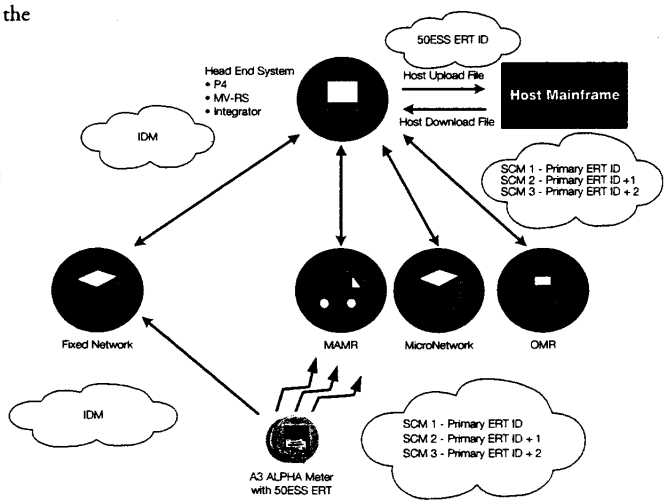
Starting current		
Form 1S and Form 3S	10mA for Class 20 100mA for Class 200 160mA for Class 320	
All other forms	5mA for Class 20 50mA for Class 200 80mA for Class 320	
Startup delay	<3s from power application to pulse accumulation	
Creep 0.000A (no current)	No more than one pulse measured per quantity, conforming to ANSI C12.1 requirements	
Primary time base	Power line frequency (50 or 60Hz), with selectable crystal oscillator	
Secondary time base	Meets the ANSI limit of 0.02% using the 32.768kHz crystal. Initial performance is expected to be equal to or better than ±55 seconds per month at room temperature	
Outage carryover capacity	6 hours at 25°C. Supercapacitor rated at 0.1 Farads, 5.5V	
Battery (optional)	LiSOCl, battery rated 800mAhr, 3.6V and shelf life of 20+ years. 5 years continuous duty at 25°C	
Communications baud	**Optical port**	9600 baud (nominal)
	Remote port	1200 to 19,200 bps

ANSI Standards

C12.1 C12.10 C12.20 C12.18 C12.19 C12.21

Itron 50ESS ERT Specifications

Transmit frequency	Spread spectrum 910-920 MHz
Data integrity	Verified in every data message
Operating temperature	-40° to +85° C
Operating humidity	5 to 95% noncondensing relative humidity
FCC compliance	Part 15 certified
ANSI compliance	Meets or exceeds ANSI C12.1 Standards
Environmental note	Uses a switch containing mercury



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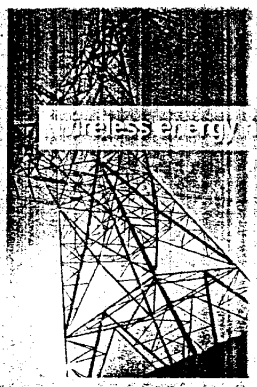

wireless energy network systems

SLB-Mod^3

commerical + industrial
wireless metering solution

Do you know your power?

know your power!

Under-the-glass Wireless Remote Polyphase Meter Reading + Control

Introducing the SLB-Mod^3, a RIM-based radio module that installs inside the SchlumbergerSema SENTINEL™ polyphase meter to facilitate remote meter reading & control. The SLB-Mod^3:

- Allows remote access to all register data provided by the meter (ANSI C12.19 compatible)
- Enables utilities to streamline C&I data management via the Internet
- Dramatically reduces costs associated with AMR and other data management functions
- Set to be released 3rd quarter 2002

Contact BlueSpan Communications:

- To be included on our product literature mailing list for release of the SLB-Mod^3
- For information on conducting an SLB-Mod^3 field trial or pilot

BlueSpan Solutions Enable:

- Bi-directional Information Exchange
- Actionable Knowledge Based on Real-time Activity
- New Revenue Streams from Value-added Services
- Rapid Provisioning & Deployment
- Choice of Network Service Options
- Increased Operational Efficiency
- Energy Outage & Restoration Data

BlueSpan Applications Include:

- Grid Integrity Monitoring
- Usage Monitoring
- Load Profiling
- Load Control
- Power Quality
- Submetering for Precise Knowledge & Control

BlueSpan Means:

- Enhanced Customer Insight
- Increased Customer Satisfaction
- Distributed Intelligence
- Actionable Knowledge

For Further Information Please Contact:

Sherri Musgrove, Director of Marketing
404.591.0086 (voice) • 404.231.9689 (fax)
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BlueSpan

Metering provided by
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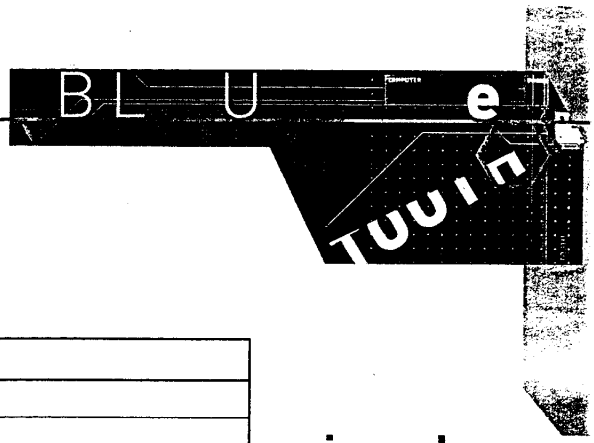

SLB-Mod^3

commerical + industrial
wireless metering solution

General Specifications

Description		Specification	
Power			
Single supply: Operation Range		4.10 to 4.75 VDC	
Battery Backup		NiMH	
Current Usage		Transmit Mode: 1700 mA	
Receive Mode:		54mA	
Stand-by Mode:		0.2mA	
Wireless Interface			
Networks Supported	DataTAC 800 MHz	Mobitex 900 MHz	GPRS 1900/850 MHz
Transmit Frequency	806-825 MHz	896-902 MHz	1850-1910 MHz & 824-829 MHz
Transmit Power		62 mW to 2.0 W at antenna port	
Receive Frequency	851-870 MHz	935-941 MHz	1930-1990 MHz & 869-894 MHz
Receive Sensitivity		Typical -118 dBm MDC (1% bit error rate)	
Antenna Type		Omni-directional patch	
Antenna Gain and Type		4dBi patch antenna	
Antenna Cable Connector		MMCX	
Communications			
Link Level Protocols	Radio Access Protocol (RAP) and Native Control Language (NCL)	Radio Access Protocol (RAP) and Mobitex Asynchronous Communications (MASC)	Radio Access Protocol (RAP) and Native Control Language (NCL)
Link Speed	1200-115,200 bps	1200-9600 bps	1200-115,200 bps
Field Strength Measurements		Readings Shown on Meter's LCD	
Certification			
FCC		Parts 15 and 90	
Canadian		Industry Canada RSS 119	
Environmental			
Operating Temperature		-30°C to +70°C (5-95% RH, non-condensing)	
Storage Temperature		-40°C to +85°C	
Operating Temperature		-30°C to +70°C	

