BID CLARIFICATION MATERIAL

CELLNET

Thomas, Chenoa

From: Jay Evensen [jay.evensen@cellnet.com]
Sent: Friday, April 15, 2005 1:22 PM
To: Giudici, E. Anthony
Subject: Cellnet Disconnect

Tony,

It appears that we inadvertently missed the request for pricing for a meter with the disconnect device in the PG&E request for BAFO. We would like PG&E to consider our follow up to include this item.

100,000 ea single phase form 2s, 240v/200A solid state electric meters with an integrated disconnect (no external collar) and a UtiliNet 2 way radio (compatible with the network) price $215 ea.

This meter is currently under integration and will be available for commercial production in the next 3-4 quarters.

This meter can be used in any of the various network options shown within our pricing submitted to PG&E on the 14th of April.

We again apologize for the omission. If I can provide any clarity or other information please advise.

Jay

Cellnet
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www.cellnet.com

Thomas, Chenoa

From: Jay Evensen [jay.evensen@cellnet.com]
Sent: Thursday, April 14, 2005 4:21 PM
To: Giudici, E. Anthony
Subject: Cellnet BAFO response

Anthony,

Cellnet has enclosed its response to the PG&E AMI BAFO. Please do not hesitate to call us if we can provide any additional clarification.

We look forward to your further review.

jay

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Schedule 1 - BAFO Instructions
Cellnet

General

1. PG&E wishes to clarify the procurement roles and responsibilities of PG&E and the selected AMI System provider. Please confirm that your bid is consistent with the following instructions. In addition, please specify any differences of approach that you would recommend and upon which your bid is based:

    a. PG&E will continue to procure new gas and electric meters through its existing Supply Chain group. Vendor's AMI proposal should be based on utilization of new meter equipment sourced by PG&E in accordance with the list of approved meters provided with the RFP (Attachment 1-9 and Attachment 1-10). Confirm that your AMI technology will integrate with equipment from those suppliers or provide the expected date it will integrate. Identify any exceptions where products are not currently available and/or not planned for integration with meter products on PG&E's approved list.

    Cellnet Response: Cellnet can provide compatible gas AMI modules for currently manufactured new gas meters, shown on PG&E Attachment 1-9.

    Cellnet can provide compatible electric AMI modules for currently manufactured new electric meters shown on PG&E Attachment 1-10, Section II Approved for Purchase, with the exception of GE model kV series, Itron model J5, Landis+Gyr models of Altimus and DX/k base, Siemens/PSI model Quad 4 series, and Ametek meters.

    Cellnet has also licensed its technology for integration into the manufacturing of the Landis + Gyr model Focus meters and the Itron models of Centron and Sentinel meters.

    The Cellnet electric meter AMI modules come in two forms i) integrated into solid state electric meters with Cellnet compatible board level components during manufacturing, and ii) an AMI module that is shipped from Cellnet and retrofitted onto an new typically electromechanical meter (at the meter manufacturer) or on an existing PG&E electric meter (at a retrofit shop). Due to the product configuration it will be impossible for vendors to quote a separate AMI module price for some of the integrated electric meters including the Landis + Gyr Focus and S4e, and Itron Centron and Sentinal meters, residential solid state meters.

    a. The AMI vendor will warrant the AMI retrofit modules. The meter vendor will warrant the meters and integrated solid state AMI meter products (if any).

    Cellnet Response: Cellnet can comply with this requirement.

    b. The Meter vendor and retrofit service supplier will warrant the meter package.

    Cellnet Response: Cellnet can comply with this however, the meter manufacturer installs the AMI module (if it is not a meter with integrated Cellnet 1-way or 2-way technology) at the new meter manufacturing factory. It is not installed by an outside retrofit service. The retrofit service provider typically only installs AMI modules on existing PG&E meters.

    c. For electric AMI products:

i. AMI Products on New Meters AMI vendor will be responsible for managing, integrating and testing meter and module components and delivering approved, installation-ready AMI equipped meter products to locations designated by PG&E. AMI vendor will coordinate with PG&E to ensure that meter purchases are correctly accounted for and paid by PG&E.

Cellnet Response: Cellnet strongly recommends that the vendor from which PG&E purchases the new meter with AMI module be responsible for the supply chain management and delivery of the completed meter to the designated PG&E location.

If Cellnet is the direct supplier of the new meter with AMI module we can provide this service for the new meters we are required to supply directly to PG&E. Where PG&E purchases a new meter directly from a meter vendor and the AMI module from Cellnet for shipment to the meter vendor, we will take full responsibility for delivering the AMI module to the meter vendor.

This proven process has been in place with Cellnet utility customers and meter vendors and results to be the lowest cost and most effective process to all parties.

ii. AMI Products on Retrofitted Meters Vendor will be responsible for managing the process of receiving meters from PG&E for refurbishment, performing the refurbishment, retrofitting AMI modules, testing and delivering the installation-ready refurbished and retrofitted AMI equipped meter products to PG&E designated service locations.

Cellnet Response: Cellnet can comply with this.

d. For new PG&E gas meters, AMI vendor will be responsible for managing, integrating and testing meter and module components and delivering approved, installation-ready AMI equipped meter products to locations designated by PG&E. AMI vendor will coordinate with PG&E to ensure that meter purchases are correctly accounted for and paid by PG&E.

Cellnet Response: Cellnet strongly recommends that the vendor from which PG&E purchases the new meter with AMI module be responsible for the supply chain management and delivery of the completed meter to the designated PG&E location.

If Cellnet is the direct supplier of the new meter with AMI module we can provide this service for the new meters we are required to supply directly to PG&E. Where PG&E purchases a new meter directly from a meter vendor and the AMI module from Cellnet for shipment to the meter vendor, we will take full responsibility for delivering the AMI module to the meter vendor.

This proven process has been in place with Cellnet utility customers and meter vendors and results to be the lowest cost and most effective process to all parties.

e. For existing PG&E gas meters, AMI vendor will ship gas retrofit modules to PG&E designated service locations for shop retrofitting by PG&E (or a service provider designated by PG&E).

Cellnet Response: Cellnet can comply with this.

f. For network products, AMI vendor will ship the products to PG&E service locations for installation by PG&E (or a service provider designated by PG&E).

Cellnet Response: Cellnet can comply with this.

2. Please confirm that your pricing is consistent with the above description of roles and responsibilities or identify any variations.

Cellnet Response: Cellnet variations have been noted above.

3. PG&E regards the skills and experience of your project implementation team to be key selection criteria. Please identify the specific personnel (where possible), who will fill critical roles in the implementation team, as defined in the position descriptions listed below. If names are not available, please define needed roles and responsibilities. PG&E will require that those personnel be committed to the project substantially, essentially on a full time basis, unless otherwise approved by PG&E.

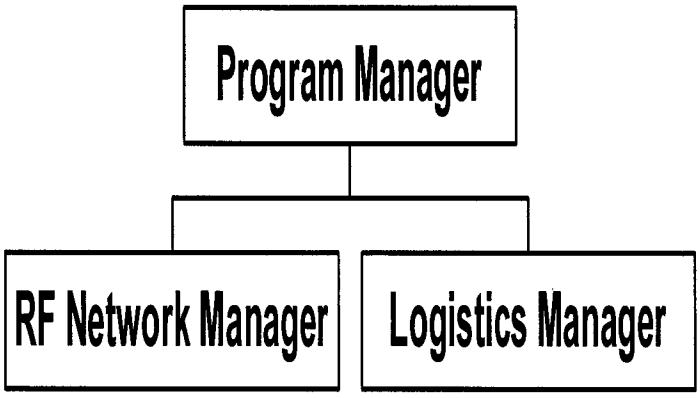
   a. Project lead

   b. Technology architect

   c. Procurement specialist

Cellnet Response: As a part of the Cellnet AMR system deployment we will provide a staff of fulltime on site qualified personnel to plan, coordinate and direct the installation of the Cellnet fixed network. Cellnet has extensive project management staff resources experienced from the deployment of 10 million meters and over 45,000 network collectors. We will leverage this experience for the deployment, management and training of personnel for the proposed network at PG&E.

Key functions of the Cellnet team supporting the PG&E implementation include the following:



Program Manager

Objective

The Program Manager (PM) is responsible for the overall planning and execution of Cellnet contracts. The PM is responsible for all Cellnet business planning, customer interface, sub contracts, and subsequent build out of the entire network. The PM is able to effectively

interact with all levels of the customer organization (first level to executive level). The PM prepares and submits annual budgets, supervises on-site personnel and coordinates the activities of corporate, sub contractor and customer personnel dedicated to the program.

Responsibilities

Planning:
The PM works with the corporate and services staffs in developing the plans for the installation, operation and maintenance of the Cellnet network. Planning includes the coordination of sub contractor efforts, statements of work, pricing, scheduling and determination of skills, experiences and qualifications for the work to be accomplished. The timely acquisition of resources such as equipment, facilities, supplies and people must be planned carefully to maximize efficiency while minimizing cost outlay.

Scheduling:
The PM coordinates a business and programmatic calendar through the members of the PM's staff. They schedule and the PM develops topics for and conducts periodic meetings with customers, subcontractors, corporate headquarters and special meetings as necessary. This demands an ability to de-conflict competing interests and prioritize the efforts of all participants along with necessary fiscal and physical, and personnel resources.

Supervising:
The PM directly supervises the RF Network Engineer and the Logistics Manager in the execution of technical matters and the Office Manager (OM) in administrative matters. The PM is the second line supervisor for all on site personnel and also has limited matrix authority over corporate and other services resource personnel when they are committed to projects for which the PM is responsible.

Logistics Manager

Objective:

The Logistics Manager (LM) provides logistics and materials support for Cellnet contracts. The LM coordinates the materials forecasting, planning and procurement support necessary to fulfill Cellnet's contractual commitments. The LM directs the start-up and continuing operations of Cellnet's Cross Dock Facility and provides the linkage between Cellnet and its installation and maintenance subcontractors as provided in its contract. The LM provides strong professional skills across a broad range of business disciplines within Operations Management, Human Resources, Facilities, Quality and Engineering.

Responsibilities:

Operations Management:
The LM develops and leads the production organization to achieve the highest quality performance, while maintaining a positive and productive work environment. The LM institutes a consistent system of controls which measure performance against the Cross Dock production plan. The LM coordinates with and/or manage the installation

subcontractor to meet the installation quality objectives and schedule while maintaining a safe and utility customer friendly process.

Production System:
The LM develops a capacity/inventory plan to proactively plan people, equipment and materials requirements. The LM leads the development and implementation of Total Quality Management on the production floor by training and implementing Statistical Process Control Methods and Analysis. The LM enhances the material handling, flow strategies and floor layout to increase productivity while minimizing WIP and manufacturing cycle times.

Materials Management & Procurement:
The LM coordinates, collects & analyzes technical metering and network information necessary to support the contract. The LM leads planning efforts necessary to interpret all metering and network requirements so that they conform to contract requirements & schedule. The LM provides the master materials forecast to the Cellnet Corporate Procurement organization. The LM updates, on a periodic basis, actual materials performance against plan, and modifies the forecast for future activities based on actual performance to date and as changing conditions dictate.

Customer Interface:
The LM coordinates the production and Utility Customer Delivery Schedules. The LM represents CellNet's installation and retrofit issues at the Utilities metering and installation subcontractor meetings.

Radio Frequency Network Manager (RFM)

Objective

The Radio Frequency Network Manager (RFM) is responsible to the Program Manager (PM) and is the technical lead for establishment, operation, maintenance and optimization of Cellnet's installed Radio Frequency (RF) and dedicated communications network. The RFM provides technical interface among customers, subcontractors and the Cellnet staff in coordinating the successful accomplishment of the installation and maintenance of the network. The RFM also provides information, support, and feedback to Development and Operations on the performance of the system and improvements for the next generation of hardware and software.

The RFM is the expert on RF path propagation and antennas. He is responsible for managing site surveys and installation of all Cellnet RF Network devices and other network components. The RFM reports to the PM.

Responsibilities

Network Planning / Site Acquisition Support / Installation / Operations / Maintenance:
The RFM, in coordination with the Corporate Director of Engineering Services, plans for the establishment of the network and then supervises the RF Engineer, RF Technicians, and

utility site acquisition personnel, and subcontractor personnel (as it may apply) in installing the network.

The RF Engineer and Technicians perform LAN planning, installation and physical maintenance services on the network. The RFM directs the RF technicians in the execution of the LAN plan and conducts post-installation evaluation of the LAN performance and corrects problems as they are discovered. This Team represents the principal interface with Cellnet, and supervises installation subcontractors in the installation and commissioning of the network devices.

The RFM must also ensure the continuous operation and maintenance of the network by adequately planning, staffing, and supporting ongoing programs to ensure a cost effective yet fully functional network which provides the customer with all data required by the contract.

The RF RFM must be knowledgeable on all elements, both theoretical and practical, of RF Path Propagation. He must assure that his team continually reviews the antenna configurations used in the Cellnet Wide Area Network (WAN) and the Cellnet Local Area Network (LAN) and assure that Cellnet is using the best antenna for the installation terrain as balanced against cost per point.

The RFM must train RF Technicians on use of RF propagation evaluation equipment and survey practices. The RFM must lead efforts to troubleshoot and correct any RF path problems on the WAN and LAN. He must ensure adherence to standard procedures for RF path verification before and during RF Network device installation.

The RFM must provide input to Development and Operations concerning local issues with installation, antenna placement and RF conditions. He must support the field testing of new products, and provide input concerning RF use and concerns.

Scheduling:
The RFM develops the master Network installation schedule in coordination with the customer, the Cellnet Logistics Manager (LM), corporate headquarters, subcontractors and local staff for the installation and normal and emergency operations of the network. The RFM uses this schedule for coordinating the successful execution of the contract.

Accountability:
The RF RFM is responsible to the PM for all technical matters relating to the project. He must ensure continuity of operations and satisfaction of the utility in accordance with the contract. Restoration of service and meeting contract standards are the highest priority requirements the RFM is responsible for accomplishing.

The RFM supervises the entire RF technical team be they local, contract or provided on a temporary basis from Corporate headquarters. This includes making and / or approving work assignments, setting work schedules including shift schedules, setting goals and objectives, and authoring performance appraisals for the local staff under the RFM's supervision.

4. Please use this opportunity to review your pricing and to submit your best offer to PG&E. Please identify all assumptions made in developing your pricing, provide a description of all relevant details, and the potential implications of changes to any assumption.

   Cellnet Response: Cellnet pricing and assumption responses have been submitted in the pricing workbook.

5. PG&E requires a source code license allowing PG&E to use third parties to operate and/or maintain the system during the term. Please confirm your agreement to provide PG&E source code access through a licensing agreement.

   Cellnet Response: Cellnet typically does not provide source code licensing for its host systems other than through an escrow arrangement affected by a major event. In the event that PG&E further requires such host system licensing for active use, Cellnet generally cannot warrant the performance or the ability of the system to be upgraded in the event changes are made to the original source code by a third party. However, Cellnet is willing to explore specific scenarios as long as the provide protection to the proprietary and confidential nature of Cellnet's source code, the financial benefit of supplying the source code, and the warranty and maintenance support issues raised by third party modifications of the software.

6. Please provide pricing and other considerations in response to the following implementation scenarios/options:

   a. 100% economic deployment of gas and 1-way electric fixed network for both gas and electric customers
   b. 100% economic deployment of gas and 2-way electric fixed network for both gas and electric customers
   c. 100% economic deployment of 1-way electric fixed network for electric customers only
   d. 100% economic deployment of 2-way electric fixed network for electric customers only
   e. Deployment of gas only fixed for 100% of PG&E's gas customers.
   f. 100,000 single-phase/240V/200A remote disconnect switches operable via fixed network

   Cellnet Response: Cellnet pricing and assumption responses have been submitted in the pricing workbook.

cellnet

30000 Mill Creek Avenue, Suite 100, Alpharetta, GA 30022 p 678 258 1500 f 678 258 1550 www.cellnet.com

April 14, 2005

Mr Anthony Giudici
Pacific Gas and Electric Company
Supply Chain, Mail Code N5D
245 Market Street, Room 546B
San Francisco, CA 94105-1702

Dear Mr Giudici,

Cellnet has enclosed its response to the PG&E Advanced Meter Infrastructure (AMI) Request for Proposal (RFP) No. F-10427-04-EAG – Phase IV- BAFO. The response includes price revisions and assumptions as noted.

We have also enclosed an additional pricing table for your review that shows the impact of using 1-way Cellnet radios on singlephase electric and gas meters and 2 way radios on the advance polyphase electric meters. This option provides the highest function possible for the highest revenue meters but with a much lower price than a complete 2 way Cellnet system.

Our proposed pricing is in effect for 180 days. We are also available for further discussions on clarification to our proposal.

