MA DPU Grid Modernization Working Group
Questions for Utilities Regarding Grid-Facing Systems

Unitil – Fitchburg Gas and Electric Light Company Responses
April 8, 2013

This document provides Unitil's responses to the MA DPU Grid Modernization Working Group *Questions for Utilities Regarding Grid Facing Systems* dated March 18, 2013. These responses are based Unitil's experience with the given enablers. Unitil has attempted to answer the questions as completely as possible. Unitil has identified the areas where Unitil has not previously evaluated a certain enabler.

The costs provided in the responses are meant to be used as high level estimates to offer some level of information. In addition to the costs identified in the responses, there might be other costs that have not been identified. For instance, if the implementation of an enabler requires a communication system that does not currently exist, then the cost to implement that enabler may increase substantially due to the cost of implementing a communication system. The total cost of a project requires detailed evaluation and engineering design work specific to the individual electric system before a complete estimate can be provided.

The utility electric systems in Massachusetts have been evolving for the past 100 years. There are valid reasons why each of the systems is different (customer density, customer load profiles, amount of load, seasonality of the load, type of equipment, voltage class of equipment, miles of distribution, etc.). The application of any given enabler may be different for a given electric system and a one-size-fits-all approach may not provide the same opportunities or address the same goals from system to system. A particular enabler may provide a benefit to one electric system while it does not for another. Therefore a direct comparison of these answers between the utilities may not provide any useful basis upon which to draw any conclusions. Careful consideration and investigation must occur prior to implementing any of these enablers.

Functionality: Network System Utilization

Enabler: Distribution Management System (DMS/SCADA)

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the system your company has.

Unitil as an Areva's E-terracontrol SCADA system. Where SCADA is installed, it is capable of both status and control of the field devices that it is connected to.

b) Describe the year of installation; years of any significant upgrade; current plan for retirement or replacement, and current plans for changes or updates.

This system was originally installed in the early 2000's and has been expended over time to include SCADA installations at four of Unitil's eleven substations. Unitil currently has plans to replace this system with an efacec ACS SCADA system that is currently installed in our other operating companies and more easily integrates with our OMS system.

c) Describe:

i. Any characteristics that enable or facilitate grid modernization goals and objectives.

The Areva E-terracontrol SCADA system is a typical SCADA system that will allow status and control of any distribution or substation device.

ii. Any characteristics that represent challenges or barriers to grid modernization goals and objectives.

The Areva E-terracontrol SCADA system does not easily or effectively integrate with our ABB OMS system. As such, Unitil has plans to replace this SCADA system. This system is deployed in four of Unitil's eleven substations. To facilitate grid modernization, SCADA may need to be expanded to all of the distribution substations as well as out on the distribution circuits.

iii. Any additional upgrades necessary to enable or facilitate grid modernization goals and objectives.

Reference the response above.

iv. Approximate cost estimates for any such upgrades, to the extent they are available.

The installation of SCADA at a substation is very specific to the size of the substation and the amount of equipment that you are trying to connect to the SCADA system. Typical costs for Unitil may range between $50,000 to $200,000 per location depending on the size and complexity of the substation.

v. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

This SCADA system is currently installed at four substations (one transmission and three distribution substations) and is in the process of being extended to two different distributed generation installations.

Functionality: Network System Utilization

Enabler: Outage Management System (OMS)

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the system your company has.

Unitil installed ABB's Network Manager OMS System in 2010. This system is integrated with our GIS, IVR, AMI and CIS systems. The OMS system uses information from customer calls, AMI and eventually SCADA(once the SCADA system is replaced) to predict the location of the potential outage device. It also reports estimated restoration times and provides information to the customer facing web map.

b) Describe the year of installation; years of any significant upgrade; current plan for retirement or replacement, and current plans for changes or updates.

Unitil's OMS system was placed into operation in 2010. Since that time, Unitil has been working to improve the performance and reporting capability of the system. All upgrades to the system are currently focused upon reporting and customer facing information.

c) Describe:

i. Any characteristics that enable or facilitate grid modernization goals and objectives.