Features

- Communications module embedded *"Under the Glass"*
- RF modem shielded by a metal enclosure; high noise immunity
- Supports reading intervals down to 5 minutes; response latency <10 sec. per message
- Supports SchlumbergerSema SENTINEL meter and PC-PRO+98 software
- User-definable alarms and thresholds for notification or profiling
- Transmits all register data native to the meter, plus data from external sensors (e.g. temperature)
- Data to or from multiple formats delivered to end-user system or energy management package
- Unparalleled wireless coverage domestically and internationally
- Modular technology for ease of installation, service and maintenance
- Remotely programmable

BlueSpan

simple
affordable
reliable
flexible

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Atlanta GA 30326

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e-mail: info@bluespancom.com

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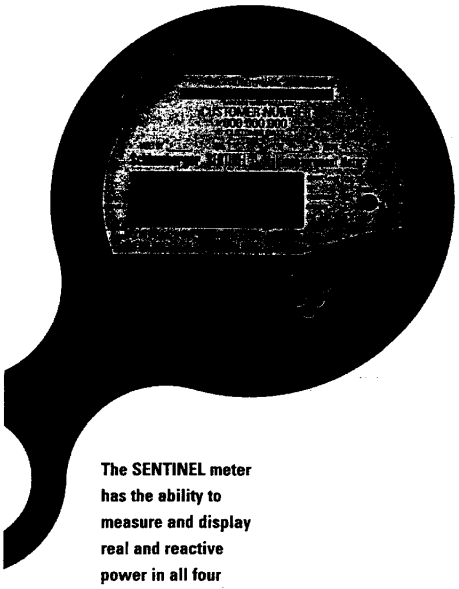
SENTINEL™ Electronic Multimeasurement Meter

Your Competitive Advantage



The SENTINEL meter has the ability to measure and display real and reactive power in all four quadrants.

Exceptional Accuracy

The SchlumbergerSema SENTINEL meter is a solid-state, electronic, multimeasurement, polyphase meter of exceptional accuracy. This self-contained or transformer-rated meter is designed for use in commercial and industrial locations, including large industrial sites and substations.

An advanced analog-to-digital sampling technique samples each incoming current and voltage waveform 32 times per cycle (60Hz). Voltage and current values are calculated every 2 cycles using true Root Mean Square (RMS) calculation. Volt-amperes are calculated by multiplying the RMS voltage value with the RMS current value, thus providing an arithmetic calculation for VA. The SENTINEL meter also allows for a vectorial calculation of VA.

Flexible Platform

The SENTINEL meter is modular in construction, consisting of electronic circuit boards that fit together to perform various functions including the following:

- Transformer input for current and resistive divider input for voltage
- Analog-to-digital conversion and measurement processing
- Register, load profile, real-time clock, and communications processing
- Input and output board for pulse accumulation or event notification

Protocols

The SENTINEL meter uses PSEM (ANSI C12.18-1996) protocol.

Dependable Support

SchlumbergerSema backs the SENTINEL meter with the reliable support you expect from the leading solutions provider to electric utilities. Our engineers work with you to implement the SENTINEL meter in the field and tailor its software to provide the intelligent, real-time information you need.

Key Features

- Class 0.2 accuracy
- 5 measurement levels
- MeterKey™ options: measurement level, TOU, load profile, power quality, bidirectional measurement, per phase voltage and current
- Upgradable firmware
- Error and event logging
- SiteScan™ onsite monitoring system
- Flexible configuration for various metering applications
- Pulse outputs and inputs
- Autoranging power supply (1 phase and 3 phase)
- PF (avg., min., inst.)
- Internal modem option board
- R300S (energy only), R300SD (energy and demand), R300SD3 (3 quantities) option board
- RS-232/RS-485 option board
- OEM development options
- Fixed network multifunction meter communication module (MFMM module)

Available Registers

Register data and program information are retained in non-volatile memory in the event of a power failure. The SENTINEL meter allows selection from hundreds of items for display. This information is displayed on a liquid crystal display (LCD) that is programmable by the user. The SENTINEL meter offers a wide range of parameters that can be programmed by the user through SchlumbergerSema PC-PRO+® 98, a 32 bit Windows® based meter programming software.

The SENTINEL meter, depending on measurement level, is capable of displaying the following registers:

Energy
- Wh: delivered, received, net
- VARh: delivered (lag) and received (lead), net delivered, net received, 4-quadrant
- VAh: vectorial and arithmetic, delivered, received, and lagging
- A^2h: aggregate
- V^2h: aggregate
- Ah: per phase and neutral
- Vh: per phase and average

Demand

Maximum, present, previous, projected, cumulative, continuous cumulative, and coincident demand values are available.

Demand Register Types
- Block and rolling demand intervals with programmable interval and subinterval lengths.
- Thermal demand calculations

Instantaneous Values

Updated every second

Self Read and Snapshot Data
- Two sets of snapshot data, automatically read at demand reset
- Four sets of self-read data, user programmable schedule
- One set of self-read data, automatically read at season change (last season data)

Standard Features

- Class 0.2 accuracy
- 5 measurement levels
- Upgradable firmware
- Error and event logging
- SiteScan™ onsite monitoring system
- Flexible configuration for various metering applications
- Pulse outputs and inputs
- Autoranging power supply

Optional Features

- MeterKey™ options: measurement level, TOU, load profile, power quality, bidirectional measurement
- Internal modem option board
- OEM development options
- Fixed network multifunction meter communication module
- PF (avg., min., inst.)
- R300S (energy only), R300SD (energy and demand), R300SD3 (3 quantities) option board
- RS-232/RS-485 option board
- BlueSpan communication module

I/O Network

The input and output options available are determined by the type of I/O board that is installed in the meter. The SENTINEL meter supports a maximum of 4 KYZ outputs, 1 low current/high current output, and 2 pulse or solid-state inputs.

Internal Modem

The modem allows customers to remotely connect to the SENTINEL meter to program or read the meter. It operates at a speed of 300/1200/2400 baud rates and is available for Stand-alone or Phone Line Sharing applications.

Software

- PC-PRO+® 98, PC-PRO+® 98 Advanced
- HHF meter data file creation with PC-PRO+ 98 Advanced version 5.0 or greater
- EnergyAudit™ 3.0

Voltage Input Rating

The SENTINEL meter has an automatic voltage sensing power supply, which is available in singlephase or three-phase. The singlephase power supply operates over a voltage input range of 120-480 V. The three-phase power supply operates over a voltage input range of 57.7-277V.

Technical Data

General Codes:

Conforms to:
- ANSI C12.1: 1995
- ANSI C12.20: 1997
- ANSI C12.21: 1999

Surge, Impulse, and RF Interference

Conforms to:
- ANSI C37.90.1: 1989
- ANSI C62.41: 1991
- FCC Part 15 (Class B)

Product Availability

	Transformer-rated	Self-contained
Socket	Class 20 - Form 9S (8S)	Class 200 - Form 16S (12S, 14S, 15S, 17S)
	Class 20 - Form 45S (5S)	Class 200 - Form 12S
	Class 20 - Form 46S (6S)	Class 200 - Form 2S
	Class 20 - Form 66S (26S)	Class 320 - Form 16S (14S, 15S, 17S)
		Class 320 - Form 12S
		Class 320 - Form 2S
A-Base	Class 20 - Form 10A (9A)	Class 150 - Form 16A (14A, 15A, 17A)
	Class 20 - Form 45A	
	Class 20 - Form 46A	
	Class 20 - Form 48A	

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International Symposium

AMR for C&I Customers

Robert I. Singh, P.E

Florida Power
A Progress Energy Company

Sept 29 – Oct 2, 2002

FOUNDATIONS For Business SUCCESS

NEED - C&I AMR DRIVERS

- On Time Reads
- Load Profile Data - Web Access
- Customer Access to Data
- Cost Of Service Study
- Early Problem Detection and Resolution
- On Demand Reads
- Calendar Month Billing
- Remote troubleshooting, phase angle check.