Sincerely,

Mike Zito
Chief Executive Officer

Enclosures

	Cellnet Proposal Cost Item	Type	Quantity	100%	80%	60%	40%	20%
	Cellnet Revision 4/14/2005 2-way Electric							
	1. Endpoints							
	For endpoints with new meters, include only the cost of the meter modules or boards and the integration. PG&E will acquire the meters directly.							
1	2S Meter/Module - 2W	One-Time	3,641,353	$ 80.00	$ 80.00	$ 80.00	$ 80.00	$ 80.00
2	1S, 3S, 4S Meter/Module - 2W	One-Time	85,162	$ 105.75	$ 105.75	$ 105.75	$ 105.75	$ 105.75
3	12S (non Poly) Meter/Module - 2W	One-Time	312,483	$ 118.75	$ 118.75	$ 118.75	$ 118.75	$ 118.75
4	2K Meter/Module - 2W	One-Time	15,549	$ 173.75	$ 173.75	$ 173.75	$ 173.75	$ 173.75
5	5S, 8S, 9S, 10S, 12S,14S,15S, 16S Meter/Mod - 2	One-Time	289,311	$ 500.00	$ 500.00	$ 550.00	$ 575.00	$ 600.00
6	2S Retrofit							
7	1S, 3S, 4S Retrofit							
8	12S (non Poly) Retrofit							
9	5S, 8S, 9S, 10S, 12S,14S,15S, 16S Retrofit							
10	PP Solid State Retrofit							
	2. Communications Network							
21		One-Time						
22	Concentrator (Bridge)	One-Time	9,000	$ 1,224	$ 1,224	$ 1,224	$ 1,224	$ 1,224
23	Wan Master (takeout point)	One-Time	89	$ 12,000	$ 12,000	$ 12,000	$ 12,000	$ 12,000
	3. IT							
24	Sun Computers	One-Time	1	$ 190,000	$ 190,000	$ 190,000	$ 105,000	$ 105,000
25	Oracle and Infinet	One-Time	1	$ 2,260,000	$ 2,165,000	$ 1,895,000	$ 1,445,000	$ 835,000
26	Infinet	Annual	1	$ 610,000	$ 585,000	$ 515,000	$ 400,000	$ 230,000
	4. Deployment Support and Management							
27	Antennae	One-Time		$ 125	$ 125	$ 125	$ 125	$ 125
28	Cable	One-Time		$ 50	$ 50	$ 50	$ 50	$ 50
29	MS-MFT	One-Time		$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000
30	Field Tester	One-Time		$ 155	$ 155	$ 155	$ 155	$ 155
31	Link Assessment	One-Time		$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000
32	Network Planning	One-Time	1	$ 21,000,000	$20,300,000	$19,300,000	$18,000,000	$17,000,000
33	Training	One-Time	1	$ 135,000	$ 135,000	$ 135,000	$ 135,000	$ 135,000

Questions

Note: Above summary excludes installation labor, new gas meters, and Wan communication charges

CELLNET NOTES TO ABOVE:

1. Cellnet pricing in lines 1-5 is for a complete solid state meter which includes the meter with Cellnet AMI components integrated during assembly
2. The electric meters\modules above are 2-way using Cellnet UtiliNet radios
3. The 2-way polphase electric meter\modules above are commercially available
4. The 2-way single phase electric meters\modules above are expected to be commercially available Q4 2005
5. FYI 1-way and 2-way Cellnet radio module products will work together in the proposed Cellnet Fixed Network system.
6. The total network quantities and total price remain as previously quoted but configured to include all UtliNet 2-way radios.
7. Any related pole attachment fees, and on going costs for use of PG&E or Third party poles have NOT been included and can be further defined once the deployment scope is defined by PG&E
8. For electric AMI meters with Reactive option add $100 ea, For KYZ add $40 ea.
9. Office and material warehousing are not included in the pricing for line 32
10 Approximately 100k meters located in the core downtown San Francisco and Oakland will require site surveys before final network quantities can be confirmed. Cellnet can work with PG&E to develop a scope of work to provide this service.
11. Labor for retrofitting and refurbishing existing PG&E electric meters is not included in our proposed retrofit AMI module price and has been previously submitted
12. The designated quantities are based on the average for 90% Cellnet fixed network coverage of the population. Further quantity details by brand\type can be available by business division once the scope of work is known.
13. Exact quantities of deployment support items can be determined when the final scope of work is known for Cellnet product

Thomas, Chenoa

From: Jay Evensen [jay.evensen@cellnet.com]
Sent: Friday, April 08, 2005 12:28 PM
To: Giudici, E. Anthony
Subject: Re: AMI RFP Proposal Clarification Request - Phase IV- BAFO

Tony,

Cellnet appreciates the opportunity to provide a BAFO response to PG&E. In order to be as effective as possible our review of the Schedule 1 Instructions raise several questions around which we would like some clarity.

Question 1) Schedule 1 - Is the AMI vendor also responsible for delivering the PG&E ordered meters to PG&E or delivering the AMI module to the meter vendor "...locations designated by PG&E"? Once at the meter vendors locations, the meter vendor would physically install, integrate, test and ship to PG&E designated locations in accordance with approved AMI vendor procedures? This is in specific reference to section 1.c.i for electric meters, and 1.d. for gas meters.

Question 2) The Cellnet electric AMI modules come in two forms i) integrated solid state electric meters with Cellnet compatible board level components during manufacturing, and ii) an AMI module that is shipped from Cellnet and retrofitted onto an new electromechanical meter (at the meter manufacturer) or on an existing PG&E electric meter (at a retrofit shop). Due to the product configuration it will be impossible to quote a separate AMI module price for the integrated electric residential solid state residential meters meters as they are not separate components as a retrofit AMI module may be. Is this what PG&E is expecting?

Question 3) Section 1 c.ii AMI Products on Retrofitted Meters.
A) What assumptions should the AMI vendor make around the quantities, types and age of PG&E electric meters to be retrofitted?
B) Are the electric meters to be refurbished (or rebuilt) in addition to the normal cleaning and calibration and testing for retrofitting?
C) Where is the receiving locations of meters to be retrofit? and will PG&E have the electric meters sorted and in packaging\containers for retrofitting by the AMI vendor?

Question 4) Section 1 e. - This section designates shipments for shop retrofitting of gas AMI modules by PG&E will there also be field retrofitting of Gas AMI modules? Is this for PG&E shop working inventory? For the in field retrofit of gas meters, what is the shipping expectation for those modules? Will they be provided to PG&E or to PG&E's installation vendor?

Question 5) Section 3. What it the definition and role of the "Technology Architect"?
Question 6) Section 6. What is the definition of "100% economic deployment..."

We are available to for a conference call on these questions at your convenience.

Thanks

jay

At 04:13 PM 4/6/2005 Wednesday, you wrote:

Mr. Evensen:
CELLNET

Attached are three files: 1) a cover and instructional letter; 2) instructions for submission by your firm of its best and final offer in connection with PG&E's Advanced Metering Infrastructure Request for Proposal; and 3) a pricing schedule. Please review and respond as soon as possible within the timelines set forth in our letter.

E. Anthony "Tony" Giudici
Sr. Procurement Specialist
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Thomas, Chenoa

From: Jay Evensen [jay.evensen@cellnet.com]
Sent: Thursday, March 31, 2005 11:09 AM
To: Giudici, E. Anthony
Cc: gary.fauth@att.net
Subject: Cellnet Gas Analysis Update

Tony,

Cellnet continues to find ways to optimize the deployment of its system to the benefit of the PG&E business case.

In this effort we have found it within our ability to adapt Cellnet gas modules to an additional quantity of existing PG&E gas meters. You will find in the attached details of the updated quantities of gas meters that we estimate we can retrofit and a substantially reduced quantity of meters that need to be replaced. We now estimate that there are only about 200k new gas meters that will need to be purchased, and quite possibly less if we can physically analyze other specific models in question.

Please also not that our electric meter 2-way pricing is corrected to reflect the same unit price for the various quantity options. We understand that a previous transmission of the two-way price template may not have the same 2-way product pricing in the column for 80%, 60%, 40% and 20% quantities.

We would like to add clarity to any of this information either in person or on a conference call. Our teams are also available to do a physical review of additional gas meters that might possibly be retrofitted.

Thanks

jay

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	Cellnet Proposal Cost Item	Type	Quantity	100%	80%	60%	40%	20%
	Cellnet Revision 3/31/2005							
	1. Endpoints							
1	2S Meter/Module - 1 way	One-Time	2,550,079	$ 52.25	$ 52.25	$ 52.25	$ 52.25	$ 52.25
2	1S, 3S, 4S Meter/Module - 1 way	One-Time	80,551	$ 78.00	$ 78.00	$ 78.00	$ 78.00	$ 78.00
3	12S (non Poly) Meter/Module - 1 way	One-Time	128,805	$ 91.00	$ 91.00	$ 91.00	$ 91.00	$ 91.00
4	2K Meter/Module 1-way	One-Time	15,549	$ 146.00	$ 146.00	$ 146.00	$ 146.00	$ 146.00
5	5S, 8S, 9S, 10S, 12S,14S,15S, 16S Meter/Module 1-w	One-Time	184,731	$ 301.00	$ 301.00	$ 301.00	$ 301.00	$ 301.00
6	2S Retrofit 1- way	One-Time	1,091,274	$ 38.57	$ 38.57	$ 38.57	$ 38.57	$ 38.57
7	1S, 3S, 4S Retrofit 1- way	One-Time	4,611	$ 42.00	$ 42.00	$ 42.00	$ 42.00	$ 42.00
8	12S (non Poly) Retrofit 1- way	One-Time	183,678	$ 55.00	$ 55.00	$ 55.00	$ 55.00	$ 55.00
9	5S, 8S, 9S, 10S, 12S,14S,15S, 16S Retrofit 1- way	One-Time	44,842	$ 55.00	$ 55.00	$ 55.00	$ 55.00	$ 55.00
10	PP Solid State Retrofit 1-way	One-Time	59,738	$ 136.00	$ 136.00	$ 136.00	$ 136.00	$ 136.00
11	American Module	One-Time	1,480,595	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
12	American 5 B	One-Time	10,098	$ 64.00	$ 64.00	$ 64.00	$ 64.00	$ 64.00
13	Equimeter Module	One-Time	1,022,835	$ 53.50	$ 53.50	$ 53.50	$ 53.50	$ 53.50
14	Sprague Module	One-Time	666,435	$ 53.50	$ 53.50	$ 53.50	$ 53.50	$ 53.50
15	Sprague 1A	One-Time	267,042	$ 73.50	$ 73.50	$ 73.50	$ 73.50	$ 73.50
15	AM/EQ/SP Module	One-Time	54,676	$ 156.00	$ 156.00	$ 156.00	$ 156.00	$ 156.00
16	Non-Diaphram Module	One-Time	15,429	$ 126.00	$ 126.00	$ 126.00	$ 126.00	$ 126.00
17	American Module for new Meter	One-Time	134,323	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
18	Equimeter Module for new Meter	One-Time	19,231	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
19	Sprague Module for new Meter	One-Time	19,822	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
20	Other Unidentified for new Meter	One-Time	11,440	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
21	American module for new Meter Commercial	One-Time	20,438	$ 156.00	$ 156.00	$ 156.00	$ 156.00	$ 156.00
	2. Communications Network							
21								
22	Concentrator (Bridge)	One-Time	18,073	$ 1,224	$ 1,224	$ 1,224	$ 1,224	$ 1,224
23	Wan Master (takeout point)	One-Time	89	$ 12,000	$ 12,000	$ 12,000	$ 12,000	$ 12,000
	3. IT							
24	Sun Computers	One-Time	1	$ 190,000	$ 190,000	$ 190,000	$ 105,000	$ 105,000
25	Oracle and Infinet	One-Time	1	$ 2,260,000	$ 2,165,000	$ 1,895,000	$ 1,445,000	$ 835,000
26	Infinet	Annual	1	$ 610,000	$ 585,000	$ 515,000	$ 400,000	$ 230,000
	4. Deployment Support and Management							
27	Antennae	One-Time		$ 125	$ 125	$ 125	$ 125	$ 125
28	Cable	One-Time		$ 50	$ 50	$ 50	$ 50	$ 50
29	MS-MFT	One-Time		$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000
30	Field Tester	One-Time		$ 155	$ 155	$ 155	$ 155	$ 155
31	Link Assessment	One-Time		$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000
32	Network Planning	One-Time	1	$ 21,000,000	$ 20,300,000	$ 19,300,000	$ 18,000,000	$ 17,000,000
33	Training	One-Time	1	$ 135,000	$ 135,000	$ 135,000	$ 135,000	$ 135,000

Questions

Note: Above summary excludes installation labor, new gas meters, and Wan communication charges

CELLNET NOTES TO ABOVE:

Adjustments to this 3/31/2005 revision reflect changes that reduce required quantities of new gas meters

Assumptions:

1. Cellnet can provide modules for the American 5B and Sprague 1A meters as shown. These modules would be a modification to existing modules and available for installation within 12 months from notice to proceed.
2. Gas module pricing for lines 17 thru 21 are based on the new replacement meters being American meters. If the replacement meters are not American the pricing is the same as shown in line 13 & 14 for Sprague and Equimeter.
3. The designated quantities are based on the average for 90% Cellnet fixed network coverage of the population. Further quantity details by brand\type can be available by business division once the scope of work is known.
4. Cellnet may be able to retrofit additional 85,000 meters but needs to physically review meter types that PG&E designates as American AR-175 & W-175 and Rockwell 415. We are available at any time for such a site visit.
5. Previously submitted assumptions or options remain in effect.

	Cellnet Proposal Cost Item	Type	Quantity	100%	80%	60%	40%	20%
	Cellnet Revision 3/31/2005							
	1. Endpoints							
1	2S Meter/Module - 2W	One-Time	3,641,353	$ 80.00	$ 80.00	$ 80.00	$ 80.00	$ 80.00
2	1S, 3S, 4S Meter/Module - 2W	One-Time	85,162	$ 105.75	$ 105.75	$ 105.75	$ 105.75	$ 105.75
3	12S (non Poly) Meter/Module - 2W	One-Time	312,483	$ 118.75	$ 118.75	$ 118.75	$ 118.75	$ 118.75
4	2K Meter/Module - 2W	One-Time	15,549	$ 173.75	$ 173.75	$ 173.75	$ 173.75	$ 173.75
5	5S, 8S, 9S, 10S, 12S,14S,15S, 16S Meter/Mod	One-Time	289,311	$ 600.00	$ 600.00	$ 600.00	$ 600.00	$ 600.00
6	2S Retrofit							
7	1S, 3S, 4S Retrofit							
8	12S (non Poly) Retrofit							
9	5S, 8S, 9S, 10S, 12S,14S,15S, 16S Retrofit							
10	PP Solid State Retrofit							
11	American Module	One-Time	1,480,595	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
12	American 5 B	One-Time	10,098	$ 64.00	$ 64.00	$ 64.00	$ 64.00	$ 64.00
13	Equimeter Module	One-Time	1,022,835	$ 53.50	$ 53.50	$ 53.50	$ 53.50	$ 53.50
14	Sprague Module	One-Time	666,435	$ 53.50	$ 53.50	$ 53.50	$ 53.50	$ 53.50
15	Sprague 1A	One-Time	267,042	$ 73.50	$ 73.50	$ 73.50	$ 73.50	$ 73.50
15	AM/EQ/SP Module	One-Time	54,676	$ 156.00	$ 156.00	$ 156.00	$ 156.00	$ 156.00
16	Non-Diaphram Module	One-Time	15,429	$ 126.00	$ 126.00	$ 126.00	$ 126.00	$ 126.00
17	American Module for new Meter	One-Time	134,323	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
18	Equimeter Module for new Meter	One-Time	19,231	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
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33	Training	One-Time	1	$ 135,000	$ 135,000	$ 135,000	$ 135,000	$ 135,000

Questions

Note: Above summary excludes installation labor, new gas meters, and Wan communication charges

Cellnet Notes

1. The electric meters\modules above are 2-way using Cellnet UtiliNet radios
2. The 2-way polphase electric meter\modules above are commercially available
3. The 2-way single phase electric meters\modules above are expected to be commercially available Q4 2005
4. Cellnet 1-way gas & electric meters\modules previously quoted can also be used concurrently with 2-way meters\modules
5. The total network quantities and total price remain as previously quoted but configured to include all UtliNet 2-way radios.
6. Previously submitted assumptions or options remain in effect

CELLNET NOTES TO ABOVE:

Adjustments to this 3/31/2005 revision reflect changes that reduce required quantities of new gas meters

Assumptions:

1. Cellnet can provide modules for the American 5B and Sprague 1A meters as shown. These modules would be a modification to existing modules and available for installation within 12 months from notice to proceed.
2. Gas module pricing for lines 17 thru 21 are based on the new replacement meters being American meters. If the replacement meters are not American the pricing is the same as shown in line 13 & 14 for Sprague and Equimeter.
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4. Cellnet may be able to retrofit additional 85,000 meters but needs to physically review meter types that PG&E designates as American AR-175 & W-175 and Rockwell 415. We are available at any time for such a site visit.
5. Previously submitted assumptions or options remain in effect.

FYI 1-way and 2-way Cellnet radio module products will work together in the proposed Cellnet Fixed Network system.

Thomas, Chenoa

From: Jay Evensen [jay.evensen@cellnet.com]
Sent: Wednesday, March 23, 2005 3:51 PM
To: Giudici, E. Anthony
Subject: Cellnet response to additional radio questions

Tony,

The attached document reflects some corrected technical items in our response to your radio questions, please destroy the document we previously sent.

We have also included a document on the interval transmission design in our AMI module that we were not able to discuss in detail at our recent meeting. As we have formally applied for patents on the design, we are now available to discuss this in detail. We would like to review your team once they have had a chance to read it. Our schedule is such that we are available to be on site at PG&E even for a short period.

Please do not hesitate to contact us if you have any questions.

jay

At 12:27 PM 3/17/2005 Thursday, you wrote:

> Jay Evensen<?xml:namespace prefix = o ns = "urn:schemas-microsoft-com:office:office" />
>
> VP Business Development
>
> Cellnet
>
> <?xml:namespace prefix = st1 ns = "urn:schemas-microsoft-com:office:smarttags" />
>
> PG&E must develop an understanding of your proposed radio system for a CPUC California Environmental Quality Act [CEQA] process assessment that covers potential environmental, health, safety and other issues. PG&E has engaged external consultants to support this task.
>
> One of the issues relates to the radio frequency aspects of the proposed AMI systems. To that end, we request that you provide additional information to PG&E by March 23, 2005. We realize that some of this information may have been provided already, but we wish to be certain that the correct information is provided, in summary form, to the radio system consultant.
>
> Please provide the following information for every different AMI radio in your proposed offering to PG&E:
>
> **Item**

Question

1

Transmitting frequency band and modulation used

a. Meter to repeater

b. Repeater into network

c. Repeater to meter

2

RMS transmitter output power level

a. Meter to repeater

b. Repeater into network

c. Repeater to meter

3

Antenna

a. Antenna type

b. Antenna gain

c. Antenna size

4

Duty cycle of the transmitter

a. Meter to repeater

b. Repeater into network

c. Repeater to meter

6

Provide a digital file of the antenna pattern including elevation and azimuth data for

a. Meter to repeater

b. Repeater into network

c. Repeater to meter

7

Provide a copy of your radio signal and the associated emission mask

a. Meter to repeater

b. Repeater into network

c. Repeater to meter

E. Anthony "Tony" Giudici
Sr. Procurement Specialist
Phone: 415.973.3443 (Int: 223.3443)
Fax: 415.973.2553 (Int: 223.2553)
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Cellnet Response to PG&E Question
3-24-2005 Rev1

The following are the responses to you questions. Also, at the end of this document are the UtliNet Series III Specification for you use.