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Technologies

- POTS - Plain Old Telephone Service
- AMPS- Advanced Mobile Phone System
- Digital
  - TDMA - Time Division Multiple Access
  - CDPD - Cellular Digital Packet Data
  - GSM - Global System for Mobile
  - CDMA- Code Division Multiple Access

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What is GSM

- Global System for Mobile
  - 2G - Second Generation
  - Uses a 200 KHz channel divided into 8 time slots
  - One call uses one time slot in two channels
  - An FDMA-TDMA Technology
  - Operates on 1900 & 800 MHz in US Market
  - Other frequencies such as 900, 1800 in European Market
  - Utilizes SIM, interchangeable between devices.

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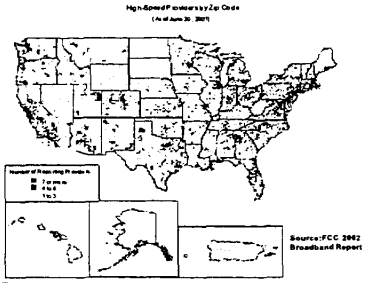
Broadband Deployment



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The 'G' Genealogy

1G Wireless	AMPS Advanced Mobile Phone Service	-Analog voice service - No data service
2G Wireless	CDMA Code Division Multiple Access TDMA Time Division Multiple Access GSM Global System for Mobile Communications PDC Personal digital cellular	- Digital voice service - 9.6K to 14.4K bit/sec. - CDMA, TDMA and PDC offer limited data transmission - Enhanced calling features like caller ID - No always-on data connection
3G Wireless	W-CDMA Wide-band Code Division Multiple Access CDMA-2000 Based on the Interim Standard-95 CDMA standard TD-SCDMA Time-division synchronous code-division multiple-access	- Superior voice quality - Up to 2M bit/sec. always-on data - Broadband data services like video and multimedia - Enhanced roaming

source: 3GNewsroom.com

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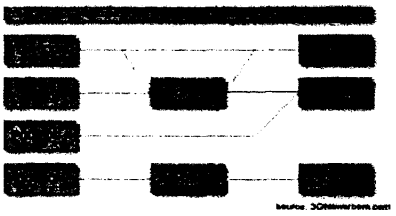
2G to 3G Evolution



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The Message. . .

- Deployments are at a slower rate than expected 5 years ago
- But, wireless communication technology is evolving and stabilizing
- Long term wireless infrastructure must be flexible to adjust to the changes and differing global standards
- Adaptability is important, because the unexpected may become reality . . .

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WHAT IS CDMA

- Code Division Multiple Access
  - First used by the military for secure phone calls.
  - CDMA is a "spread spectrum" technology, which spreads the call over the full 1.25 MHz bandwidth of the channel.
  - Capacity of 8 to 10 times that of an AMPS analog system
  - Improved call quality compared to AMPS
  - Higher Security
  - Improved Coverage - fewer cell sites
  - Operates on 1900 & 800 MHz in US Markets

METERING INTERFACE

- Internal Modem
  - Land Line Telephone
  - Analog Cellular
  - PCS under Glass
- External Modem
  - RS232/485

Internal Modem

- 1200/2400 Baud
  - POTS
    - Reliable
    - Limited throughput
    - Relatively expensive
  - AMPS
    - Obsolete Technology/Equipment
    - Limited throughput
    - Susceptible to noise

RS232/485

- EIA Standard
- No Internal Modem - Lower Cost
- Multiple meters on single device
- Flexibility - External Device
  - Can change out meter or modem
  - Can locate modem or antenna remote from Meter
  - Ease of Troubleshooting
  - Multiple Meters, one line
- Higher Throughput
  - 9600 and above

RS232

- Limited distance - 50 feet
- Limited devices on same modem
  - Subject to modem splitter
  - Can be expensive
- Suited for standalone installation

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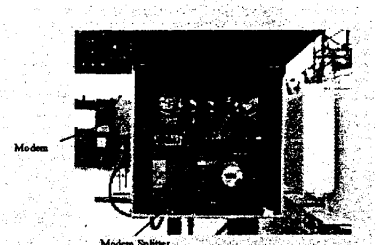
Typical RS232 Installation



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RS485

- Allowable distance up to 4000 feet
- 32 addressable meters on single device
- Can mix meter types on same digital modem
- Can access multiple devices with single call utilizing some software packages
- Lower cost per point with more devices
- Two or four wire Bus

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RS485 Connection Layout

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Simple Schematic Diagrams

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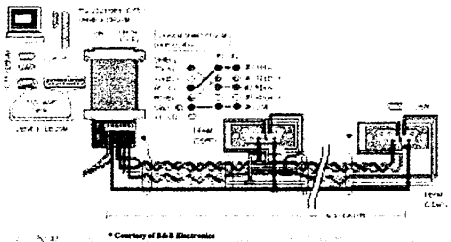
RS485 Wiring Diagram



* Courtesy of B&B Electronics

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RS485 Technology

RS485 will support 32 drivers and 32 receivers (we are talking about bi-directional - half duplex - multi-drop communications over a single or dual twisted pairable 1). An RS-485 network can be connected in a 2 or 4 wire mode. Maximum cable length can be as much as 4000 feet because of the differential voltage transmission system used. The typical use for RS485 is a single PC connected to several addressable devices that share the same cable. You can think of RS485 as a "party-line" communication system (like telephoning is handled by the Remote Computer unit). The RS232 may be converted to RS485 with a simple interface converter - it can have optical isolation and surge suppression. Electronic data communications between electronic will generally fall into two broad categories; single-ended and differential. RS232 (single -ended) was introduced in 1962, and despite reasons for its early demise, has remained widely used through the industry. The specification allows for data transmission from one transmitter to one receiver at relatively slow data rates (up to 20K bits/second) and short distances (up to 50 ft. @ the maximum data rate).

There are many cables available meeting the recommendations of RS5, made specifically for that application. Another choice is the same cable commonly used in the twisted pair Ethernet cabling. That cable, commonly referred to as Category 5 cable, is defined by the EIA/TIA/ANSI 568 specification. The extremely high volume of Category 5 cable used makes it widely available and very inexpensive, often less than half the price of specialty RS485 cabling. The cable has a maximum capacitance of 12PF/ft (14.5pF typical) and characteristic impedance of 100 ohms.