1 Transmitting frequency band and modulation used.

- **a.** Meter to repeater – **Cellnet: 917 MHz / UtiliNet: 902-928 MHz**
- **b.** Repeater into network – **902-928 MHz**
- **c.** Repeater to meter – **One-way with Cellnet endpoint. 902-928 MHz for UtiliNet endpoint**

2 RMS transmitter output power level

- a. Meter to repeater – **Cellnet: 100 mW / UtiliNet: 90 mW**
- b. Repeater into network –**Programmable from 100 mW – 1 W**
- c. Repeater to meter – **Programmable from 100 mW – 1 W**

3 Antennas

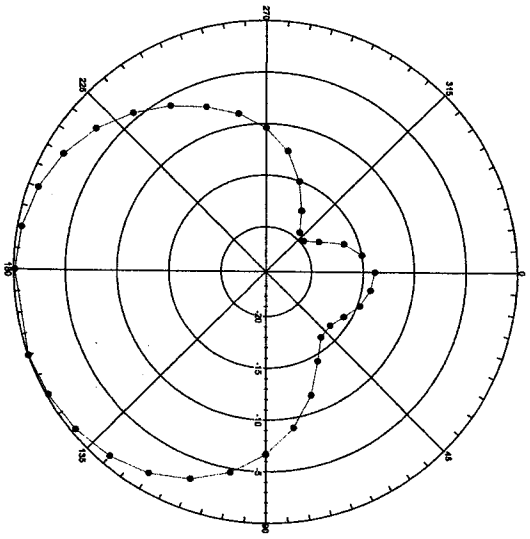
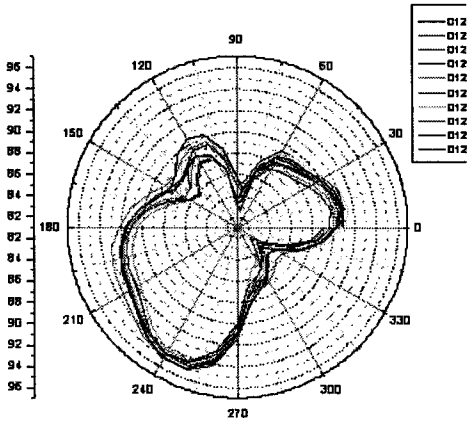
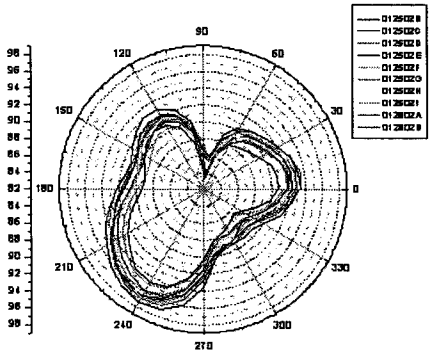
- **a.** Antenna type – **Cellnet: Patch Antenna In Meter / UtiliNet: Slot On Board Antenna / Repeater: Whip Antenna**
- **b.** Antenna gain – **Cellnet/UtiliNet Module: -1 dBi / Repeater: +6dBi**
- **c.** Antenna size – **Cellnet/UtiliNet Module: Built in to PCB, fits inside existing meter / Repeater: 15" length**

4 Duty cycle of the transmitter

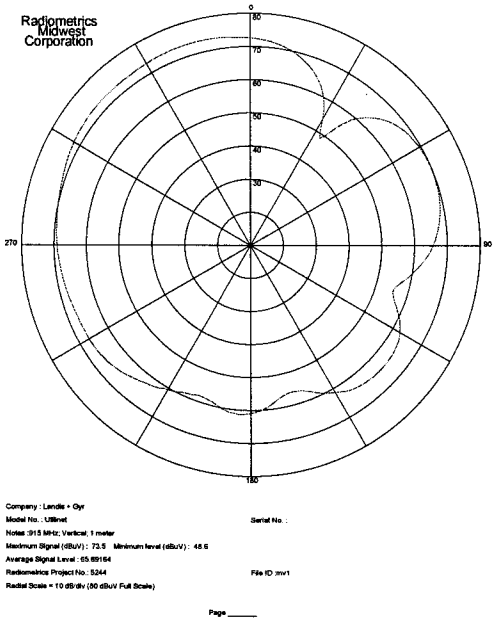
- a. Meter to repeater – **Average of <1%**
- b. Repeater into network – **Average of 5%**
- c. Repeater to meter – **Average of <1%**

6 Provide a digital file of the antenna pattern including elevation and azimuth data for

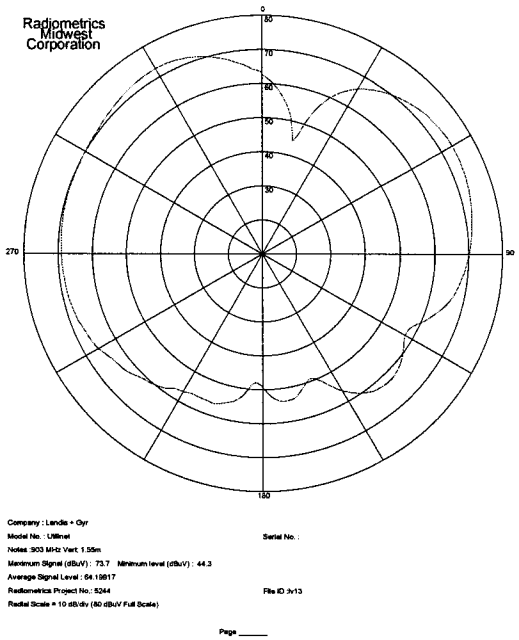
a. **Meter to repeater "See below"**
b. **Repeater into network – Utilize Whip antennas that have full 360° pattern**
c. **Repeater to meter - Utilize Whip antennas that have full 360° pattern**

FOCUS Antenna Pattern (Cellnet 1-way)	Retrofitted ABB Meter Pattern (Cellnet 1-way)
	 ABB Avg ERP = 16.8dbm ABB Max/Avg = 0.8 Front
Retrofitted ABB Meter Pattern (Cellnet 1-way)	
 GE Avg ERP = 18dbm GE Max/Avg = 0.83 Front	

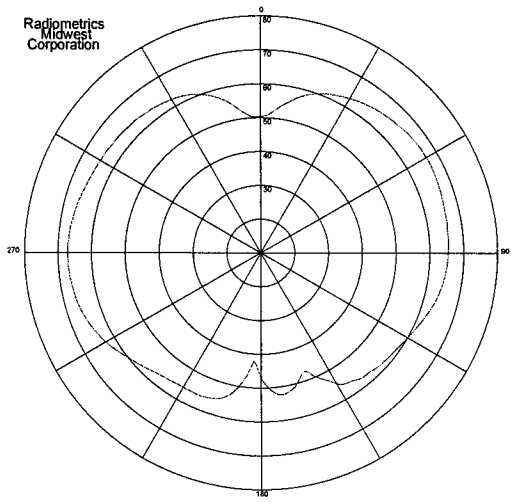
S4e Antenna Pattern (UtiliNet 2-way) @ 1 meter



S4e Antenna Pattern (UtiliNet 2-way) @ 1.55 meter



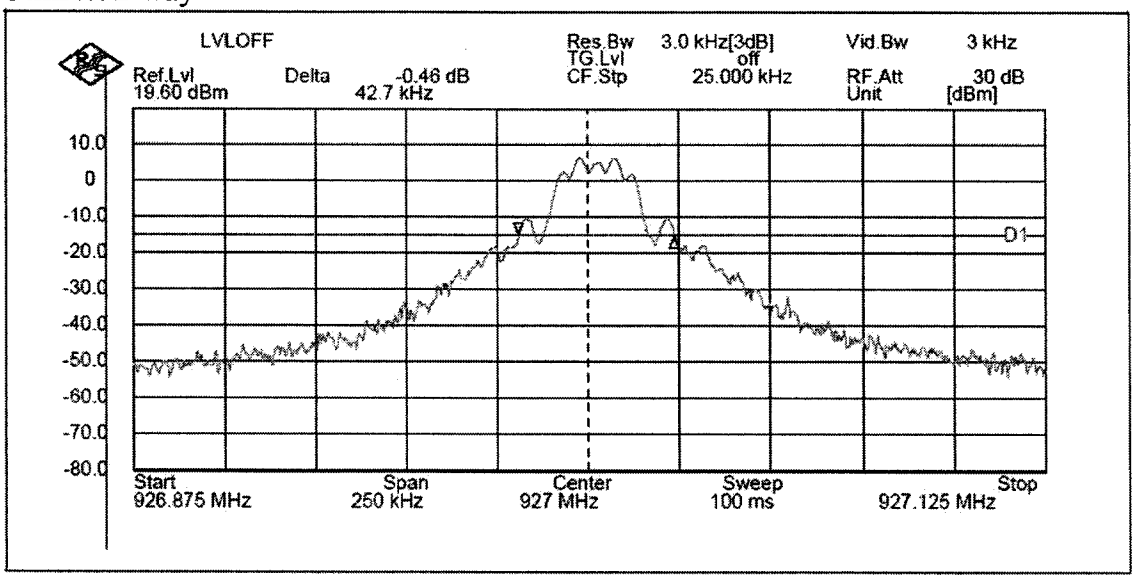
S4e Antenna Pattern (UtiliNet 2-way) @ 3 meter



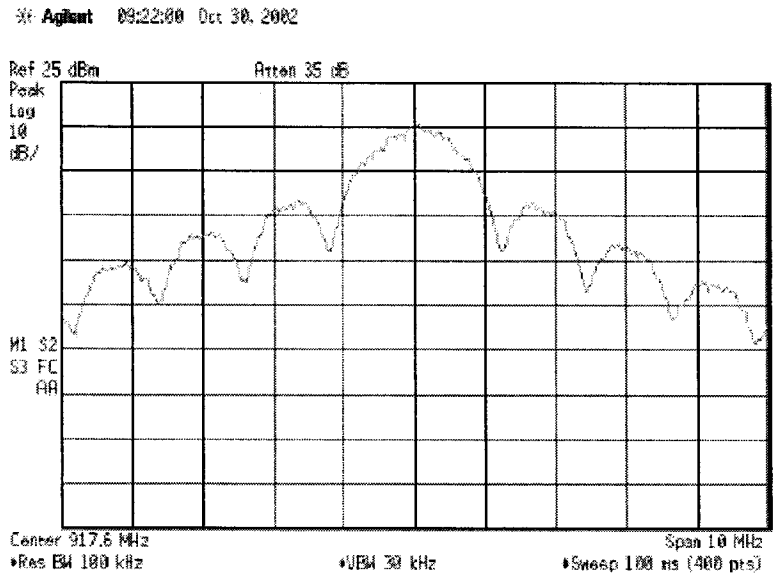
7 Provide a copy of your radio signal and the associated emission mask

a. Meter to repeater
b. Repeater into network
c. Repeater to meter

UtiliNet 2-way



Cellnet 1-way



Series III WanGate Radio General Specifications

General

Frequency Range	License-free, 902-928 MHz
Channels	240
Channel Spacing	100 kHz
Raw RF Data Rate	9600/19,200 bps
Spreading Technique	Frequency Hopping
Hopping Technique	Pseudo Random, Asynchronous
Hopping Patterns	65,536 (Unique per Network)
Network Address	Latitude/Longitude Coordinates
Frequency Stability	2.5 ppm

Receiver

Type	Double Conversion Superheterodyne; 1st IF 136 MHz, 2nd IF 10.7 MHz	
MDS Sensitivity @ 10E-5 BER	9,600 bps	19,200 bps
	-109 dBm	-106 dBm
Co-channel Rejection	61 dBm minimum	
Worst case Image Rejection	58 dB minimum	

Transmitter

RF Output Power (@ antenna connector)	+10 dBm (10 mW) to +30 dBm (1 Watt), user configurable
Out-of-Band Spurious Emissions	-20 dBc maximum @ +30 dBm
Deviation	±5.5 kHz ± 10%
Modulation Bandwidth	25 kHz
Modulation	Direct 2-FSK
Output Impedance	50 Ohms

Processing

CPU	M16C/62P
Clock Speed	9.8304 MHz
SRAM memory	31 Kbytes internal + 512 Kbytes external
FLASH memory	384 Kbytes internal + 1 Mbytes external
Programming Language	Device Control Word (DCW)

Data Ports/Formats

	LAN Packet Port	**Transparent Port**
Serial Interface	RS-232C	RS-232C
Data Rate	1200, 9600, 19,200 or 38,400 bps	300, 600, 1200, 4800, 9600, 19,200 or 38,400 bps
Protocol	UtiliNet LAN Packet Protocol	Any Asynchronous Byte-Oriented Protocol
Parity	None	Odd, Even, or None
Data Bits	8	7 or 8
Stop Bits	1	1 or 2
Duplex	Full	Full

Environmental

Operating Temperature Range	-40° to +85° Celsius
Storage Temperature Range	-40° to +85° Celsius
Operating Vibration	IEC 68-2-6
Operating Shock	IEC 68-2-27

Humidity	ANSI 12.20 § 5.4.3.18

EMI & Power/Control Susceptibility

Electromagnetic Radiation	FCC Class B, Part 15.247
Electromagnetic Susceptibility	ANSI C37.90.2 Modified
Surge Withstanding Capability	ANSI C37.90.1 and ANSI C62.41
Electrostatic Discharge	IEC 801.2

Agency Approvals

FCC Certified	Part 15.247
Industry Canada	RSS 210
NOM	121-SCTI-1994

Series III IWR Radio Specifications

Power

	DC Operation
Input Voltage Range	6–30 VDC
Input Current on receiving mode	33 mA maximum @ 12 VDC
Input Current [1] (on transmitting mode @ 100 mW	220 mA maximum @ 12 VDC
Input Current (on transmitting mode @ 1 W)	550 mA maximum @ 12 VDC

Mechanical

Interface Connections	**DC Version**
Power	Molex Mini-fit
Data Ports	DB-9
Antenna	SMA Type, Female
Enclosure (indoor)	
	Extruded aluminum
Weight.	0.575 lb.
Size	4.250"W x 5.770"D x 1.720"H

[1] 50% duty cycle

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REI: Collection of interval data in consumption steps

Ruben Salazar, Ph.D. Director UtiliNet and Systems Engineering

General introduction

One of the primary functions of a network for energy collection is the ability to capture data across the system for the purpose of establishing patterns of consumption and therefore revenue generation. Gathering data often and time stamping the measured events usually achieves this purpose. The goal is to trace consumption value as a function of the time at which the measurement was performed. The easiest example is monthly consumption, but applications requiring daily consumption, hourly consumption, and up to five-minute consumption are already in use.

When the collection is done very often it is known as interval data collection.

Interval Data Collection and can happen in different places in the system: For example, the high-end meters generally generate interval data is the meter itself, which is the closest element to the energy-measuring device. However in lower cost residential meters interval data is generally generated in the communication module attached to it and sent across the network for storage, processing, and consumption profiling. This is mainly due to the fact that most residential meters have only mechanical means of measurement.

New generation of residential meters, solid-state, may potentially handle this type of data capture at the meter level. In most of the CellNet deployments with residential solid-state meters the communication module is still performing the sampling and storage of interval information.

Battery-operated communication devices, attached to gas and water meters, generally avoid interval data applications in the end devices because it would represent valuable battery drain. In these cases the application can be envisioned at the system level: Every packet of information collected is aligned in time as to provide the wanted profile.

For all interval data applications the sampling is decided at exact time intervals, at which the consumption is recorded. The transmission of the information across the system happens also in a regular basis, most often an integer number of times the sampling period.

That concept, while providing enough information to reconstruct the desired pattern, is highly redundant generating and moving information. For example the system will move packets as regular as defined, even if there is no consumption activity. This has serious consequences on the battery-operated devices, creates RF traffic with potential for collisions and loss of data or reduction of performance, increases the amount of data to be moved through a WAN, which is known to be an expensive resource, and finally requires significant amount of CPU power and memory space for data storage, post-processing and archiving.

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In a system like CellNet the transmissions are randomized in each communication device to avoid collisions, which requires that separate randomizing modules be implemented in each endpoint. Since each packet of data has to be referenced to an absolute and precise time boundary to show when the information was sampled from the meter, additional information has to be conveyed with every packet identifying the difference between the data-capture time and the data-transmission time. Also additional processing has to be put in place in the system to safely recover the time boundaries of events in the endpoints.

Revenue Event Interval (REI) approach

This paper presents an alternative procedure that provides the same end result – construction of consumption profiles, using much less communication time, much less data traveling across the system, avoiding the need for randomizers, letting the system act as the absolute timekeeper, and finally offering opportunities for reduction in the requirements for data storage and archiving.

The method is stated as Revenue Event Intervals (REI).

For a given constant, **Revenue Event** of the quantity to measure, information will be captured about how long it took to complete that Revenue Event from the previous one. Additionally the communicating device will be activated to transmit only when the specific Revenue Event has been reached. REI packets will contain information for several Revenue Events.

For electric energy the Revenue Event will be kWh or any other electric energy quantity. For volume metering, gas or water, the Revenue Event could be cubic feet, cubic meters, gallons, or any other volumetric quantity. For a generic device the Revenue Event could simply be a pulse unit.

REI packets will be built around the absolute current Count Value, which will vary in integer amounts of the Revenue Event. Each REI packet will contain the current absolute Count Value as well as the **periods of time** elapsed from the current count value N to the previous Count Value N-1, from N-1 to N-2, from N-2 to N-3, and so on. See Figure 1 and Table 1.

According to this procedure each REI packet transmitted will contain, in addition to the most current Count Value (current consumption), information about N previous Revenue Events represented by N variable time intervals.

The Revenue Event is constant, but the time at which it occurs will be variable: This is in opposition to the systems used today where the time step is constant and the count is variable.

The function describing Absolute Count vs. Time is such that the true consumption profile can be built off of REI information at least as good as with current interval data approaches. In fact it can be built more accurately as it will be explained in a later section.

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cellnet

REI Advantages

There are several immediate advantages of the Revenue Event Interval approach.

1- There is use of the communication channel only when there is new information in the module, as defined by the Revenue Event event. If there is no new information there are no communications.

As a result there is typically much less use of the communication channel. This has not only associated reduction in battery use but also improvement regarding channel contention.

2- The use of the communication device memory is optimized.

The interval memory is used only when there is new information to store. Previously a new interval is captured and stored even if there has been no change of the count value. According to the REI scheme only changes in the counter are logged in memory.

3- The randomization in the communicating device is not necessary anymore.

Indeed, the different values of the counter and counter intervals for different meters ensure a completely random access of packets to the communication channel. The communication Channel can be RF or any other type.

4- Data moved from the intermediate levels of concentration upwards are also optimized in the same sense described above:

Since only changes are recorded in intervals, every interval provides information. This means that the typical amount of data moved over the WAN is optimized.

5- Better use of the channel statistics with impact on required Packet Success Rate (reduction of it) for specified services and the equivalent optimization of the required network equipment.

The REI approach allows for increasing the time between packets from a given device and if the same interval memory size is kept, the "memory" capacity of each packet increases and the time without receiving packets is significantly increased. See examples below.

6- Flexibility in the revenue event allowing for more use of resources only when more information is available for measurement.

Overall the REI approach can be seen as an optimized way of capturing interval information and an improved way of transmitting it over the LAN and the WAN. The

performance over time of the profiling process is mainly dependent on the Revenue Event size and not on the Time Step size.

The REI approach can also be seen as a natural compression of the meter data for a given service. Alternatively, this approach is a much more information-rich approach for the resources available in the system.

The improvements provided by the REI approach can be used in any of the two following ways:

- Capture and communicate the same information at less overall cost, or
- For the same cost capture and communicate much more information.

The REI concept is the right match between information and transmission: the more information that is available for transmission means the more often transmissions take place.

The approach requires only relative time in the endpoint module, not absolute time stamping.

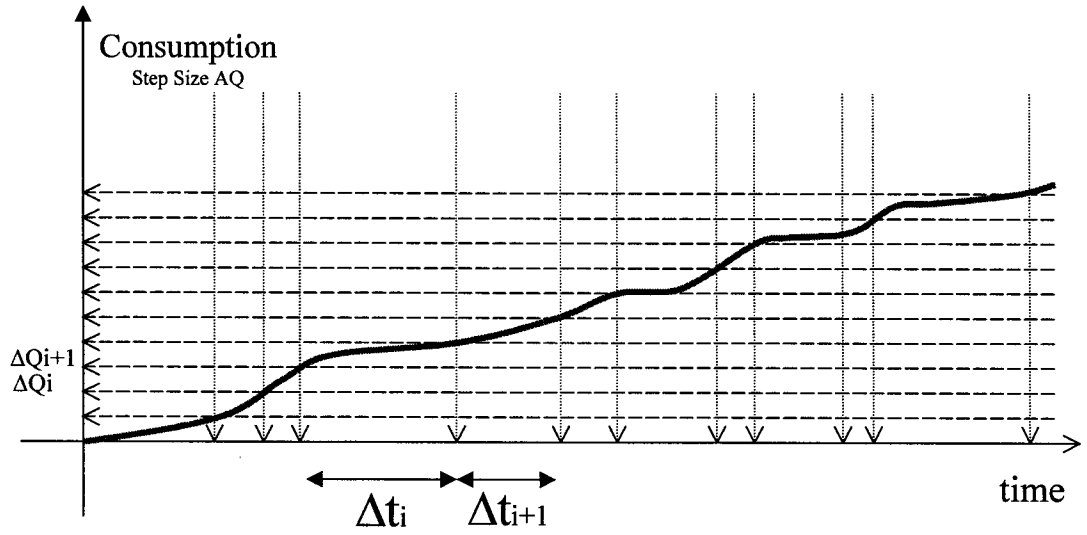

Figure 1 Graphic Representation of the REI method. ΔQ is constant, Δt is variable.

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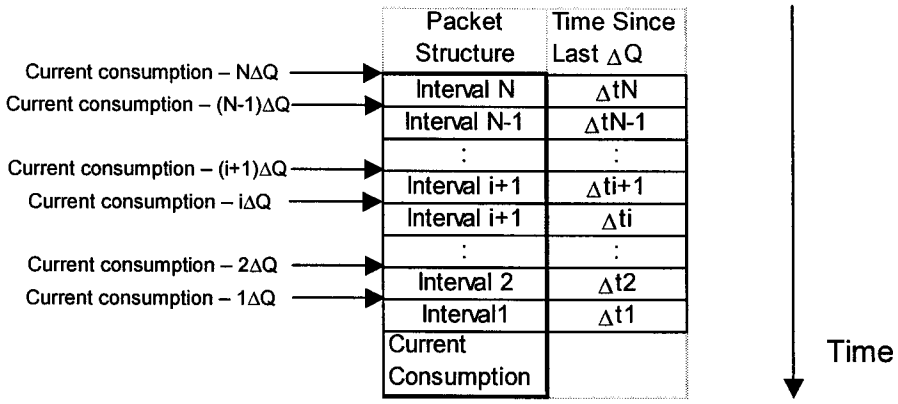

Table 1 REI packet Structure

REI Examples

The following are examples of use to show the improvements introduced by the REI concept.

1- Electric Endpoint, standard electromechanical Residential meter.
Step Count 1KWh, Time resolution 1 minute, Time interval size one byte.
Time and count accuracy are still as good as provided by the modules today.
Assume that each REI packet can contain 18 REI intervals.

Consider a household that consumes 2400 KWh per month, which correspond to approximately 30A continuous current over 120 V. This is quite high consumption, well above the national average of 900KWh per month.

At this pace it will take 1000s to complete one KWh of energy consumed and there will be 86 such events in a day. In other words, according to this concept there will be 86 transmissions necessary in one day, which represents a little more than 15 minutes between two transmissions from endpoints. This represents three times less often than today's implementation.

Creating intervals of time between each KWh, it will take 1000/60 minutes, or approximately 16 minutes, to complete the new KWh. Assuming 18 such intervals in each packet there will be total of 16*18 = 248 minutes of consumption information per packet or the equivalent of 4 hours. It is necessary to receive only one packet every four hours to ensure data continuity. There are six packets required per day to correctly reproduce the consumption profile for this meter. In comparison, the previous approach had only 45 minutes of information in each packet and required a minimum of 32 packets per day to complete the same profile.

It is clear from this presentation that the requirement of six packets per day for full data profile in the REI scenario creates much less RF constraints in the system compared to the 32 packets per day required by standard 5-minute interval data collection.

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Also it is clear that the ratio between the number of packets needed for the load profiling and the number of packets need for daily Consumption service is much smaller (1:6) than the previous situation (1:32).

Additional benefit happens in the WAN transfer: as mentioned before the REI approach requires an average 90 intervals of 16 minutes (and 1 byte each) to move all the information required for one day. In comparison the previous 5-minute approach required 288 intervals of five minutes of one byte each for the same application. There is a ratio of at least three between the two situations, meaning that the REI approach needs on average only one third of the information to be moved up the system through the WAN for consumption profiling.

While the same result could be accomplished by implementing data compression, it is interesting to note that the compression is done naturally by the REI collection and storage method.

The assumptions in the example above are not for average consumption but are rather representative of the extreme cases for residential electricity consumption.

The lower the consumption the more efficient the REI algorithm is, as shown in the following example:

The same residential meter may have an average of 800 KWh (or less) of monthly consumption over the year. This corresponds to approximately 10 A of continuous load on the 120 V electric network. At this consumption it will take 3000 seconds to complete 1KWh and 28 such events happen in a day, which also represent the number of transmissions. It will take 50 minutes to complete each new KWh count, so each interval will carry 50 minutes of new information, and each packet will contain 50*18= 900 minutes of redundancy. This is the equivalent of 15 hours of memory on each packet, so it would be necessary to receive a little less than two packets per day to ensure correct reproduction of the daily consumption pattern! The ratio between Daily Consumption application and Load Profile application is less than (1:2)!

2- Battery Operated Devices, Pulse counters.

The battery-operated devices benefit highly from the REI concept. Instead of periodic wake up and transmission, the RF module transmits only when the Revenue Event happens. This, together with the possibility to include several Revenue events in each packet provides for redundancy. Giving the rate of change in either the gas meter or the water meter, it is very likely that there will be much lower communication coming from these devices. This helps keep the battery alive longer. In addition the possibility of building consumption profiles comes naturally with the REI approach. Today the consumption profiling is almost inexistent in battery-operated devices because it requires too much energy from the battery.

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REI and Time-Of-Use reconstruction.

Time-Of-Use is built around knowing the energy consumption within well-defined periods of time during the day/month/year, with the purpose of applying the respective billing rates to each period.

In the normal Interval Data scenario, having absolute consumption information at the points in time where the switch boundaries are defined is enough to build that TOU profile. This is because the Interval Data information is collected to ensure timely storage/delivery. One can say that Interval Data has well defined time boundaries and undefined consumption boundaries.

The REI concept, on the other hand, has well defined consumption boundaries but completely undefined time boundaries. As a consequence, any time boundary will always lie between two consumption boundaries. The best estimate of a time boundary will occur whenever the two consumption boundaries are known, because the two times at which the consumption boundaries were reached are then known. However the position of the desired time boundary will be as random as the consumption itself. In other words in REI it is irrelevant to talk about time accuracy (Except for the time resolution of the interval).

This does not mean that the TOU service cannot be provided: Knowing the fact that any time-boundary lies between two successive consumption values means that estimating the consumption at that time-boundary (which is the only meaningful quantity for TOU purposes) is as accurate as the Consumption Step that was used to collect the data.

Typically, for example in the electric metering application, if one uses 1KWh as the Revenue Event, then any consumption at any time-boundary will be known with an accuracy of 1KWh. This means that the TOU bin will be represented correctly with the accuracy of that Step, and the time alignment error becomes irrelevant.

As long as the resolution required by the TOU service is compatible with the Step selected, then the TOU service is provided to satisfaction within that Consumption resolution.

The tables below shows data obtained from a simulation of electricity consumption through a load of approximate 6 KW.

The resolution of the simulation was one second on the time axis, and data was simulated for 18 hours. This allows an immediate comparison between several examples of different schedules, and using either the standard TOU process derived from time interval data or the TOU process as derived from the REI approach.

For the purposes of the REI approach it is assumed a Revenue Event Interval of 1KWh.

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For the purposes of the Interval Data approach it is assumed that the wall alignment is perfect to the second.

The first schedule in Table 2 is the hourly schedule. The plot in Figure 2 shows graphically the bin comparison for the Hourly TOU. The second schedule in Table 3 creates bins of 4 hours, and the third schedule in Table 4 has switching points at 6am, 10am, and 3pm.

The ID column stands for Interval Data and the REI column stands for Revenue Event Interval.

Table 2- Hourly TOU

TOU1_ID [KWh]	TOU1_REI [KWh]	Schedule1
6.1	6	Bin1
6.4	6	Bin2
6.6	7	Bin3
6.8	6	Bin4
6.9	7	Bin5
7.0	7	Bin6
7.0	7	Bin7
6.9	7	Bin8
6.8	7	Bin9
6.6	7	Bin10
6.4	6	Bin11
6.1	6	Bin12
5.9	6	Bin13
5.6	6	Bin14
5.4	5	Bin15
5.2	5	Bin16
5.1	5	Bin17
5.0	5	Bin18

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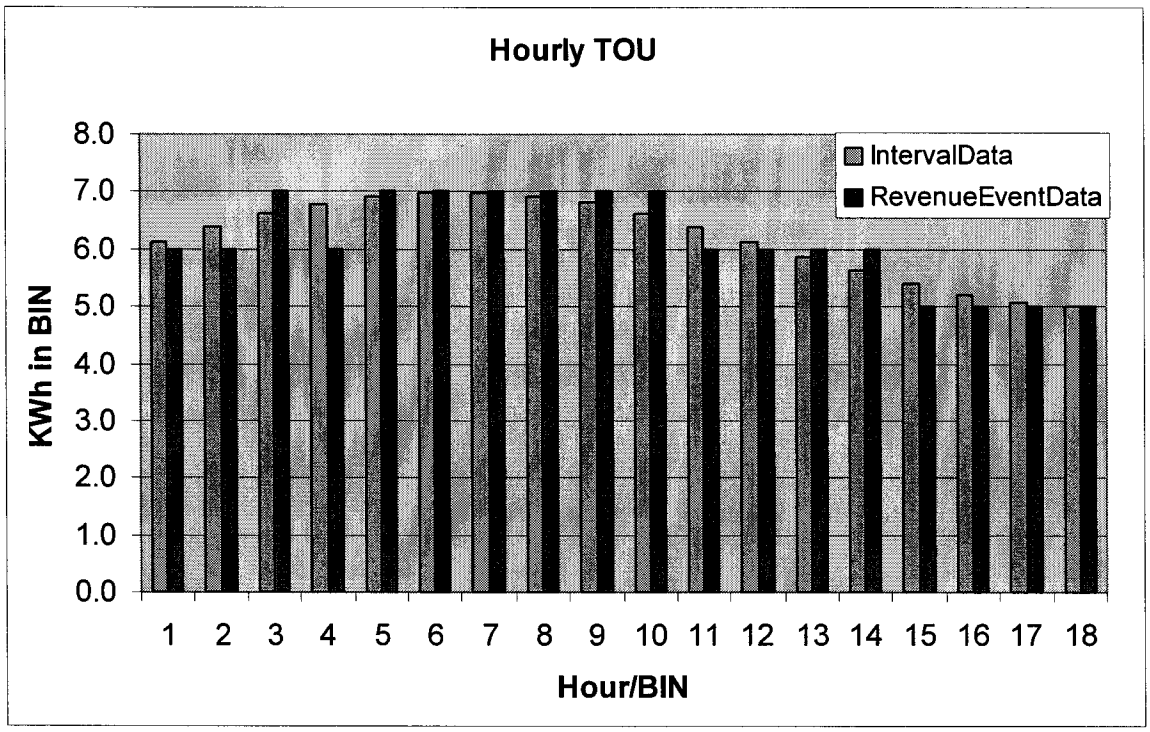

Figure 2. Hourly TOU bins for Time Interval Data and Revenue Event Interval Data

Table 3. Four-hour TOU

TOU2_ID [KWh]	TOU2_REI [KWh]	Schedule2
25.9	25	Bin0h-4h
27.8	28	Bin4h-8h
25.9	26	Bin8h-12h
22.1	22	Bin12h-16h

Table 4. Custom TOU schedule

TOU3_ID [KWh]	TOU3_REI [KWh]	Schedule3
39.8	39	Bin0h-6h
27.33	28	Bin6h-10h
29.38	29	Bin10h-15h

As expected, some of the REI bins are larger than the ID bins, some others are smaller, but the difference between the two methods is never more than the Revenue Event of 1KWh.

It can also be noticed that this accuracy is valid independently of the number of KWh of consumption in the bin.

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Conclusions

This document presented the Revenue Event Interval approach, which is an alternative method to collect interval data at the modules connected to Utility meters.

The approach has significant advantages compared to the standard time-based interval data collection in several areas of the data collection, data transport and data processing functions.

Regarding data collection, the REI concept collects new data only when new information is available, reducing data redundancy. Additionally the reality of consumption in most of the Utility meters is such that the REI uses much less processing power to collect the data and conserves energy for battery-powered devices.

By transmitting only when new information is available at the module, the amount of packets generated decreases significantly providing for a healthier operation of one-way communication approaches. Additionally, the amount of information carried by each packet is also significantly increased and the packet requirement for advanced services is considerably reduced, with has very positive impact on the network infrastructure.

By coupling the advantages in data collection and data transport, the REI concept opens the door to viable consumption profiling in battery-operated devices.

The volume of data transported across the Wide Area Network is also reduced, with beneficial impact on reliability, network capacity, and storage in intermediate devices.

Regarding the data processing at the host level rendering consumption profiles is not anymore time limited. This removes the constraint of time-accuracy in the data collection and transport across the system.

The TOU analysis presented in the document shows that this advanced service can be provided within well-controlled accuracy of the consumption on each bin. The discrepancy should always be smaller than the Revenue Event size that is selected for the data collection.

It is also made visible that the notion of time, time accuracy and time alignment becomes much less critical in this reconstruction: Aligning the TOU schedules on top of the consumption profiles renders the complete Bin information required for the application, and the information has well-known accuracy and resolution.