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Choosing Technology/Carrier

- Rate Plan -
  - Off Peak cheaper
  - need some on peak minutes
- Carrier Support
- Pooling of minutes
- Good Coverage
- IP capable to support packet data - Future
- Roaming agreement with between carriers

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Modem Manufacturer

- Technology driven, support
- Clear understanding of future
- Good documentation
- Watchdog circuitry for lockups
- OTA programmable - Update PRL (CDMA)
- Remote configuration

What you Need From Carriers

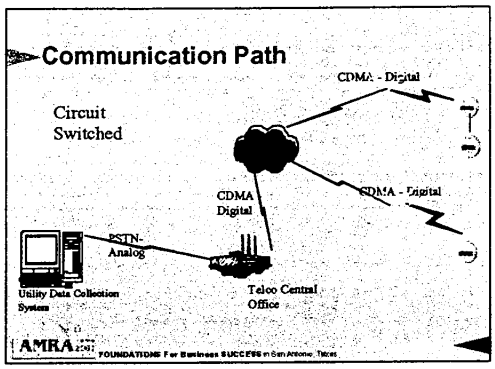
- Coverage Maps
- PRL - Preferred Roaming List
- System ID
- No Voice Mail
- No Caller ID
- No Three Way Calling
- Preference (A or B)
- Support
- Supports 1900 MHz, 800MHz and Analog

FPC DEPLOYMENT

- Identify Class of Customers
- Survey Accounts for Adequate Signal
  - RSSI - Relative Signal Strength Indication
  - Use AT Commands - CSQ?, CAD?, CSS?
    - 11 or greater - approx. equiv., to -90dBm
    - Use Higher Gain Antenna if needed
- One on One training with technicians
- Diagrams, instructions
- 75 Units deployed 2002 - Pilot
- 1000 planned for 2003 - 2005
- Devices available in Dual Mode, dual band or tri-mode dual band

Future

- 3G - Packet Data
- IP addressable devices
- Higher throughput
- Always On
  - 1xRTT, EV-DO - CDMA
  - GPRS - GSM
- Data Collection System that supports IP based devices


Communication Path
Circuit
Switched
CDMA - Digital
CDMA
Digital
CDMA - Digital
PSTN-
Analog
Utility Data Collection
System
Telco Central
Office
AMRA
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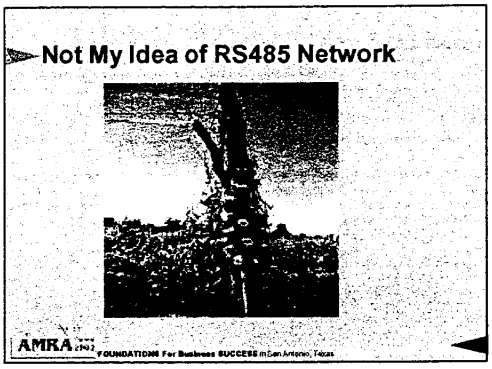
Not My Idea of RS485 Network
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TRACK - C , < EI Application

(2C)

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10 Top Reasons for C/I AMR

Incorporating Logic and $ into your Business Plan

Carolyn M. Kinsman
Automated Communication Links Inc.
Aclinc@aol.com
www.automatedcommunicationlinks.com

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Large Industrial Customers Over 5 MW

Historically these are the first customers to be connected to a telephone line that download information to the utility head-end software

Load forecasting

Special rate design

Customer information ... if they ask...

MR is born at the utility
ata is reviewed manually
ew other than the engineers see or know the value

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Large Commercial & Industrial Customers over 1 MW

Load Profiling

Special Requests

Customer Account request

Deregulation

Attempting a limited energy services retail program

If the price is right generation and transmission can use this
Special customers require special care

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Load Aggregation & Consolidation

Multi-site valued customers

Possibility for energy service offerings

Deregulation

Customers at risk to AEP

Customer Requests

Rate and Load Information

the budget and understanding is there evolution continues
ome concept is forming that the customer likes this
bility understand that this is only possible for good customer

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1

HUGS

Hospitals, universities, government & schools

Most prevalent for requesting assistance for facilities management

- Good rapport with service reps
- Rate testing
- Load control and device testing
- Often shares utility fiber

Generally part of items 9 & 10
Are patient customers to experiment on
Utility learns the value in commercial energy management
Marketing translates findings into retail service offerings

Load Forecasting

Energy Delivery
Power Purchase Agreements

Generally completed by rates and finance
Used to cost justify new generation & transmission
Environmental issues and lead time more difficult now

Individual Customer Profitability

Individual Customer
Profitability varies within the same rate class

Customer profiling ensures accurate development and delivery of rates and marketing programs

Profitable customers know who they are
Profitable customers may be able to shift load
Largest potential for power buy back from this group

Building New Rate Structures

More flexibility of rate contracts and options within standard customer rate classes

Minimum of 6?
interruptible, seasonal, etc.

Customer satisfaction and loyalty is assured
Understand usage and relation to bottom line
Long-term energy contracts means secure forecasting

WEB Based Information & Enhanced Services

The Value Environment has arrived

If utilities get this far percentage profit from services is higher than energy sales!
Customer programs small but over time do expand

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Because Information Technologies are not going away

- **Deregulation in some form is coming**
- **Bill settlement**
- **Alternate Energy providers**
- **Energy Service providers**
- **Energy Management Systems**
- **Facilities based conferences**
- **Manufacturing conferences**

Commodity Pricing will always be that
New revenues and profits must come from services
Environment, customers, evolution will occur
Utilities and/or other entities will provide these services

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New revenues and profits must come from services ?

Because the Customer Wants It!

$

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Wireless Communications for the 21st Century

Emerging Technologies

William H. (Bill) Kirby, Jr.
BlueSpan Communications Corp.

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Initial Thoughts

1. No technology is perfect.
2. No solution works everywhere every time.
3. No one company can provide the WHOLE solution.
4. Any given technology will probably provide an acceptable solution, given a defined set of circumstances existing at a given point in time.

THEREFORE...

We will focus on technologies that can provide affordable solutions for the metering function and offer a high degree of compatibility, reliability, flexibility, and scalability within an existing operating environment.

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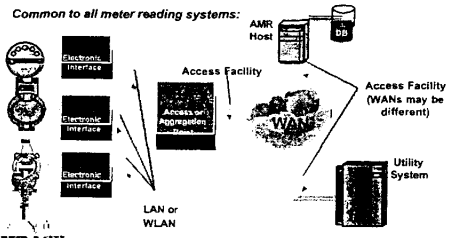
System Components

Common to all meter reading systems:



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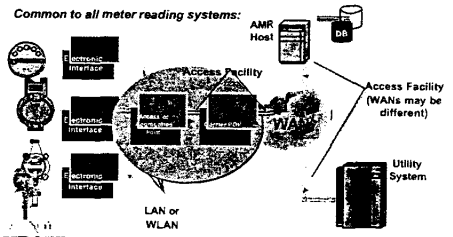
System Components

Common to all meter reading systems:



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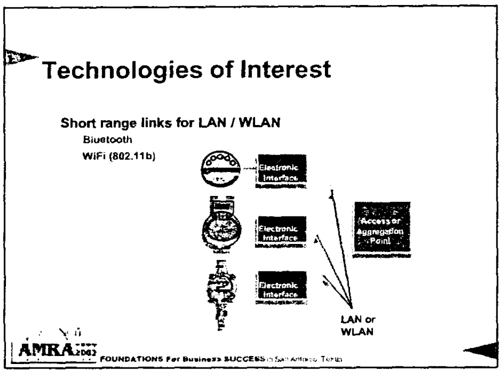
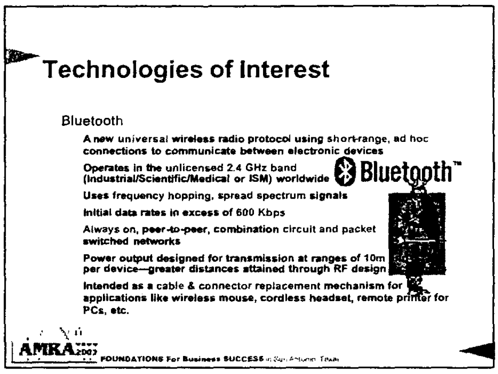
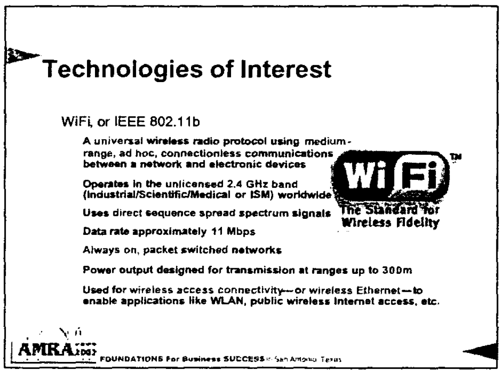
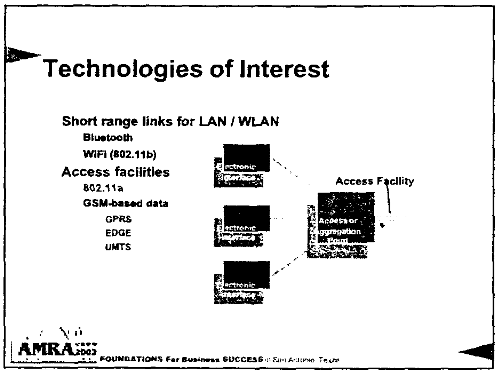








IEEE-802.11b : 2.4GHz, 11Mbps, 300m (免執照) (直接序列展頻)

IEEE-802.11a : 5 GHz, 54Mbps, 325m (〃) (正交分頻多工)

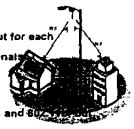
bluetooth : 2.4GHz (跳頻展頻), 600kbps, 10m(〃)

2

Technologies of Interest

IEEE 802.11a

- A wireless radio protocol using short to medium-range ad hoc, connectionless communication between a network and electronic devices
- Operates in the unlicensed 5 GHz band divided into 3 distinct domains with a different max power output for each
- Uses orthogonal frequency division multiplexed signals
- Data rate up to 54 Mbps
- Always on, packet switched networks
- Communicates at ranges between typical Bluetooth and 802.11b can go 325m
- Used for wireless access connectivity—or wireless Ethernet—to enable applications like WLAN, public wireless Internet access, etc.



Technologies of Interest

GSM-based technologies

- GSM (Global System for Mobile communications) is the most extensively used digital cellular network technology in the world
  - 850 million users in over 170 countries
  - 2G mobile is circuit -switched voice-oriented technology
  - Platform to migrate into 3G technology
- 3G introduces high-speed always on, IP and packet-based data:
  - *GPRS* (General Packet Radio Service) — 2.5G
    - Can be used in existing spectrum at 450, 850, 900, 1800 and 1900 MHz bands
    - Low-cost software upgrade
    - 30-40 Kbps average rate up to maximum 115 Kbps
  - *EDGE* (Enhanced Data for GSM Evolution) — 2.75G
    - Can be deployed in 800, 900, 1800 and 1900 MHz bands
    - Middle of the road post with hardware and software upgrades
    - Average data rates 80-150 Kbps but up to 473 Kbps
  - *UMTS* (Universal Mobile Telecommunications Service) — 3G
    - Expensive hardware -based upgrade
    - Mobile multimedia and video capability
    - Low-cost, high-capacity data up to 2 Mbps fixed or 384 Kbps mobile

Technologies of Interest

Short range links for LAN / WLAN

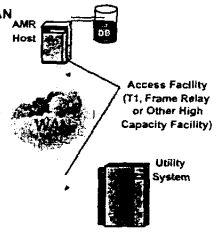
- Bluetooth
- WiFi (802.11b)

Access facilities

- 802.11a
- GSM-based data
  - GPRS
  - EDGE
  - UMTS

WAN

- Internet

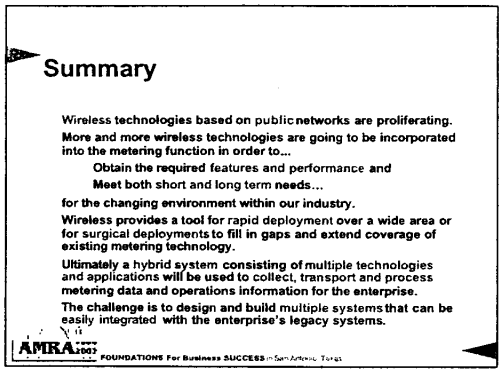


Technologies of Interest

The Internet

- A global communications network consisting of thousands of interconnected networks...
  - Pervasive
  - Distance insensitive
  - Compatible with multiple communications technologies, both wireless and wireline
  - Easy, inexpensive access via numerous interface devices
  - Enables rapid deployment of applications

With proper security techniques in place, becomes the ideal Wide Area Network for energy information applications


Summary
Wireless technologies based on public networks are proliferating.
More and more wireless technologies are going to be incorporated into the metering function in order to...
Obtain the required features and performance and
Meet both short and long term needs...
for the changing environment within our industry.
Wireless provides a tool for rapid deployment over a wide area or for surgical deployments to fill in gaps and extend coverage of existing metering technology.
Ultimately a hybrid system consisting of multiple technologies and applications will be used to collect, transport and process metering data and operations information for the enterprise.
The challenge is to design and build multiple systems that can be easily integrated with the enterprise's legacy systems.
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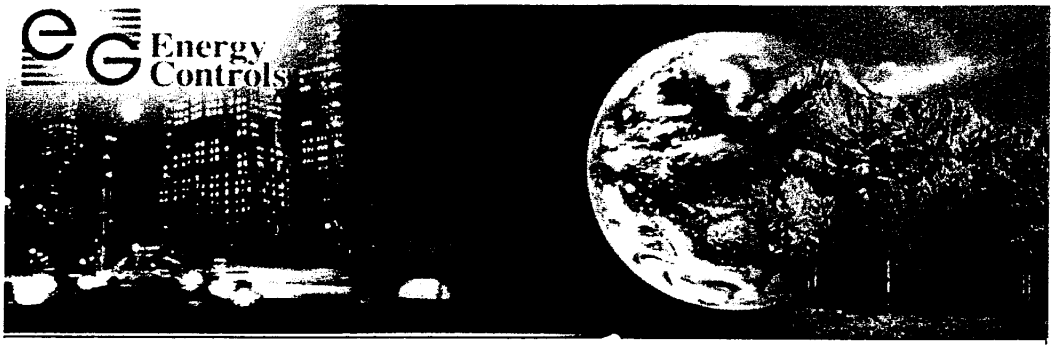


Who We Are...