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Thomas, Chenoa

From: Jay Evensen [jay.evensen@cellnet.com]
Sent: Wednesday, March 23, 2005 11:35 AM
To: Giudici, E. Anthony
Subject: Cellnet response to additional radio questions

Tony,

Cellnet has provided our response to the radio questions in the attached document. Please do not hesitate to contact us if you have any questions.

jay

At 12:27 PM 3/17/2005 Thursday, you wrote:

> Jay Evensen<?xml:namespace prefix = o ns = "urn:schemas-microsoft-com:office:office" />
>
> VP Business Development
>
> Cellnet
>
> <?xml:namespace prefix = st1 ns = "urn:schemas-microsoft-com:office:smarttags" />
>
> PG&E must develop an understanding of your proposed radio system for a CPUC California Environmental Quality Act [CEQA] process assessment that covers potential environmental, health, safety and other issues. PG&E has engaged external consultants to support this task.
>
> One of the issues relates to the radio frequency aspects of the proposed AMI systems. To that end, we request that you provide additional information to PG&E by March 23, 2005. We realize that some of this information may have been provided already, but we wish to be certain that the correct information is provided, in summary form, to the radio system consultant.
>
> Please provide the following information for every different AMI radio in your proposed offering to PG&E:
>
> **Item**
>
> **Question**
>
> 1
>
> Transmitting frequency band and modulation used

a. Meter to repeater

b. Repeater into network

c. Repeater to meter

2

RMS transmitter output power level

a. Meter to repeater

b. Repeater into network

c. Repeater to meter

3

Antenna

a. Antenna type

b. Antenna gain

c. Antenna size

4

Duty cycle of the transmitter

a. Meter to repeater

b. Repeater into network

c. Repeater to meter

6

Provide a digital file of the antenna pattern including elevation and azimuth data for

a. Meter to repeater

b. Repeater into network

c. Repeater to meter

7

Provide a copy of your radio signal and the associated emission mask

a. Meter to repeater

b. Repeater into network

c. Repeater to meter

E. Anthony "Tony" Giudici
Sr. Procurement Specialist
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PG&E Question

The following are the Cellnet responses to PG&E questions. Also, at the end of this document are the UtliNet Series III Specification for you use.

1 Transmitting frequency band and modulation used.

a. Meter to repeater – **Cellnet: 917 MHz / UtiliNet: 902-928 MHz**
b. Repeater into network – **902-928 MHz**
c. Repeater to meter – **One-way with Cellnet endpoint. 902-928 MHz for UtiliNet endpoint**

2 RMS transmitter output power level

a. Meter to repeater – **Cellnet: 200 mW / UtiliNet: 90 mW**
b. Repeater into network –**Programmable from 100 mW – 1 W**
c. Repeater to meter – **Programmable from 100 mW – 1 W**

3 Antennas

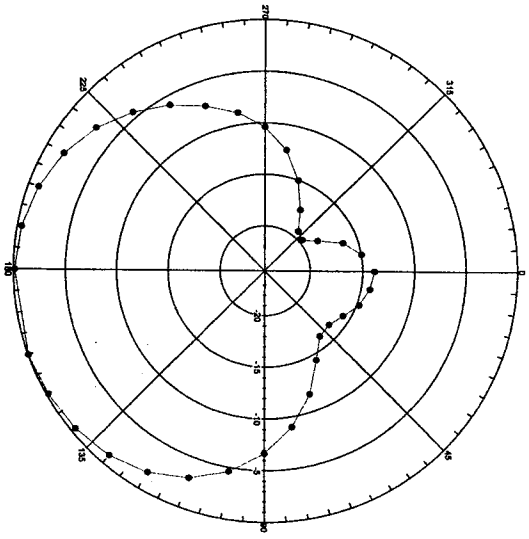
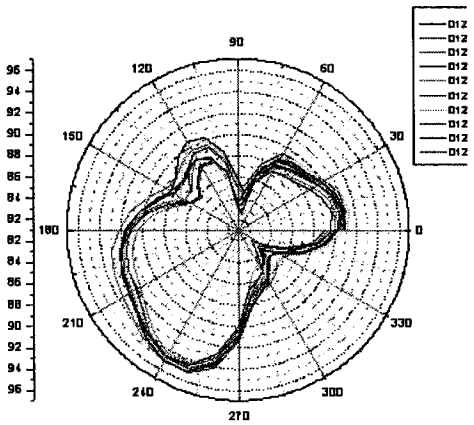
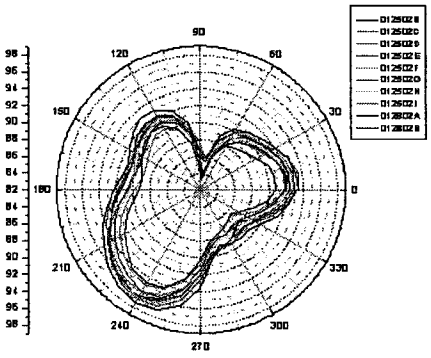
a. Antenna type – **Cellnet: Patch Antenna In Meter / UtiliNet: Slot On Board Antenna**
b. Antenna gain – **1 dB**
c. Antenna size – **Built in to PCB, fits inside existing meter**

4 Duty cycle of the transmitter

a. Meter to repeater – **Average of 5%, Maximum of 60 %**
b. Repeater into network – **Average of 5%, Maximum of 60 %**
c. Repeater to meter – **Average of 5%, Maximum of 60 %**

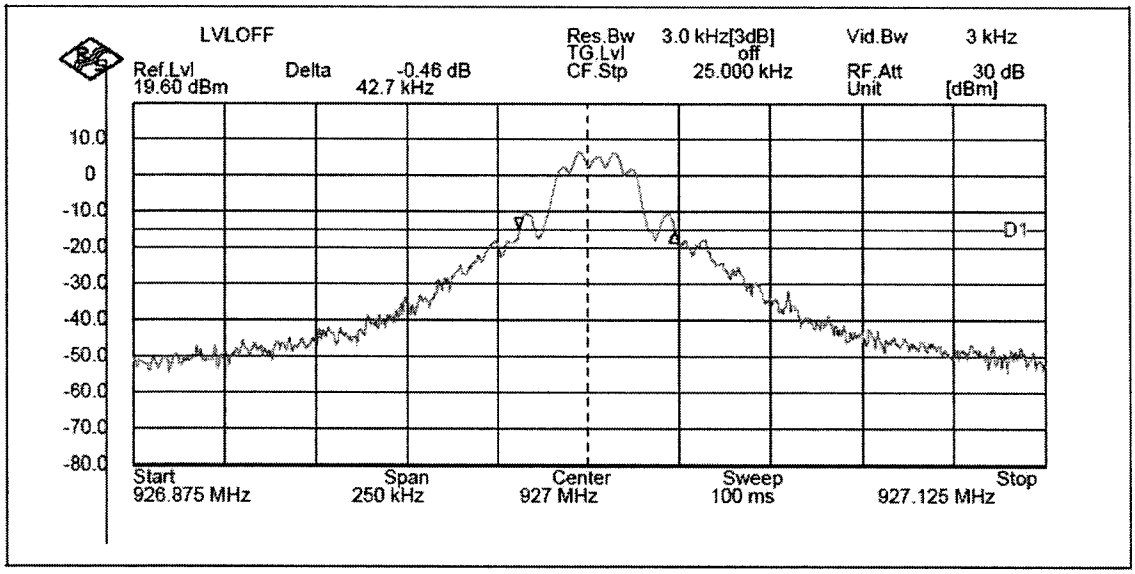
6 Provide a digital file of the antenna pattern including elevation and azimuth data for

a. **Meter to repeater "See below"**
b. **Repeater into network – Utilize Whip antennas that have full 360° pattern**
c. **Repeater to meter - Utilize Whip antennas that have full 360° pattern**

FOCUS Antenna Pattern	Retrofitted ABB Meter Pattern
	 ABB Avg ERP = 16.8dbm ABB Max/Avg = 0.8 Front
Retrofitted ABB Meter Pattern	
 GE Avg ERP = 18dbm GE Max/Avg = 0.83 Front	

7 Provide a copy of your radio signal and the associated emission mask

a. Meter to repeater
b. Repeater into network
c. Repeater to meter



Series III WanGate Radio General Specifications

General

Frequency Range	License-free, 902-928 MHz
Channels	240
Channel Spacing	100 kHz
Raw RF Data Rate	9600/19,200 bps
Spreading Technique	Frequency Hopping
Hopping Technique	Pseudo Random, Asynchronous
Hopping Patterns	65,536 (Unique per Network)
Network Address	Latitude/Longitude Coordinates
Frequency Stability	2.5 ppm

Receiver

Type	Double Conversion Superheterodyne; 1st IF 136 MHz, 2nd IF 10.7 MHz	
MDS Sensitivity @ 10E-5 BER	9,600 bps	19,200 bps
	-109 dBm	-106 dBm
Co-channel Rejection	61 dBm minimum	
Worst case Image Rejection	58 dB minimum	

Transmitter

RF Output Power (@ antenna connector)	+10 dBm (10 mW) to +30 dBm (1 Watt), user configurable
Out-of-Band Spurious Emissions	-20 dBc maximum @ +30 dBm
Deviation	±5.5 kHz ± 10%
Modulation Bandwidth	25 kHz
Modulation	Direct 2-FSK
Output Impedance	50 Ohms

Processing

CPU	M16C/62P
Clock Speed	9.8304 MHz
SRAM memory	31 Kbytes internal + 512 Kbytes external
FLASH memory	384 Kbytes internal + 1 Mbytes external
Programming Language	Device Control Word (DCW)

Data Ports/Formats

	LAN Packet Port	**Transparent Port**
Serial Interface	RS-232C	RS-232C
Data Rate	1200, 9600, 19,200 or 38,400 bps	300, 600, 1200, 4800, 9600, 19,200 or 38,400 bps
Protocol	UtiliNet LAN Packet Protocol	Any Asynchronous Byte-Oriented Protocol
Parity	None	Odd, Even, or None
Data Bits	8	7 or 8
Stop Bits	1	1 or 2
Duplex	Full	Full

Environmental

Operating Temperature Range	-40° to +85° Celsius
Storage Temperature Range	-40° to +85° Celsius
Operating Vibration	IEC 68-2-6
Operating Shock	IEC 68-2-27

Humidity	ANSI 12.20 § 5.4.3.18

EMI & Power/Control Susceptibility

Electromagnetic Radiation	FCC Class B, Part 15.247
Electromagnetic Susceptibility	ANSI C37.90.2 Modified
Surge Withstanding Capability	ANSI C37.90.1 and ANSI C62.41
Electrostatic Discharge	IEC 801.2

Agency Approvals

FCC Certified	Part 15.247
Industry Canada	RSS 210
NOM	121-SCTI-1994

Series III IWR Radio Specifications

Power

	DC Operation
Input Voltage Range	6–30 VDC
Input Current on receiving mode	33 mA maximum @ 12 VDC
Input Current [1] (on transmitting mode @ 100 mW	220 mA maximum @ 12 VDC
Input Current (on transmitting mode @ 1 W)	550 mA maximum @ 12 VDC

Mechanical

Interface Connections	**DC Version**
Power	Molex Mini-fit
Data Ports	DB-9
Antenna	SMA Type, Female
Enclosure (indoor)	
	Extruded aluminum
Weight.	0.575 lb.
Size	4.250"W x 5.770"D x 1.720"H

[1] 50% duty cycle

Thomas, Chenoa

From: Jay Evensen [jay.evensen@cellnet.com]
Sent: Monday, March 21, 2005 12:27 PM
To: Giudici, E. Anthony
Subject: Re: AMI Meeting / Additional Clarifications

Tony,

We have attached our response to your request for a 2-way electric solution. Please call if we can add clarity to any item.

thanks

jay

At 02:24 PM 3/14/2005 Monday, you wrote:

> Mr. Jay Evensen
>
> CELLNET
>
> We would like to thank CELLNET for responding to our first request for bid clarification. CELLNET's team helped us to better understand the retrofit issues for both gas and electric meters.<?xml:namespace prefix = o ns = "urn:schemas-microsoft-com:office:office" />
>
> The purpose of this letter is to request a "second round" bid clarification. In this round, we should like to see what costs might be associated with a two-way solution (instead of the one-way solution currently proposed), to read all of the electric meters CELLNET would cover in PG&E's service territory.
>
> In addition, if there are any component prices that, upon reflection, need clarification in CELLNET's full system proposal, for both electric and gas, please forward to us those changes and identify any changes to your proposal or product specifications that are required to reflect the revised component prices.

The template used for the first clarification round is attached.

In this second round, please make any additional clarifications CELLNET would like to include in the combined gas and electric system and, also, edit a copy of this template to reflect a two-way electric solution.

We request that CELLNET respond no later than 12:00 pm on Monday, March 21st. As per RFP requirements, all materials, and questions, must be directed to the undersigned.

E. Anthony "Tony" Giudici
Sr. Procurement Specialist
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Fax: 415.973.2553 (Int: 223.2553)
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	Cellnet Proposal Cost Item	Type	Quantity	100%	80%	60%	40%	20%
	Rev. 3/21/2005							
	1. Endpoints							
1	2S Meter/Module - 2W	One-Time	3,641,353	$ 52.25	$ 80.00	$ 80.00	$ 80.00	$ 80.00
2	1S, 3S, 4S Meter/Module - 2W	One-Time	85,162	$ 78.00	$ 105.75	$ 105.75	$ 105.75	$ 105.75
3	12S (non Poly) Meter/Module - 2W	One-Time	312,483	$ 91.00	$ 118.75	$ 118.75	$ 118.75	$ 118.75
4	2K Meter/Module - 2W	One-Time	15,549	$ 146.00	$ 173.75	$ 173.75	$ 173.75	$ 173.75
5	5S, 8S, 9S, 10S, 12S,14S,15S, 16S Meter/Mod	One-Time	289,311	$ 600.00	$ 600.00	$ 600.00	$ 600.00	$ 600.00
6	2S Retrofit							
7	1S, 3S, 4S Retrofit							
8	12S (non Poly) Retrofit							
9	5S, 8S, 9S, 10S, 12S,14S,15S, 16S Retrofit							
10	PP Solid State Retrofit							
11	American Module	One-Time	1,468,511	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
12	Equimeter Module	One-Time	925,951	$ 53.50	$ 53.50	$ 53.50	$ 53.50	$ 53.50
13	Sprague Module	One-Time	650,765	$ 53.50	$ 53.50	$ 53.50	$ 53.50	$ 53.50
14	AM/EQ/SP Module	One-Time	41,565	$ 156.00	$ 156.00	$ 156.00	$ 156.00	$ 156.00
15	Non-Diaphram Module	One-Time	15,665	$ 126.00	$ 126.00	$ 126.00	$ 126.00	$ 126.00
16	American Module for new Meter	One-Time	167,177	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
17	Equimeter Module for new Meter	One-Time	117,666	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
18	Sprague Module for new Meter	One-Time	304,766	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
19	Other Unidentified for new Meter	One-Time	11,482	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
20	American module for new Meter	One-Time	34,497	$ 156.00	$ 156.00	$ 156.00	$ 156.00	$ 156.00
	2. Communications Network							
21		One-Time						
22	Concentrator (Bridge)	One-Time	18,073	$ 1,224	$ 1,224	$ 1,224	$ 1,224	$ 1,224
23	Wan Master (takeout point)	One-Time	89	$ 12,000	$ 12,000	$ 12,000	$ 12,000	$ 12,000
	3. IT							
24	Sun Computers	One-Time	1	$ 190,000	$ 190,000	$ 190,000	$ 105,000	$ 105,000
25	Oracle and Infinet	One-Time	1	$ 2,260,000	$ 2,165,000	$ 1,895,000	$ 1,445,000	$ 835,000
26	Infinet	Annual	1	$ 610,000	$ 585,000	$ 515,000	$ 400,000	$ 230,000
	4. Deployment Support and Management							
27	Antennae	One-Time		$ 125	$ 125	$ 125	$ 125	$ 125
28	Cable	One-Time		$ 50	$ 50	$ 50	$ 50	$ 50
29	MS-MFT	One-Time		$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000
30	Field Tester	One-Time		$ 155	$ 155	$ 155	$ 155	$ 155
31	Link Assessment	One-Time		$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000
32	Network Planning	One-Time	1	$ 21,000,000	$ 20,300,000	$ 19,300,000	$ 18,000,000	$ 17,000,000
33	Training	One-Time	1	$ 135,000	$ 135,000	$ 135,000	$ 135,000	$ 135,000

Questions

Note: Above summary excludes installation labor, new gas meters, and Wan communication charges

Cellnet Notes

1. The electric meters\modules above are 2-way using Cellnet UtiliNet radios
2. The 2-way polphase electric meter\modules above are commercially available
3. The 2-way single phase electric meters\modules above are expected to be commercially available Q4 2005
4. Cellnet 1-way gas & electric meters\modules previously quoted can also be used concurrently with 2-way meters\modules
5. The total network quantities and total price remain as previously quoted but configured to include all UtliNet 2-way radios.
6. Previously submitted assumptions or options remain in effect

Thomas, Chenoa

From: Jay Evensen [jay.evensen@cellnet.com]
Sent: Monday, March 07, 2005 12:34 AM
To: Giudici, E. Anthony
Subject: Cellnet Q&A Response

Tony,

Attached is the Cellnet response to the PG&E Questions. We have also included our response to the security questionnaire for section 2, as requested.

We will be at the guard station on Bealle st. on March 8th at 7:25 am pt.

Also, at our last meeting a request was made for an additional reference examples where we had cases of product issues that we worked to resolve to the customer's satisfaction. That information is as follows:

Resolved gas module lockup - WE Energies - Ken Vlasek Project manager - office number is 262-544-7368, mobile number is 414-659-0427 and e-mail is ken.vlasek@we-energies.com.

Resolved gas module lockup - Exelon - PECO - Dave Barone Project Manager 215-841-5879.

Resolved electric module polycap failure - AmerenUE - John Luth Project Manager 314-992-6884. jluth@ameren.com

At the meeting we will have demonstration equipment and system diagrams for better response to the Q&A. I PC projector during the discussions would be of assistance if possible.

Thanks for your patience.

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Proposal Clarification Questions

Date: February 8, 2005

To: M. Zito, President Cellnet

From: A. Giudici

Topic: Request for clarification of additional items

PG&E has the following questions related to your proposal. Your firm is to provide its responses to these questions to Mr. A. Giudici at aeg5@pge.com in a single email to be received by COB PST Thursday February 10th. The format to use for the response is to repeat PG&E's original questions in the same order as presented herein and to provide Cellnet's response immediately after each question. Responses must be as comprehensive as possible in order to enable PG&E to fully understand the direct response, any implications, impacts and consequential considerations. The response must be submitted in a Word document or as a PDF file but in either case the document must allow for information to be copied so it may be incorporated into other PG&E prepared documents, responses are not be locked in any way that requires a password or other permissions in order to copy content.

PG&E will use the responses to these questions as well as the pricing clarification questions located in the attached Excel file to further its understanding and assessment of your proposal.

PG&E Questions:

1. Describe how your system will provide hourly interval data where the readings are taken within 3 minutes of the hour.

   Cellnet Response: The Cellnet proposal has two types of endpoint interval configurations; the first type of interval is to address the PG&E broad requirement for Hourly data. The other interval type would be used for all other data requirements. The first configuration accumulates consumption data every 15 minutes and then transmits this data using Cellnet protocol every 15 minutes. This data packet contains interval data that can be used to create daily, TOU and hourly interval lengths. This configuration helps reduce the network infrastructure required. The delivered interval would be +/- 30 minutes within required interval period. In the event that PG&E requires more granularity to an interval Cellnet has options to configure the end points to meet a higher resolution requirement.

   The second configuration utilizes Cellnet standard data transmission of every 5 minutes using Cellnet protocol, which contains interval data (usage every 2.5 minutes) that is used on meters that require demand peaks based on a 15-minute sub-interval. This configuration does meet your time requirements for readings taken within 3 minutes of the hour. If this interval type were used for the entire population it could have an impact to increase the number of network concentrators.

   In the event that PG&E requires more granularity to an interval Cellnet has options to configure the end points to meet a higher resolution requirement. Cellnet has several endpoint configuration options that would optimize interval structure with no impact to the number of AMI network concentrators. This information is available for discussion at our upcoming Q&A session and under an executed non-disclosure agreement.

2. Please fill in the following table with the percentages (xx.x%) of data your system provides according to the delivery schedules below and be prepared to discuss.

   Cellnet Response: The performance levels below are typical minimums for the meters that are available to be read. The performance is also subject to how the Cellnet systems are managed and maintained. The monthly scheduled read performance is based on the PG&E proposed billing window.

	Frequency of Data Delivery	Frequency of Data Delivery
Data Interval	**Daily** (by 12 noon next day)	**Monthly** (by 3:30 pm of monthly scheduled read date)
Electric Hourly	98.0%	99.0%
Electric Daily	98.0%	99.0%
Electric Monthly		99.0%
Gas Daily	98.0%	99.0%
Gas Monthly		99.0%

3. Identify which 2-way end points for InfiNet you plan to market and define the commercialization plan including when each of the proposed units will be commercially available for delivery to PG&E?

   Cellnet Response: Cellnet has already commercialized and is marketing the 2-way endpoint for use in C&I (polyphase) electric meters. The first of such meters is the Landis+Gyr S4e Commercial/Industrial meter with the Cellnet UtiliNet radio technology "under cover". This device offers complete 2-way functionality and uses a packetized mesh network communication technology.

   In mid-2005, the Elster A3 Commercial/Industrial will be available with this same 2-way technology integrated under the cover. By the end of 2005, the Landis+Gyr FOCUS meter will include the UtiliNet 2-way technology, including a version that has an optional integrated physical disconnect.

   Commercialization will continue on other meter platforms of other vendors.

4. Describe how you will guarantee to PG&E that the AMI system you propose to deliver will meet the performance requirements for the minimum fifteen year operational life given the concerns about increasing interference in the ISM BAND.

   Cellnet Response: – Cellnet's wireless electric and gas AMI modules communicate using the unlicensed part 15 band direct-sequence spread-spectrum (902 – 928 MHz) radio technology, that is ideal for communicating short bursts of data economically and reliably to and from millions of endpoints. Low power links ensure minimal transmission interference and built-in Cyclical Redundant Checking (CRC) error-checking protocols provide the very highest data reliability. Cellnet will continue to meet or exceed the unlicensed part 15-band direct-sequence spread-spectrum requirements.

   Although Cellnet cannot provide such a specific guarantee, our products will be certified to the regulatory standards for the frequencies where they are used. When Cellnet provides services to maintain and operate the system part of the services include managing and monitoring the system to identifying other parties that may be illegally or incorrectly interfering in the unlicensed ISM BAND.

5. Describe how your system will achieve the message performance requirement when your Concentrators etc. fail at 2% a year.

   Cellnet Response: Cellnet must clarify the statement of 1.5%-2% failure network device failure in our RFP response. This rate reflects the field visits made to the concentrators. This is not the product

failure rate. When the product is visited there may be no fault found at the site, the device may be removed and replaced and later no fault is found. The actual product failure of concentrators is 0.7%. In the event that the product fails in the field, the message performance is achieved through redundancy in the network. Each endpoint is visible to several concentrators, so if one is being serviced, and until it is put back into normal operation, the endpoints assigned to it will reach the system through any of the alternate paths already available. The host system constantly monitors concentrators for problems. Performance requirements are met through a combination of constant monitoring and responsive field management of the system.

6. Describe the battery life and annual failure rate for gas AMI modules and provide copies of reports to support your battery life claim.

   Cellnet Response: Cellnet has implemented an upgraded battery assembly configuration that provides an expected life of more than 15 years. Previous battery assembly configurations have provided an expected life of approximately 8 years. Failures rates of Cellnet gas modules have been approximately 0.8% per year. Many of these failures have been due to an excessive current drain of the battery. The source of these problems has been identified as a result of the manufacturing process. The issue was identified as a depanelization of the circuit boards. Modifications were made to the manufacturing process and the issue was resolved.

7. What's the variation in the time for the low battery notice.

   Cellnet Response: Low battery notification is dependent on the cause of the low battery voltage, but notification is typically several weeks before complete failure of operation of the module.

8. Describe the gas AMI module battery replacement process.

   Cellnet Response: The battery replacement for the gas AMI Module consists of a few easy steps as described below.

   a. Using an awl, remove the two red tamper seals visible from the out side of the AMI module.

   b. Remove dust or dirt off the top of the module.

   c. Remove the cover screws using a flat tip screwdriver. The American and Rockwell/Equimeter modules will have 4 cover screws each. The Sprague/Schlumberger modules will have 2 cover screws each.

   d. Gently remove the AMI module cover. Depending on the conditions, the cover may stick to the module. Be careful not to damage the module when pulling the cover off.

   e. Remove the battery from the battery compartment and disconnect it.

   f. Clean out any debris or dirt in the battery compartment.

   g. Plug in the new battery.

   h. Place the battery in the battery compartment with the wires located away from the cover sealing surface.

   i. Replace the AMI module cover. Check to make sure that the wires are not pinched between the cover and the bracket.

   j. Refasten the cover screws to 10 to 30 in-lbs. or hand tight using the flat tip screwdriver.

   k. Install new tamper seals over two of the cover screws (opposite corners are preferred).

9. Explain the 10% - 15% missing outage alarms and how this will impact the successful identification of outage situations.

   Cellnet Response: Cellnet has experience that the key to a successful outage identification program is a highly functional and responsive restoration verification process. In the Cellnet system the

outage alarms have statistical behavior dependent in their quantity. For single alarms, localized anywhere in the network the probability of reception equals the average probability of reception of any transmission packet, about 72%. For multiple alarms, on residential meters, in excess of 10 simultaneous and contiguous, there will be collisions-based degradation to the 72% and to the point where the system would not receive more than 12 alarms per outage occurrence per bridge.

It our customers experience that when an outage notification event occurs such as from an endpoint a network concentrator, a customer call in, or typically a combination, the outage is successfully confirmed through the use of both the outage and restoration functions that the Cellnet system provides. Cellnet can facilitate contact with our customers to share the first hand benefits available.

10. On Page 12 of your proposal, what was your assumption as to minimum meter density?

    Cellnet Response: The minimum meter density used in our assumptions is 150 meter per square mile.

11. Describe any load control products you have or plan to make available as well as how they will operate in your system.

    Cellnet Response: Cellnet is currently investigating the possibility of integrating our technology into BLP products (Remote Disconnect, and current limiting devices). The products would utilize the Cellnet network as a two-way communication link from a host application down to the individual endpoint devices.

12. How will you provide coverage in Monterey since there is no InfiNet coverage there?

    Cellnet Response: Cellnet has proposed to provide network concentrators that are capable of collecting the metering data. These concentrators are also capable of communicating with any existing PG&E UtiliNet radios. If there are not any existing UtiliNet radios our network planning teams will adjust the deployment accordingly.

13. On page 8 of your proposal, what is the average communication range of the three links for urban and suburban sites?

    Cellnet Response: The link between the AMI endpoints and the InfiNet concentrator is typical between 0.25 to 0.5 miles. The distance between the two devices is determined by several factors, which include territory topology, meter density, service levels, and performance requirements. This distance is about the same for both urban and suburban.

    The concentrators communicate via a mesh hopping process to the take-out-point. The distance between a single concentrator and a take-out-point can be up to 3 to 5 miles.

14. How many meters can a concentrator support?

    Cellnet Response: One concentrator directly manages up to 1,400 meters but can communicate with several thousand.

15. On page 9 of your proposal, does the concentrator receive messages from the Extenders or meter or both?

    Cellnet Response: Based on our current discussions the extenders and concentrators should be considered the same device because they perform the same functions.

16. On page 9 of your proposal, why does the Concentrator have a WAN interface if it's communicating with the WAN Master?

    Cellnet Response: The concentrator communicates wirelessly to the WAN Master or take-out-point. The WAN master is used to bridge the gap between the RF network and the communication link to the system controller application.

17. On page 9 of your proposal, what is the WAN Master's role and how is it different than the Concentrator?

Cellnet Response: The WAN Master or take-out-point is used to bridge the gap between the RF network and the communication link to the system controller application. It receives and transmits Rf communications with the concentrator and has a TCP/IP interface to the system controller. The WAN Master and concentrator utilize the same UtiliNet network 2-way radios with the same functionality for communication, however the concentrator has an additional radio that receives the Cellnet endpoint RF communication.

18. What are the WAN performance and bandwidth requirements in order to support the various billing and outage management applications?

    Cellnet Response: The expected bandwidth requirement within the concentrators mesh network is approximately 80 Kbps, which is sufficient for three to four thousand endpoints per concentrator. Outage management for a densely populated network node could result in peaks up to 100Kbps in network traffic, with a network latency of one second per hop, plus four to five seconds of event proceeding at the system controller.

19. Who would you recommend for the retrofit work?

    Cellnet Response: Austin International is the vendor we use to perform electric meter retrofits to Cellnet standards. We also understand that Austin currently performs work for PG&E. We would allow Austin to contract directly with PG&E to perform the retrofit process using Cellnet AMI modules.

20. On page 11 of your proposal, where is Cellnet currently monitoring load in support of a load control project?

    Cellnet Response: The response to the question "Overall ability to support load control and smart thermostat uses," was to address Cellnet's ability too turn relatively any meter onto load-profile at any time. Currently Cellnet provides interval data to many meters currently within our systems. Cellnet does provide daily TOU data for Puget Sound Energy for over 300K residential meter points.

21. On page 12 of your proposal, what happens to the billing data if the Concentrator or Wan Master suffers a failure?

    Cellnet Response: Typically three concentrators track each meter. Therefore, if a particular concentrator fails, then another concentrator that has been collecting the data will provide the meter data. If the WanMaster or take-out-point suffers a failure, then the meter data is simply routed to another Take Out Point.

22. On page 13 of your proposal, what is the assumed message success rate in order to meet the proposed data performance requirements?

    Cellnet Response: It is assumed that the minimum working Packet Success Rate for an individual endpoint is 15%, from the meter to the concentrator.

23. Describe the on-demand read process including the time required for each step.

    Cellnet Response: The on-demand read process is an InfiNet host application called On-Request Read Service. It is a vehicle where a real time request is issued through the system controller for metering data for a particular electric or gas AMI meter. The on-demand read process retrieves the data via a network query to the concentrator or to the endpoints, in case of UtiliNet 2-way endpoints. The average response time for the network query takes no longer than 30-45 seconds. Once the data is obtained from the concentrator, the response is available instantaneously to the InfiNet system controller, where this data is available in a user presentable format through several interfaces to PG&E applications.

24. On page 19 of your proposal, you indicate multiple repeaters can hear individual messages but what is the actual redundancy among those repeaters to provide data in the event of a failure of one. Describe how the system will provide continuous hourly interval data for meters whose concentrators or WAN Master sustains a catastrophic failure.

Cellnet Response: Each meter is tracked by typically three concentrators, and each concentrator has the ability to track up to 1,400 meters. Therefore, in the case of a catastrophic failure of a concentrator or take-out-point, meter data will simply be routed through a different concentrator or to a different take-out-point.

25. What causes the gas modules to have a 0.8% failure rate?

    Cellnet Response: Many of these failures have been due to an excessive current drain of the battery. The source of these problems has been identified as a result of the manufacturing process. The issue was identified as a depanelization of the circuit boards. Modifications were made to the manufacturing process and the issue was resolved.

26. On page 24 of your proposal, what is the actual battery life experienced for gas modules and water modules?

    Cellnet Response: Cellnet has implemented an upgraded battery assembly configuration for the Gas AMI endpoint that provides an expected life of more than 15 years. Previous battery assembly configurations have provided an expected life of approximately 8 years.

27. On page 25 of your proposal, how many utilities and meters are involved in your comment that 99.5% of all TOU data is being made available?

    Cellnet Response: There are 5 utilities with over 7 million electric meters and almost 1 million of them are on TOU.

28. On page 129 of your proposal, regarding your traffic model, how many systems have you deployed that are exactly the same as the system you described in the proposal to PG&E?

    Cellnet Response: All pieces of the proposed solution equipment (endpoints, concentrators, etc.) have been in commercial use. Cellnet will continue to optimize configurations for specific customers and leverage or develop new products and combinations that provide the most effective use possible. Due to the size and requirements of PG&E's proposal, this will be the largest and most extensive use of the system components.

29. Describe the bus transportation system interference issue in Seattle and how this is being resolved.

    Cellnet Response: The King County Metro agency, in cooperation with the Washington State Dept. of Transportation, began installing a Traffic Signal Priority system for more efficient traffic signal management aimed at improving the on-time performance of its buses.

    The Metro system uses an RF technology that was legally licensed by the FCC yet began causing some intermittent interference with the Cellnet system. The interference basically stems from a combination of two conditions: 1) the fact that a small percentage of the deployed Metro network radios operate at a frequency that is very close to the Cellnet LAN frequency; and 2) the fact that those radios operate at nearly 100% duty cycle.

    Cellnet has experienced personnel who quickly identified the underlying issue and worked hand in hand with Metro personnel to arrive at a mutual technical solution that eliminates the impact of the small percentage of problematic Metro radios.

30. On page 36 of your proposal, explain how you will mix 5 and 15 minute interval data and support the business needs.

    Cellnet Response: Cellnet endpoints on meters requiring peak demand calculations will transmit packets of 2.5-minute intervals every 5 minutes. These intervals are used at the InfiNet system controller to calculate demand peaks based on a 15 minute sub interval.

31. Explain for which meters your system can provide voltage data and how this is done.

Cellnet Response: Polyphase meters currently supporting voltage data include the Elster ALPHA Plus and Itron SENTINEL. These meters provide voltage data that is communicated over the network to the Cellnet system controller. The Landis+Gyr S4e under development will provide this information as well. For 1-way end points, the information comes as a daily snapshot, as well as voltage site diagnostic event information. For 2-way end point technology, the information is configurable depending on the capabilities of the meter. Voltage event information, register, as well as load profile may be provided over the network to the InfiNet system controller. Single phase meters soon to support this function include the Landis+Gyr FOCUS. The meter will provide voltage profile, as well as event data.

32. Compare the proposed over 15 year battery life to what has been experienced by existing customers.

    Cellnet Response: The 15-year battery life is provided by a newly implemented battery assembly configuration. Previous configurations have provided an 8-year life.

33. Does the 50% threshold for a voltage alarm hold for L+G Focus meters or just Centron meters.

    Cellnet Response: A power outage alarm will be transmitted from both devices at this voltage level. The L+G FOCUS actually sends the power outage alarm based upon its internal power supply, which is 12 volts under normal operating conditions. When the internal power supply falls below 8.5 volts, the power outage alarm will be transmitted.

34. On page 76 of your proposal, why didn't you provide outage message receive performance data and if it is available provide in your reply?

    Cellnet Response: The outage alarms have statistical behavior dependent in the quantity of events. For single alarms, localized anywhere in the network the probability of reception equals the average probability of reception of any packet is about 72%. For multiple alarms, in excess of 10 simultaneous and contiguous, there will be collision-based degradation to the 72% and to the point where the system would not receive more than 12 alarms per outage occurrence per bridge. For all alarms that are received at the bridge, there is no system limitation on making them available to the host.

35. On page 82 of your proposal, do multiple Concentrators retain copies of the data such that the data can be used to fill gaps in the event of an Extender or nearby Concentrator failure?

    Cellnet Response: Yes, each meter is tracked by typically three concentrators, and each concentrator has the ability to track up to 1,400 meters. Therefore, if a particular concentrator fails, then another concentrator that has been collecting the data will provide the meter data.

36. On page 86 of your proposal, can the system controller process the reads into billing determinants including CPP and TOU to potentially eliminate the need for the AMI Interface System? If so please describe in detail.