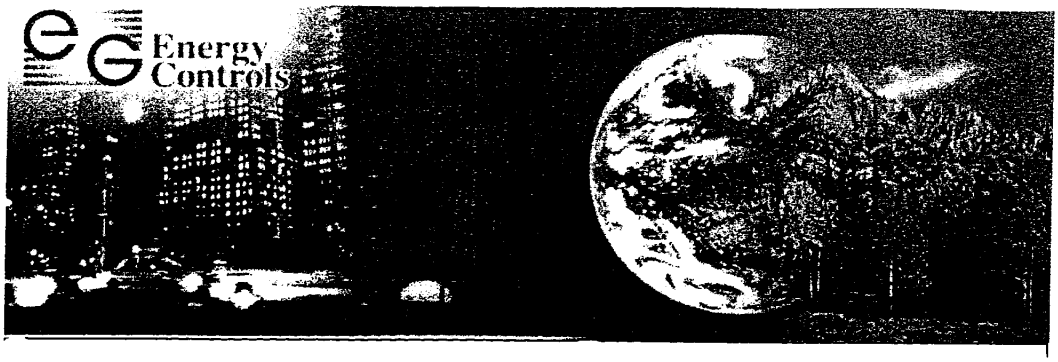
EG Energy Controls is a privately held high tech firm, based in Amherst, Nova Scotia, Canada. Edward Herniak, founder and CEO of EG Energy Controls Ltd. is the principal designer. Mr. Herniak possesses many years of experience in the field of power control technology.

Ever since its founding in 1990, EG has recognized that after rent and direct labor costs, energy and maintenance are the biggest expense items for companies. Therefore, EG Energy Controls have developed and manufactured several energy saving products for commercial and industrial applications. EG began with an analog Demand Controller but soon realized that this system was quite limited. During the following months in Research and Development, a new line of products were developed and launched as **Energy Smart Modules** ™. These products offer quality, reliability and state of the art technology at a competitive price for end-users.

EG markets and distributes its products directly to end-users and through Energy Saving Centers located in Canada and the US. EG's products are certified by ENTELA, a nationally recognized testing and rating firm.

Mission:

EG Energy Controls Ltd is committed to deepening customer trust through quality of our products and service, our responsiveness and accountability in everything we do. We connect with our customers by by understanding their needs and providing information and products to realize their energy savings. We work to ensure that the customers' existing equipment is compatible with our products. EG broadens choices by identifying new energy trends and providing its customers with innovative, reliable and cost effective technology.

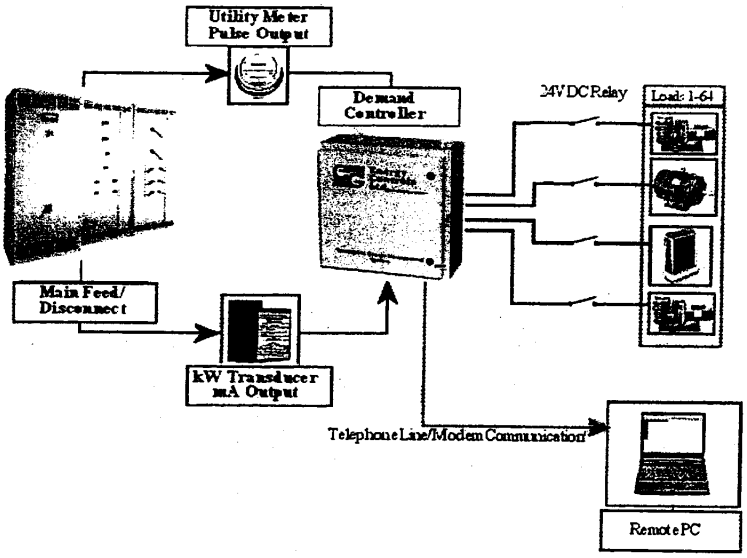


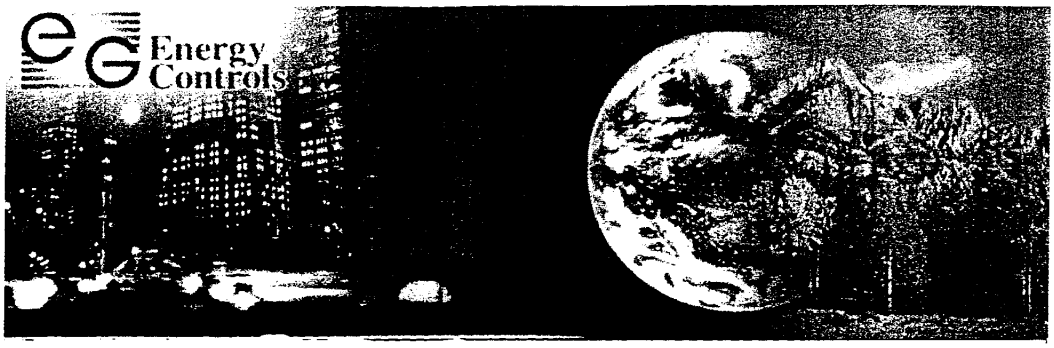
DemandMiser™ - Maximum Demand Controller

DemandMiser™ Maximum Demand Controllers monitor the instantaneous and demand power and controls them to achieve an average of 1530% percent on Maximum Demand Charges. This is achieved by temporarily reducing or cycling loads during peric of high demand. The **DemandMiser™** Maximum Controller is capable of controlling up to eight loads (power consuming devices). **DemandMiser Plus™** is designed for larger installation where as many as 64 loads can be controlled to achieve the desired savings. For technical specs click here

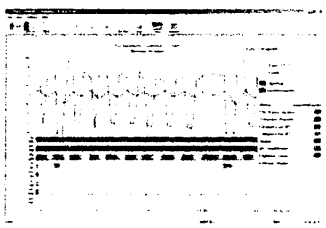
DEMANDMISER™

Demand Controller Connection Diagram





EnerMiser™ - Demand Controller



EnerMiser™ - Demand Controller

The Demand Control module of EnerMiser is a truly affordable energy management tool. Correctly implemented, they can produce a saving of **15-30%** per month on *Maximum Demand* charges.

Net electricity charges have two components; the kWh charge and the *Maximum Demand* charge. The kWh charge is based on the energy consumed, and as a result cannot be easily reduced. However, the *Maximum Demand* charge is based on the highest recorded peak demand. These peaks occur when several electrical loads are active simultaneously. By reducing loads during periods of high demand the *Maximum Demand* charge can be significantly reduced.

Click Here For Detailed Pamphlet

Specifications

Input

$0\text{-}5V_{DC}$ 0.1A

Output

8 Sequential/Alarm/Load Shedding Outputs

$24V_{DC}$ or Potential Free N/O or N/C (5A) Contacts

Gateway Connection

RS232 – RS485

Bus Length

1.2km (Beldon Communication Pair)

Communication

RS485

Enclosure

Material Steel -NEMA 12

Dimensions – Control Module

D-6" x W-12" x H-12"

ENTELA / NRTL / CSA – Certified

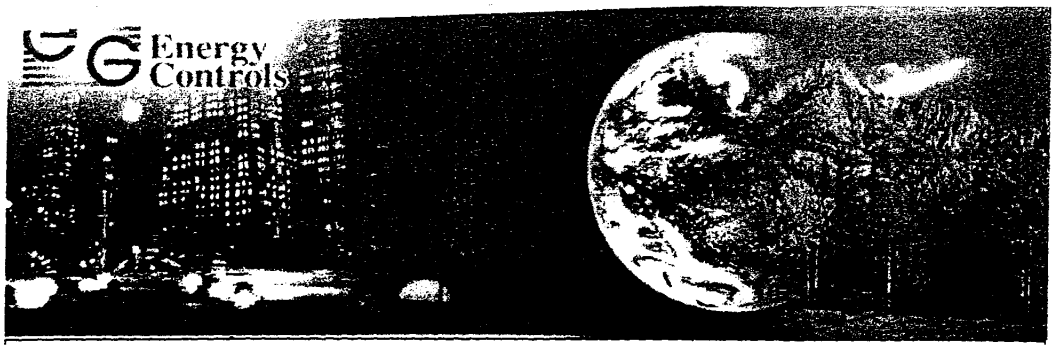
Features

- Adjustable Demand Limit Setting
- Graphical/PC User Interface
- Monitors kWh, Instantaneous kW, and Thermal kW.
- Modem and Internet Communication
- Universal Transducer Interface
- Load Profiling
- Stand Alone Operation
- Upgradable for HVAC control