    Cellnet Response: Yes, the InfiNet system controller supports a variety of metering data calculation services that include processing the daily meter read for all meters into the different types of rate structures. The most current utility rate structures are stored within the InfiNet system controller and are used to setup the data accumulation configurations for each endpoint device. Tariff revisions that impact the data accumulation within the system can be made as needed and the meter configuration interface provides the ability to register these changes and propagate them within the InfiNet system controller. In addition, the InfiNet system controller provides configurable options for basic validation and estimation of data at all levels of the data collection process. The system is modular and flexible such that PG&E specific VEE rules and billing data framing rules for CPP and TOU can be easily expanded and integrated within the InfiNet system controller.

37. On page 118 of your proposal, who is the meter supplier in the table?

    Cellnet Response: The projects listed in the table consist of meters with Cellnet radios integrated or retrofitted into them from Elster, GE, Itron, and Landis+Gyr. Cellnet radio modules are attached to gas meters from American Meter, Equimeter and Sprague.

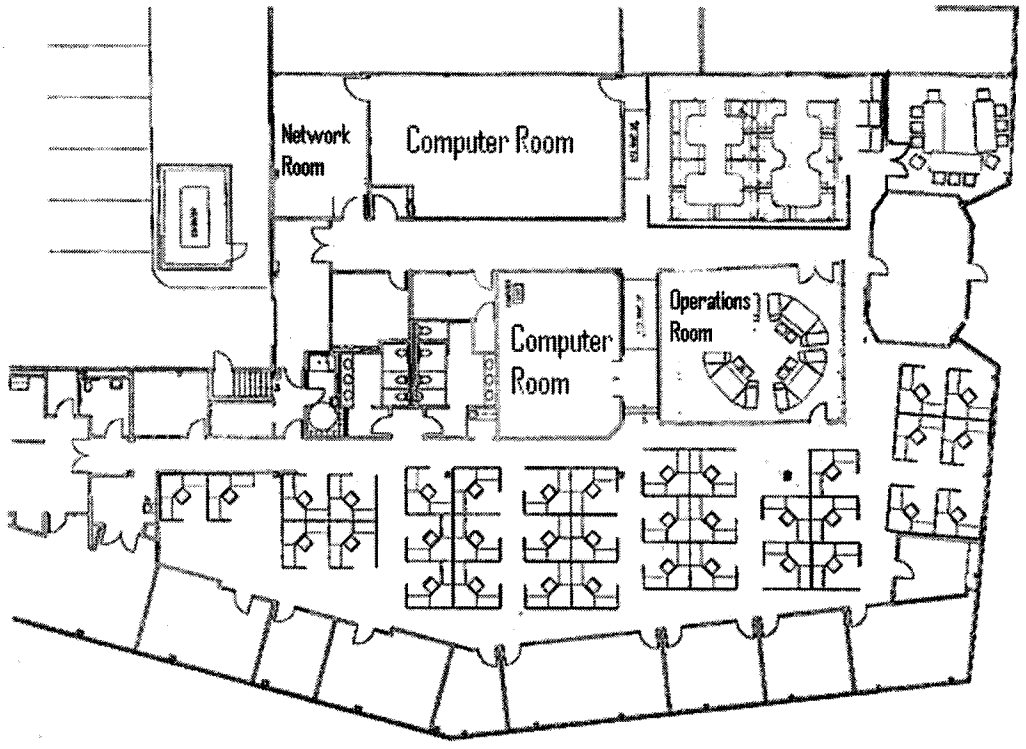
38. Describe the size of the operations center required to support the proposed PG&E system. Provide a general physical layout of your proposed operation center.

Cellnet Response: Cellnet has not proposed to provide an operations center but we are willing to further discuss the requirement once the scope of work has been developed. The data operations center required to support the proposed Cellnet system is dependent on the extent of new and reuse of the typical IT infrastructure that is around it. Although newer architecture and deployments employ less computer equipment and higher power processing, which requires less physical space; Cellnet can draw parallels between its current Network Operations Center and the requirements for the PG&E system.

Cellnet's current Network Operations Center (NOC) located in Lenexa, Kansas, a suburb of Kansas City. This NOC supports 10,000,000 meters, distributed across the Continental US, for which Cellnet provides daily reads using the traditional Cellnet MicroCell Controller (MCC) and CellMaster (CM) Architecture. To accomplish this, Cellnet operates the NOC on a 24x7 schedule. The NOC occupies 16,000 sq. ft. within a technology park office complex. System servers are typically in a rack mount configuration. The NOC has typical features found in a computing center such as raised floor, HVAC, 2 hour UPS, Diesel Generator Engine Set with 72 hour fuel supply, pre-emptive fire suppression systems, fire/smoke detection systems, Inergen Gas Suppression Systems, and controlled access security systems.

Cellnet also operates and maintains a second Network Operating Center to provide business continuity, for our subscribing utility customers, in the event of a major disaster at the Kansas City facility. This center is located at our Alpharetta, GA headquarters is a similar configuration to the Kansas City operations. .

The layout of the Cellnet Kansas City NOC is shown below.



The system quoted by Cellnet is less complex than the networks currently managed by Cellnet at the Kansas City NOC. Nonetheless, a scaled down version of the Kansas City NOC could certainly be used for the PG&E system. "Scaled down" implies smaller in size, operating personnel, etc. Cellnet can develop a more exact recommendation after further discussion around such factors as labor practices, work rules, operating requirements, business drivers, location; etc. that are not fully defined.

The Cellnet would also require a field operations center for the RF Network Deployment planning, design and field survey activities that Cellnet quoted as a part of its proposal. Cellnet envisions that these personnel resources will be housed in 4 to 6 field locations at various times locating throughout the PG&E service territory as the system is deployed. The space requirements for each of these locations are nominally 1,500 to 2,000 square feet of office space for personnel; 2,000 to 4,000 square feet of warehouse space for equipment programming and staging; 6 to 8 vehicle stalls behind a locked security fence; and the requisite support infrastructure to accompany these facilities (e.g. restrooms; break room; kitchen; small & large conference rooms; server room; visitor parking stalls; etc.) These facilities would be required within 3 months of contract signature and would remain in effect throughout the entire RF Network rollout stage, plus an additional approx. 6 month post-deployment period.

	Cellnet Proposal Cost Item	Type	Quantity	100%	80%	60%	40%	20%
	1. Endpoints							
1	2S	One-Time	2,550,079	$ 52.25	$ 52.25	$ 52.25	$ 52.25	$ 52.25
2	1S, 3S, 4S	One-Time	80,551	$ 78.00	$ 78.00	$ 78.00	$ 78.00	$ 78.00
3	12S (non Poly)	One-Time	128,805	$ 91.00	$ 91.00	$ 91.00	$ 91.00	$ 91.00
4	2K	One-Time	15,549	$ 146.00	$ 146.00	$ 146.00	$ 146.00	$ 146.00
5	5S, 8S, 9S, 10S, 12S,14S,15S, 16S	One-Time	184,731	$ 301.00	$ 301.00	$ 301.00	$ 301.00	$ 301.00
6	2S	One-Time	1,091,274	$ 38.57	$ 38.57	$ 38.57	$ 38.57	$ 38.57
7	1S, 3S, 4S	One-Time	4,611	$ 42.00	$ 42.00	$ 42.00	$ 42.00	$ 42.00
8	12S (non Poly)	One-Time	183,678	$ 55.00	$ 55.00	$ 55.00	$ 55.00	$ 55.00
9	5S, 8S, 9S, 10S, 12S,14S,15S, 16S	One-Time	44,842	$ 55.00	$ 55.00	$ 55.00	$ 55.00	$ 55.00
10	PP Solid State	One-Time	59,738	$ 136.00	$ 136.00	$ 136.00	$ 136.00	$ 136.00
11	American	One-Time	1,468,511	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
12	Equimeter	One-Time	925,951	$ 53.50	$ 53.50	$ 53.50	$ 53.50	$ 53.50
13	Sprague	One-Time	650,765	$ 53.50	$ 53.50	$ 53.50	$ 53.50	$ 53.50
14	AM/EQ/SP	One-Time	41,565	$ 156.00	$ 156.00	$ 156.00	$ 156.00	$ 156.00
15	Non-Diaphram	One-Time	15,665	$ 126.00	$ 126.00	$ 126.00	$ 126.00	$ 126.00
16	American	One-Time	167,177	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
17	Equimeter	One-Time	117,666	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
18	Sprague	One-Time	304,766	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
19	Other Unidentified	One-Time	11,482	$ 44.00	$ 44.00	$ 44.00	$ 44.00	$ 44.00
20	American	One-Time	34,497	$ 156.00	$ 156.00	$ 156.00	$ 156.00	$ 156.00
	2. Communications Network							
21	Extender	One-Time	16,424	$ 985	$ 985	$ 985	$ 985	$ 985
22	Concentrator	One-Time	1,649	$ 3,600	$ 3,600	$ 3,600	$ 3,600	$ 3,600
23	Wan Master	One-Time	89	$ 12,000	$ 12,000	$ 12,000	$ 12,000	$ 12,000
	3. IT							
24	Sun Computers	One-Time	1	$ 190,000	$ 190,000	$ 190,000	$ 105,000	$ 105,000
25	Oracle and Infinet	One-Time	1	$ 2,260,000	$ 2,165,000	$ 1,895,000	$ 1,445,000	$ 835,000
26	Infinet	Annual	1	$ 610,000	$ 585,000	$ 515,000	$ 400,000	$ 230,000
	4. Deployment Support and Management							
27	Antennae	One-Time		$ 125	$ 125	$ 125	$ 125	$ 125
28	Cable	One-Time		$ 50	$ 50	$ 50	$ 50	$ 50
29	MS-MFT	One-Time		$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000
30	Field Tester	One-Time		$ 155	$ 155	$ 155	$ 155	$ 155
31	Link Assessment	One-Time		$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000
32	Network Planning	One-Time	1	$ 21,000,000	$ 20,300,000	$ 19,300,000	$ 18,000,000	$ 17,000,000
33	Training	One-Time	1	$ 135,000	$ 135,000	$ 135,000	$ 135,000	$ 135,000

Questions

1 Do Lines 1-33 represent all the relevant cost items in your proposal? If not, what should be excluded or included?

Cellnet Response: Yes. It represents pricing Cellnet included in the proposal. Items not included are Meter - A bases, pole attachment and power fees, and office space and facilities for the Cellnet network planning and deployment teams.

2 Please provide pricing for the 80%, 60%, 40%, and 20% solutions.

Cellnet Response: Cellnet pricing has been included above. However we reserve the right to adjust the pricing based on the product mix and or geographic location or locations of the network to be deployed.

3 Please provide estimated units for Lines 27-31.

Cellnet Response: We can provide more exacting information with further detail including the exact quantities for meter related items are based on the meter locations such as quantities of meters in basements, buildings or under ground garages. The number of meter shop and testing requirements are also needed along with the number of crews installing meters.

4 The uniform coverage approximation percentages for electric and gas don't seem plausible. Gas meters are more concentrated than electric meters, and is it possible you will cover a greater percentage of gas meters than your proposal indicates?

Cellnet Response: Our analysis of the PG&E data base shows that of the meters covered with Cellnet network there are 49% gas and 51% electric meters. For the entire PG&E meter population there appear to be 45% gas and 55% electric meters.

5 You indicated that you are developing some new gas retrofit modules to reduce the new gas meters that will be required. Could you provide a revised estimate that reflects how many new gas meters will be required?

Cellnet Response: We believe that we may be able to increase gas retrofits from 3.44m to 3.61m meters and consequently reduce the new meter purchase requirements from 695k to 525k after physical review of some of the gas meter types and configuration options. This is over the entire meter population.

6 Could you revisit the mix of new and retrofit electric modules required, with the elimination of the requirement that no pre-1977 meters be used?

Cellnet Response: If the pre 1977 meters are included to be retrofit. The total meters that Cellnet can retrofit increases from 1.562M to 1.953 million and the new meters are reduced from 3.324m to 2.934m. This is over the entire meter population.

7 Please provide average annual equipment failure rates (over a 15 year planning period) for your Extenders, Concentrators, WanMasters, and endpoint modules.

Cellnet Response: Network device failures are 0.7%, gas endpoint modules are 0.5% and electric endpoint modules are 0.3%.

Note: Above summary excludes installation labor, new gas meters, and Wan communication charges

Cellnet NOTE: The Cellnet responses are based on the operations processes at our Network Operating Center and Business Continuity Centers. Cellnet has not proposed such a service to PG&E but can do so once the scope of service and performance is better defined. We look forward to the opportunity.

1 General

1 Describe your change management procedures and policies.
Cellnet Response: Cellnet has implemented a Change Control Board utilizing the Remedy Ticketing System. All change requests are entered into Remedy Action Request System and then reviewed on a weekly basis by the Change Control Board for approval or rejection.

2 What percentage of annual revenue is dedicated to security? **Cellnet Response: Cellnet is a privately held company. This information is not available to the public.**

3 Howmany customers do you have? **Cellnet response: Cellnet has 16 customers supported through our Network Operating Center. These utility customers have 10 million meters that are read daily through the NOC.**

4 How long has your business been in operation with revenue generating customers? **Cellnet Response: Cellnet and its predecessors have been generating revenue for more than 10 years.**

5 How many apps and databases are hosted on your servers?
Cellnet Response: Cellnet hosts 14 Oracle databases, 11 objectstore databases, and the Cellnet host application.

6 Describe your solicitation document's (RFP's) security requirements and evaluation/test procedures used with your suppliers. **Cellnet Response: As this is an isolated network operating system, most third party application or equipment acquisition are made through knowledge of the application requirements, an RFP solicitation process may typically not be required.**

7 How many servers does your organization have? What operating systems are currently in use?
Cellnet Response: Cellnet operates a total of 56 servers running various operating systems including Solaris 2.8 and 2.9, Linux RedHat Fidora Core 3, and Windows 2000 Server.

2. Risk Management

8 Is the current system configuration documented, including links to other systems?
Cellnet Response: Yes

9 What management authorization is required for internal and external interconnections to all systems? **Cellnet Response: Only the Cellnet operating centers are authorized to connect to our host system. Each operations team member is granted permission on an as needed basis and a background investigation is required (to assess a legitimate need). Member access accounts are reviewed and granted annually. Privileged accounts will only be available to those who require the access as defined by management.**

10 Have threat sources e.g. internal, external, natural, manmade been identified? How often are assessments done? **If NO, skip to question 13.** **Cellnet Response: Yes, a threat document has been written and is reviewed on an annual basis. An intrusion detection system (IDS) runs continuously.**

11 Has a list been developed and maintained current of known system vulnerabilities, system flaws, or weaknesses that could be exploited?
Cellnet Response: Yes, a threat document has been written and is reviewed on an annual basis.

12 Explain how risk assessments are performed and documented to ensure that resident security requirements adequately mitigate vulnerabilities. How often are assessments performed? **Cellnet Response: The Cellnet host system operates in an isolated environment. Security policies are established and monitored for violation to access, configurations or connection. Assessments are performed as required.**

3. Security Controls

13 Describe your intrusion detection/prevention systems; how often reports are generated and reviewed **Cellnet Response: Cellnet utilizes the following intrusion detection and prevention systems: Snort, Tripwire for Server, Tripwire for Networks, Secure Syslog Server, Checkpoint Firewall, LDAP, IdentiPass Badge System. Reports are generated nightly and reviewed on a daily basis.**

14 Describe how often penetration tests are performed; what was the date and results of the last test? **Cellnet Response: The Cellnet Network Operating Center host system operates in an isolated environment and general access is not a part of the system architecture. Penetration tests are performed on an as required basis.**

15 What control activities are in place to mitigate vulnerabilities identified through penetration tests and/or intrusion detection systems? **Cellnet Response: Identified vulnerabilities are analyzed and depending on the nature of the vulnerability, ie, ACLs, firewall policies, disabling services, etc. methods are put in place to mitigate the risk.**

16 Are PG&E-dedicated servers hosted in an isolated network environment? If not, describe controls established to help isolate our servers from interconnected systems. **Cellnet Response: Yes. In the event that Cellnet were selected to host the system the PG&E servers would be located on a private VLAN and isolated with firewalls and access lists.**

17 Describe any other scans that are performed on the network. Describe type, frequency, date of the last scan, results, and corrective actions performed. **Cellnet Response: Cellnet runs Nmap ("Network Mapper") scans on a quarterly basis. Previous results have indicated no undocumented machines.**

69

18 Describe any routine examinations or reviews of router and/or switch configurations. What was the date of the last review? **Cellnet Response: All router and switch configurations are examined and reviewed by Tripwire for Network Devices on a daily basis.**

19 How long are network activity logs maintained? At what frequency are they reviewed? What controls are in place to investigate questionable activity? **Cellnet Response: Firewall logs are rotated weekly and maintained for 3 months. System logs are rotated weekly and maintained for 4 months. Questionable activity is investigated on an as needed basis by the appropriate network or system administrators.**

20 Do customers share server resources, e.g. does one server support multiple customers. If yes, describe security in place. **Cellnet Response: Most Cellnet customers are on independent servers. Customers with shared servers have restricted access to data via UNIX and Network controls.**

4. Life Cycle

21 During the initial system design, how were security requirements defined for servers, routers, firewalls, databases, etc.? **Cellnet Response: Security models were defined on best industry practices, individual customer requirements, and 10 years of managed service practice.**

22 As the system design is changed, modified, and upgraded, how are security requirements further defined? **Cellnet Response: All changes to the system are controlled through the Cellnet Change Management Board which meets weekly.**

5. System Security Plan

23 Do you have a formal documented security program? **If no, skip to question 27.** If yes, can it be reviewed by PG&E? **Cellnet Response: YES.**

24 Does your System Security plan meet standards as prescribed by National Institute of Standards and Technology's Special Publications? If so, which Publication's)? **Cellnet Response: No**

25 Does your System Security plan meet standards as prescribed by ISO 17799? **Cellnet Response: Cellnet is working towards being BS 17799 certified.**

26 Describe your organizational structure for security. Do you have a designated person or persons responsible for security? **Cellnet Response: Security is managed at a discipline level (i.e. network, systems, database) by the respective operational group. The Cellnet Network Operations Center site manager is responsible for site security.**