Considerations

In order to implement the installation of a Demand Control system, the following must be considered:

- Assessment of Billing History and Demand Structure
- Identification of Sheddable Loads
- Assessment of Load Pattern
- Evaluation of production process
- Pentium 75 w/t Windows 95, 98, 00 *(or greater)*

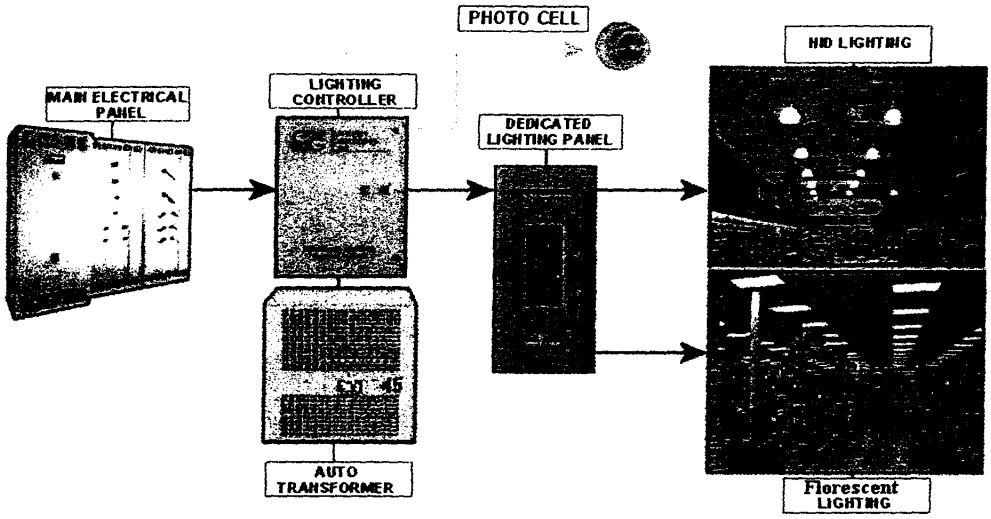


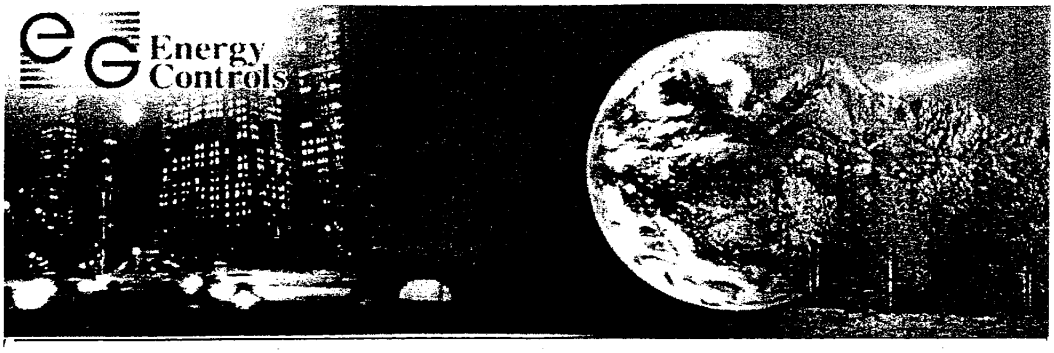
VoltMiser™ - Lighting Controller System

VoltMiser™ Lighting Controllers are designed to reduce lighting energy consumption by as much as 20% in florescent and 25% HID (High Intensity Discharge) lighting systems. The types most commonly found in industrial, commercial, institutional, office, retail and warehouse space. **VoltMiser™** Lighting Controllers are useable in retrofit as well as new installations. Since control is provided at the panel level, no extensive rewiring of fixtures is required. The units are also very compact, requiring a minimum of space. For technical specs click here

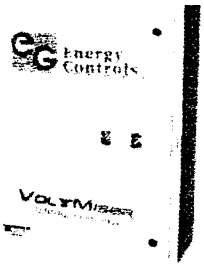
VOLTMISER™

Lighting Controller Connection Diagram





VoltMiser™ - Lighting Controller



VoltMiser™ - Lighting Controller LITE-XX-XXX

Lighting Controllers are vital building tools of any energy management strategy. Through programmed time schedule and automatic multi-step power reduction, significant energy savings can be achieved. Correctly implemented, the Lighting Controllers can achieve on average **real dollar saving of 15-25% each month** on Maximum Demand and kWh charges. The Lighting Control is designed to provide High, Medium or Low voltage supply to the lighting panels. Since the system employs an auto-transformer, it is considered to be the most efficient method of step voltage control. It also sustains perfect sine wave and as a result, does not create any harmonics in the power system. This type of control is suitable for **Fluorescent and High Intensity Discharge Lamps**. The controller supplies High, Medium or Low voltage to the existing lighting panel and therefore, is ideal for retrofit applications or for new constructions.

Click Here For Detailed Pamphlet

Specifications

Input Voltage

3 x 347 / 277 / 220 / 208 / 120 V

Output

25 / 37 / 50 / 75 / 100 kVA

Power Reduction

HID - 15 / 20 / 25 %
Fluorescent - 15 / 20 %

Lumen Reduction

HID - 20% @ 15% Power Reduction
Fluorescent - 12% @ 15 % Power Reduction

Lamp Warm-Up Time

20 Minutes

Miscellaneous Data

Working Temperature 7°C —— 40°C (45°- 104°F)
Temperature Storage 0°C ——55°C (32°-131°F)

Enclosure

Material Steel

Dimensions

D-203 mm x W-610 mm x H-610mm
D-8", x W-24" x H-24"

Features

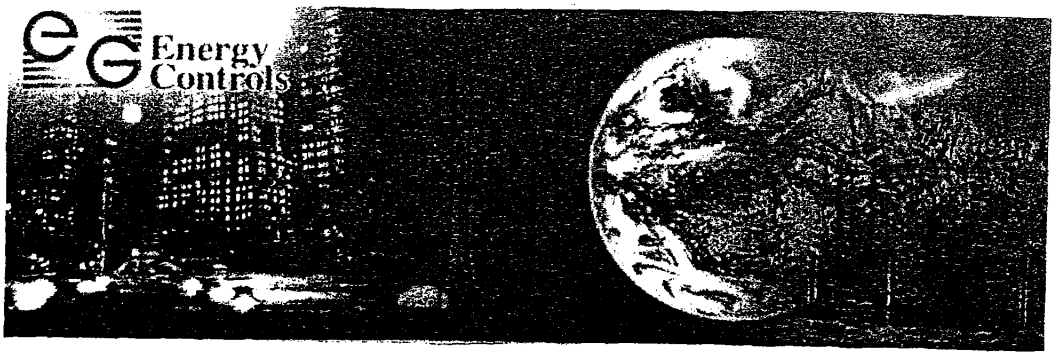
- Modularized for easy Expansion
- 99.5% Operating Efficiency
- 80- 100% Voltage Output
- Automatic Full Voltage At Start Up
- Lamp Warm-Up Timer
- 24 -Hour, Seven Day Programmable Timer
- Temporary Lighting Override
- Demand Control Interface
- Photocell Control

Considerations

In order to implement the installation of a Lighting Controller the following steps are considered:

- Assessment of Lighting Fixtures
- Evaluation of monthly kWh & Maximum Demand values for at least 12 months
- Evaluation of production process
- Assessment of the load pattern

ENTELA / CSA -Certified / Special Inspection



EG has designed a calculator that enables you to calculate the amount of savings you can gain by implementing the **VoltMiser**^{TM}.