6. Personnel Security

27 Describe the policies in place to govern rules of behavior for your employees? **Cellnet Response: All employees are required to wear a photo id/access key at all times. Only authorized personnel with secure pass keys are allowed into the computer or telco rooms. All employees are required to change passwords every 180 days. Passwords are checked against a secure/strong password policy.**

28 What security awareness and training is provided to employees, contractors, and others. How is compliance monitored and measured? **Cellnet Response: Employees are taught security awareness training such as password protection, social engineering, risk awareness, and disaster avoidance.**

29 How many "super users" have access to the system. How are they monitored and audited? **Cellnet Response: There are 5 employees who have Super User authority. All activities on all systems are logged to a secure log server to which only the site manager and the systems manager have access. These logs are reviewed weekly. The system is backed-up to tape nightly.**

30 What sort of a background check is run against your employees, temps, contractors, on-site vendors, etc **Cellnet Response: Cellnet runs a routine criminal background check and drug screening check on all employees as part of a pre-employment process.**

31 Are job descriptions written that accurately reflect assignments and responsibilities, and that segregate duties. Are they available for review? **Cellnet Response: Yes, Cellnet has job descriptions for all positions and descriptions can be made available for review if necessary.**

32 What controls are in place to monitor user compliance of job descriptions. Who performs this work? **Cellnet Response: The site manager is responsible for doing performance evaluations of employees on a yearly basis. The results and reviewed and managed through the HR department.**

33 What process is in place for requesting, establishing, issuing, and closing user accounts and passwords? **Cellnet Response: All users requests for system access are controlled through a user request system. Users must read and acknowledge a proper usage/security policy, state what system they are requesting access to, and justify the access request. Access permissions are reviewed and renewed on an annual basis for all operations employees**

34 What confidentiality and/or security agreements are in place for employees, temps, contractors, vendors, etc. who have access to sensitive information? How is compliance audited? **Cellnet Response: All employees sign a confidentiality documents as a condition of employment.**

35 How many employees does your company have? Provide a breakdown between employees, temps, contractors, vendors, etc. **Cellnet Response: Cellnet has approximately 380 employees. There are no more than an additional 10% as contractors currently in place.**

36 Is physical access monitored; are audit trails available? **Cellnet Response: Yes, physical access is monitored and reviewed daily. Video surveillance is also in place and records all entrances.**

7. Physical and Environmental Protection

37 Describe control mechanisms for physical access to data transmission circuits within facility. All teleco access, network, switches routers, firewall, ect. Are in a secure facility with access limited to only those with a verified and approved need. **Cellnet Response: Physical access is limited and controlled by a badge system to the telecommunication room.**

38 Are electric power, heating/cooling systems, water, and other utilities within your facilities periodically reviewed for risk of failure? Provide details. **Cellnet Response: UPS and air handling are under a maintenance contract and undergo periodic preventive maintenance. The backup generator and automatic bypass switches are tested weekly.**

39 Is an uninterruptible power supply or backup generator in place and tested? **If no, skip to question 43. Cellnet Response: Yes. The Cellnet Network Operations Center has a backup generator and UPS system. The generator and UPS systems are tested weekly.**

40 How often is the backup system tested? **Cellnet Response: Weekly**

41 How long is backup power available to keep systems up and operational? **Cellnet Response: The UPS system has approximately a 2 hour capacity and the generator has a fuel supply for 72 hours.**

42 What systems are protected by the alternate power source? **Cellnet Response: All systems are protected by the UPS and generator.**

43 Are formalized and tested disaster and recovery plans in place? **If none, skip to question 46. Cellnet Response: Yes**

44 What controls are in place to keep disaster and recovery plans up to date and appropriate for the current business climate? **Cellnet Response: Disaster Recovery and Business Continuity plans are reviewed annually and adjusted as needed or required.**

45 Describe any other controls implemented to mitigate disasters such as earthquakes, floods, hurricanes, tornados, etc. **Cellnet Response: The Cellnet Network Operations Center is strategically positioned in a location normally not subject to earthquakes, flooding, or hurricanes. Cellnet operates a fully redundant Disaster Recovery center 850 miles away in Alpharetta, GA.**

46 What security controls are in place for access to the tape library/storage media. **Cellnet Response: Cellnet**

8. Contingency Planning

47 Describe how back up tapes/storage media are rotated and stored. **Cellnet Response: Cellnet operates a 14 month tape retention/rotation policy. All tapes are stored offsite at an Iron Mountain facility.**

48 If backup media is reused, describe the process for sanitizing. **Cellnet Response: Backup media that is recycled is reused on the same customer program. Tapes are over written with new data.**

49 What happens to information/data when media is purged, disposed or used elsewhere? **Cellnet Response: Data that is purged from disk is deleted using UNIX commands. Tapes that contain data to be deleted are shredded and disposed of via a third party security company. Tapes that are to be recycled are only used on the same customer.**

50 Is there a help desk or group that offers advice and support? Please describe. **Cellnet Response: Cellnet staffs a 24x7 help desk for managing the Cellnet network and customers.**

9. Production and Input/Output Controls

51 Describe controls in place to ensure that unauthorized individuals can not read, copy, alter, steal, electronic or printed information. How is compliance monitored? **Cellnet Response: Access to customer systems is tightly controlled. LDAP authentication is used to control system access. Oracle access is controlled through Oracle authentication procedures. Data transmission is sent via SFTP or by direct customer pickup from the Cellnet system.**

52 Describe controls implemented to secure the physical and/or electronic exchange of information. **Cellnet Response: Physical access is limited and controlled by a badge system to the telecommunication room. In addition Cellnet employs MD5 hash for file security along with SFTP for file transfer.**

53 Describe labeling system used to identify sensitivity levels of information. **Cellnet Response: All data is treated as private and confidential.**

54 Are approved configurations for all servers, databases, routers, switches, firewalls, and other hardware documented? Describe your change control process. **Cellnet Response: All router and switch configurations are backed up and stored on our Tripwire for Network Devices machine. This machine is also backed up to tape. Our firewall hardware and policy configurations are backed up to tape. Cellnet utilizes a Change Control Board for all changes.**

10. System Hardware and Software Maintenance

55 Describe what maintenance is performed on-site versus off-site. Who performs maintenance? **Cellnet Response: All Sun maintenance is performed on site by Cellnet employees and or by a manufacturer approved third party maintenance company.**

56 Describe your emergency change control procedures including procedures to ensure operational failures (e.g., disk drive problems, program abends, other emergencies) are identified and resolved in a timely manner. **Cellnet utilizes manufacturer as well as Cellnet developed tools to monitor applications and hardware. Failures are alarmed and notifications are sent via e-mail and paging to the appropriate operations personnel.**

57 Describe how version control is implemented for applications and operating systems? What is the process for installing software patches, upgrades, or roll-out of new applications? **Cellnet Response: Cellnet uses Clear Case to track and control software versions of Cellnet Software. Third party applications and operating systems are maintained in an Oracle database. Patches and new software releases undergo rigorous testing prior to being released into a limited production environment.**

58 Describe your hardware patch maintenance and installation process e.g. BIOS, flash ROM, NIC's, RAM, HDD, etc. **Cellnet Response: All hardware maintenance is tracked with a change management ticket and performed by Cellnet IT staff.**

59 Is virus detection and elimination software installed and activated? On which devices? **Cellnet Response: Yes, all**

11. Data Integrity

60 How are virus signature files are validated and updated. **Cellnet Response: Cellnet uses McAfee virus detection with automatic updates.**

61 Describe integrity verification systems in place used by applications for evidence of data tampering, errors, and omissions? **Cellnet Response: Cellnet employs MD5 hash for file security and we use a 32bit checksum for data integrity on the wireless network.**

62 Describe your formal security and operational procedure documents. How is compliance measured? **Cellnet Response: Cellnet has written formal security documents as well as Standard Operating Procedure documents to cover all aspects of the Cellnet operation. Compliance is measured through spot checks and incident investigations.**

12. Documentation

63 Provide network diagrams of infrastructure (e.g. routers, switches, firewalls, etc.); Indicate data flow and storage. **Cellnet Response: See attached**

64 Describe your incident recognition and response training for personnel. **Cellnet Response: Incident reports are written on a per incident basis. All employees are required to review the report following an incident.**

13. Incident Response Capability

65 How are advisories/alerts received and responded to? **Cellnet Response: Advisories/alerts are received electronically from vendors and from the SANS institute subscription. Corrective actions are taken based on the threat assessment and relevance to Cellnet operations.**

66 Describe your customer notification procedures when a breach or suspected compromise of data occurs. **Cellnet Response: Customer communications are handled by the assigned Customer Service Administrator. Communication is conducted by phone or e-mail.**

67 Does a current and maintained list of approved and authorized users exist? How often is it reviewed? How are access levels defined? **Cellnet Response: Yes. The list of approved and authorized users is reviewed annually and access levels are defined as needed.**

14. Identification and Authentication

68 Provide details on minimum password requirements and complexity. **Cellnet Response: Eight characters, one lower case, one upper case, one number, and one special character. LDAP enforces the password policy.**

69 What controls are in place to measure compliance with password policies? **Cellnet Response: Password rules, and aging. User accounts are periodically audited for password strength, existence of the user, and privilege level by using freely available "john the ripper". This test will be conducted by an operations manager only on a non-production machine. Passwords that are found to have weak passwords within 4 days of checking will be emailed to change their password immediately.**

70 How are passwords securely distributed? **Cellnet Response: Passwords are distributed by telephone or in person.**

71 What protocols/algorithms are used to transmit passwords? **Cellnet Response: Passwords are not distributed by e-mail.**

72 What procedures are in place for handling lost and compromised passwords? **Cellnet Response: Lost passwords are reset by an administrator. Compromised passwords are locked and reset by administrators.**

73 How are vendor supplied default accounts and passwords handled? **Cellnet Response: Default accounts are changed along with the passwords.**

74 What system limits are placed on invalid user access attempts? **Cellnet Response: Users are allowed three failed attempts before their account is locked. A system administrator must reset the account password.**

15. Logical Access Controls

75 What controls are in place to detect unauthorized/invalid access attempts? Who is responsible for monitoring and follow-up? **Log servers and an intrusion detection system detect unauthorized/invalid access attempts. Physical access is detected by pass/ID logs.**

76 What happens to connections at the end of a session? **Cellnet Response: Timed session limits close the connection.**

77 What is the time period for identifying, disabling, and removal of inactive user accounts? **Cellnet Response: Terminated employee accounts are immediately removed. Inactive accounts are locked after 60 days.**

78 Are employee or contractor accounts disabled immediately upon termination of personnel? **Cellnet Response: Yes**

79 Describe how guest and anonymous accounts are authorized and monitored? **Cellnet Response: Guest and anonymous accounts are not allowed.**

80 If encryption is used, does it meet Federal standards? List encryption solutions offered. **Cellnet Response: SSh system has been certified for FIPS 140-2 for Solaris.**

81 If encryption is used, describe procedures for key generation, distribution, storage, use, destruction, and archiving.

82 What banners are displayed to users during system access? What banners are displayed to administrators when logging on to routers, firewalls, etc?
Banner message: **"Use and access to this service is restricted to authorized users of Cellnet Technology, Inc. only. Access by anyone else is prohibited. Each Cellnet authorized user must comply with Cellnet's use and access policies when accessing this service. Usage is monitored. All unauthorized use will be prosecuted."**

74

83 Describe how suspicious activity is investigated; describe the process in place for taking appropriate action. **Cellnet Response: Cellnet utilizes Snort, Tripwire for Server, Tripwire for Networks, Secure Syslog Server, Checkpoint Firewall, LDAP, IdentiPass Badge System. Reports are generated nightly and reviewed on a daily basis.**

84 Is remote access to system available? What controls are in place to restrict access? How is it monitored and controlled? How long are audit logs kept? **Cellnet Response: Secure VPN and Firewall authentication.**

85 Is there a privacy policy published? Please provide a copy for review. **Cellnet Response: Yes, we do have a privacy published and can be made available on request.**

86 What services and protocols are enabled on each device used for access to PG&E data? **Cellnet Response: SFTP, SCP, SSH, and ICMP protocols are enabled on each device used for access.**

87 What happens to unused ports and services on production servers, routers, firewalls, etc? **Cellnet Response: Unused ports are controlled via access list on the routers and by firewall policy on the firewalls. Required ports are determined on a per customer basis.**

88 Describe maintenance. retention, and access control for audit log files. **Cellnet Response: Log files are available for 4 months.**

16. Auditing and Audit

89 Describe the audit process for internal systems and controls. Cellnet Response: Periodic internal audit processes

90 Please describe the last independent web code audit performed for the explicit purposes of finding and remediation of security vulnerabilities? **If none, please skip to question 93. Cellnet Response: We have performed internal audits on an as needed basis. No independent audit has been performed.**

91 Have SAS70, SAS70 Type II, SysTrust, or WebTrust audits been performed? If so, at what frequency? Can the audit be reviewed? **Cellnet Response: Yes, The audit can be reviewed under an executed NDA.**

92 What remediation activity has taken place to address findings? **Cellnet Response: No remediation was required.**

93 Describe any security coding standard/guidelines mandated for programmers and QA engineers to follow. **Cellnet Response: Programming code centrally stored and logged on central repositories.**

17. Development and Implementation

94 Please disclose what language the application uses. (e.g. Java, JavaScript, Java Servlet, ActiveX, PHP, ASP, ASP.NET, C#, VB, etc) **Cellnet Response: All development and deployment tools are industry standard and commercially available. Java, C/C++, and Perl are used as development tools. The host databases are built on Oracle 10G. Apache Tomcat is the Web server. XML is the standard file data format.**

95 In what language is the back-end application written in? (e.g. C, Perl, Python, VBScript, etc.) **Cellnet Response: C/C++ and PERL are used as development tools for the back-end processes.**

96 Describe testing performed to ensure that applications achieve the necessary business and application control requirements. **Cellnet Response: Alpha testing, performed in a test lab. Beta testing is done on a production system prior to full distribution.**

97 What encryption is used to protect information in databases? **Cellnet Response: Databases are not encrypted.**

98 For all hardware supporting PG&E applications, list all operating systems including version and patch levels. **Cellnet Response: Solaris 2.8 and 2.9, Cisco IOS 12.6, Checkpoint NG Feature Pack 3, Nokia IPSO 3.7, Oracle 10G**

Thomas, Chenoa

From: Jay Evensen [jay.evensen@cellnet.com]
Sent: Sunday, March 06, 2005 3:32 PM
To: Giudici, E. Anthony
Subject: NDA

Thank you, I will be on line.

j

At 08:56 AM 3/5/2005 Saturday, you wrote:

> Mr. Evensen:
> I have submitted a draft NDA to be distributed to meeting participants to our Law Department for approval. This assumes that the review team decides to commit to the NDA to view your protected solution.
>
> Unfortunately, I will be away beginning today until late Monday, and will not be able to submit their version for your review until then. I trust you will review your e-mail messages late into the day on Monday. Hopefully, I will have something for you to review at that time.
>
> E. Anthony "Tony" Giudici
> *Sr. Procurement Specialist*
> *Phone: 415.973.3443 (Int: 223.3443)*
> *Fax: 415.973.2553 (Int: 223.2553)*
> *E-mail: aeg5@pge.com*

From: Jay Evensen [mailto:jay.evensen@cellnet.com]
Sent: Thursday, March 03, 2005 7:19 AM
To: Giudici, E. Anthony
Subject: Cellnet Attendees

Tony,

We will bring product to support any necessary Q&A response at the meeting on March 8th. Is it possible to gain access to the meeting room as early as 7:00 am? Or the evening before, if it is secure? Will a PC projector be available again?

Also, the Cellnet attendees at the meeting will be

Mike Zito - CEO
Ed Solar- VP of Sales and Marketing

Tommy Childress - CTO
Dennis Perrone - Account Executive
Ruben Salazar - System Engineering Manager
Mark Michaels - Regional Operations Manager
Derek Booth - Marketing Manager - Systems
Marc Lipski - Marketing Manager - Produts
Letha Mclaren - Marketing Manager - Software
Jay Evensen - Business Development

Thanks for your efforts.

jay

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Thomas, Chenoa

From: Jay Evensen [jay.evensen@cellnet.com]
Sent: Friday, March 04, 2005 2:15 PM
To: Giudici, E. Anthony
Cc: Randolph Houchins
Subject: PG&E\Cellnet NDA

Tony,

Following our discussion we would like to execute an NDA with PG&E based on specific items that we anticipate will be a part of our Q&A discussions on the 8th of March. The following is the subject area.

"Alternative interval packet structures to provide meter data for the fixed network covered population creating an optimized automated metering system."

Please let me know if we should expect to proceed in this area of discussion.

Thanks

Jay

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Thomas, Chenoa

From: Jay Evensen [jay.evensen@cellnet.com]
Sent: Monday, February 14, 2005 1:16 PM
To: Giudici, E. Anthony
Subject: RE: Schedule Follow-up

Tony,

We can confirm that the Cellnet team is available on this date if it works for the PG&E team. Thank You for your assistance. We will await your confirmation and forward our response to the questions.

jay

At 09:00 AM 2/14/2005 Monday, you wrote:

> Mr. Evensen:
> I am awaiting word on a possible shift of your meeting date to March 8th. This is the only possible date left. I will let you know if it works out from this end. In the meanwhile, please advise if this is acceptable, assuming it can be done.
> Tony Giudici

From: Jay Evensen [mailto:jay.evensen@cellnet.com]
Sent: Monday, February 14, 2005 7:12 AM
To: Giudici, E. Anthony
Subject: Schedule Follow-up

Tony,

Just wanted to follow-up to our need to confirm a date for the Cellnet Q&A. Again we had conflicts with your proposed dates of the 15th, 16th & 28th.

Please feel free to call or send me a note if I can assist further.

jay

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