You input the amount of lights, the number of days and the amount of power reduction recommended 15/20/25%.

With this information the calculator will calculate the total annual energy savings available.

Lighting Data

Lighting Area #1

Type Of Lights	
Number Of Lights	
Wattage of Each Light (W)	

Lighting Area #2

Type Of Lights	
Number Of Lights	
Wattage of Each Light (W)	

Control Data

Power Reduction (%)	
Hours Controlled Per Day	
Days Controlled Per Week	
Hours Off Per Week	
Number Of Months	

Utility Charges

kWh Charge	
Demand Charge	

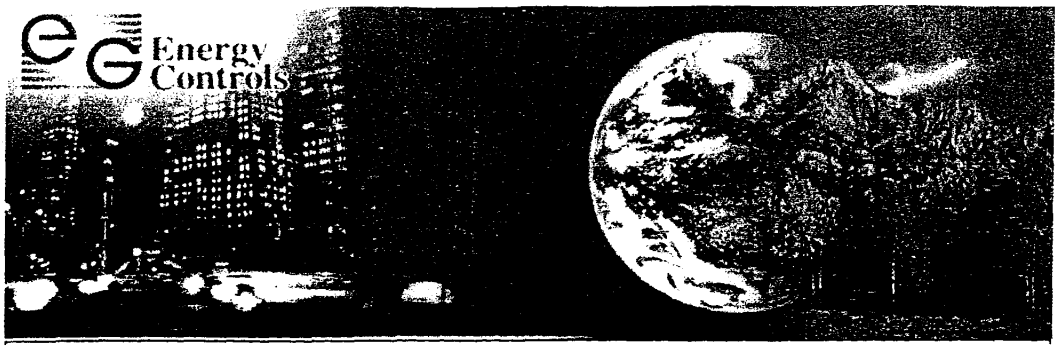
Summary

Instructions

- Simply count the number of light fixtures in each area with their wattage. Don't forget to include the wattage of the ballasts. (Ex. HID Lamp 400 WATTS consumes up to 43C WATTS per fixture.) (Ex. Fluorescent T8 4 foot lamp with ballast consumes 35 WATTS each.) Use these numbers in the wattage of each light.

- Power can be reduced up to 25% for HID lamps and ballast but only up to 17% for fluorescent lamps and ballast and HPS (High Pressure Sodium) lamps and ballast. Note: when combining mixed lamp types the lowe power reduction must be used. (Ex. HID and Fluorescent overall power reduction can only be 17%)

- The hours controlled per day are the actual run times that the lights are on.
- Days controlled per week is the lights on time in days.
- Hours off per week is optional unless lamps are running 24 hours a day 7 days a week and there is no off time ignore this box.
- Number of months applies only with seasonal facilities
- Kwh (Kilowatt Hour) charges are the utility rates for energy use. Usually in cents per kilowatt hour. (Ex. $0.05 cents kWh)
- Demand charge is also provided by the utility in dollars per kilowatt. (Ex. $7.5 per kilowatt)



Kent Building Supply's Bottom Line Brightens Up With VoltMiser™ Lighting Controllers

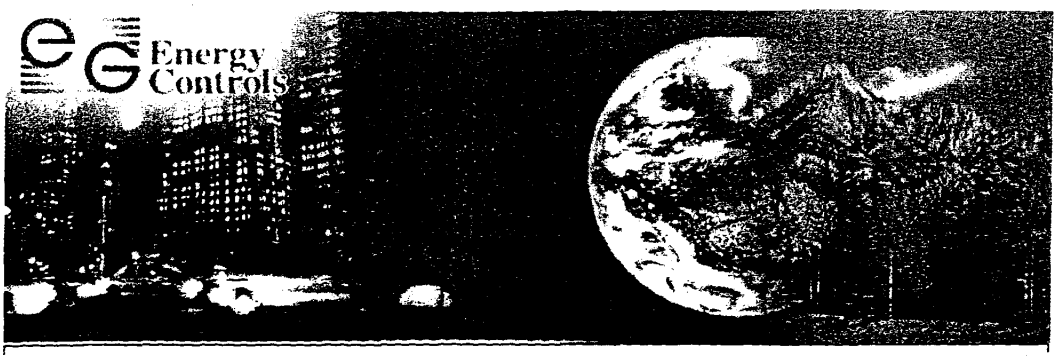
- Runtime of the facility is16 hrs a day, 6 days a week with 24.5% power reduction
- Lighting for this facility consists of 400500 Metal Halide Fixtures.
- Four VoltMiser™ Lighting Controllers were installed in the electrice room to provide three power reduction levels
- Operation is controlled from two locations, the contractor desk in th front of the store and the main lighting control panel in the electrical room.

Kent Building Supplies of St. John, NB (New Brunswick , Canada) is the largest home improvement retailer in Atlantic Canada, employing over a thousand dedicated associates. They have grown rapidly in the past decade, adding modern Home Improvement Warehouses to their superior chain of home center outlets.

Their modern store layout averages 28,000 square feet for their home center, with the latest warehouse stores boasting a size of 138,000 square feet. They are proud of what they do and have built a reputation for excellence. For the last five years, they have ranked in the top ten nationally for home center sales.

In 1998, Kent was adding a new 100,000-sq. ft. facility to their chain located in Fredericton , NB. EG Energy Controls VoltMiser™ Lighting Controllers were installed in the new store to save lighting energy costs. "Lighting is a major electrical load and poses a substantial operational cost burden in a facility this size"; according to Project manager Rick Davis. Mr. Davis affirms that: **"They are pleased with the results of the EG supplied Lighting Controllers and although a 24.5% power reduction to the lighting fixtures have been achieved, they have not had any discernable reduction in illumination levels on the sales floor".**

Measured against other Kent stores in the region, energy consumption results at the Fredericton store have been impressive. The payback on their investment was less than 22 months, better than the two-year payback period typical of EG Energy Controls VoltMiser™ and other energy saving products. Mr. Davis also states that; "On the basis of these results, they intend to include EG Energy's systems as a standard feature in all of their future building plans".



EnerMiser™ - Energy Management System

EnerMiser™ Energy Manager is a modular, multifunctional system designed to economically provide both control and monitoring of energy usage in smaller enterprises. Modules are provided for lighting control, controlling maximum demand, HVAC control as well as monitoring environmental and alarm conditions. Due to its diverse capability and ability to be expanded to monitor or control as many as 2000 points, **EnerMiser™** provides both a very attractive investment payback and long term value.

- **EnerMiser™ Demand Controller**
- **EnerMiser™ Real Time Energy Controller**