Unitil's OMS system is focused on reducing the duration of outages while providing the customers information about restoration times.

ii. Any characteristics that represent challenges or barriers to grid modernization goals and objectives.

The OMS system works extremely well during most events. However, during the most extreme weather events when most of your system is on the ground, the OMS may not provide much value until the end of such event.

iii. Any additional upgrades necessary to enable or facilitate grid modernization goals and objectives.

Improvements to the OMS system are focused on reporting and customer facing information. As those requirements change, so will the OMS system.

iv. Approximate cost estimates for any such upgrades, to the extent they are available.

The near term costs may generally be between $200,000 and $500,000. There will continue to be ongoing hardware, maintenance, training, integration, back office, network and communication costs as long as this system is in service. These costs are not known at this time.

v. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

The OMS system is used primarily on Unitil's distribution system.

Functionality: Network System Utilization

Enabler: Geospatial Information System (GIS)

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the system your company has.

Unitil has an ESRI based GIS system with a Schneider Electric (Telvent, Miner & Miner) ArcFM version 9.3 utility database overlay. The GIS system in integrated with our CIS, OMS, AMI, Milsoft circuit analysis and field inspection systems.

b) Describe the year of installation; years of any significant upgrade; current plan for retirement or replacement, and current plans for changes or updates.

This GIS system has been installed since the early 2000's. This system has gone through many different version upgrades since it has been in service.

c) Describe:

i. Any characteristics that enable or facilitate grid modernization goals and objectives.

A fully functional GIS system which identifies all equipment, customers and system connectivity is part of the foundation for grid modernization goals. Unitil has spent a great deal of time on the accuracy and configuration of our GIS system to make certain it can be leveraged for grid modernization.

ii. Any characteristics that represent challenges or barriers to grid modernization goals and objectives.

None at this time.

iii. Any additional upgrades necessary to enable or facilitate grid modernization goals and objectives.

The GIS system configuration may continue to be modified as new technologies are developed which rely on GIS for accurate spatial information. There are no planned upgrades besides from version upgrades at this time.

iv. Approximate cost estimates for any such upgrades, to the extent they are available.

There will continue to be ongoing hardware, maintenance, training, integration, back office, and network costs as long as this system is in service. There are no planned upgrades at this time.

v. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Unitil's GIS system is primarily used for distribution.

Functionality: Network System Utilization

Enabler: GIS-OMS Integration

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the system your company has.

Unitil's GIS system is fully integrated with our OMS system. The GIS system provides all of the circuit related information (i.e. equipment, circuit connectivity, customer connectivity, etc.) used by the OMS system for managing outages.

b) Describe the year of installation; years of any significant upgrade; current plan for retirement or replacement, and current plans for changes or updates.

Unitil's GIS and OMS systems were integrated in 2010. This integration has performed very well and there are no upgrades planned other than routine software version upgrades.

c) Describe:

i. Any characteristics that enable or facilitate grid modernization goals and objectives.

Unitil's GIS system provides necessary circuit and customer connectivity required by the OMS outage prediction engine. This integration facilitates the full use of OMS and the information that OMS provides.

ii. Any characteristics that represent challenges or barriers to grid modernization goals and objectives.

None identified.

iii. Any additional upgrades necessary to enable or facilitate grid modernization goals and objectives.

There are no planned upgrades other than routine software version upgrades.

iv. Approximate cost estimates for any such upgrades, to the extent they are available.

There are no planned upgrades other than routine software version upgrades.

v. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Unitil's GIS-OMS integration is primarily used for distribution.

Functionality: Network System Utilization

Enabler: Billing System

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the system your company has.

Unitil's Customer Information System (CIS) is an HTE based system that runs off of an AS/400 platform.

b) Describe the year of installation; years of any significant upgrade; current plan for retirement or replacement, and current plans for changes or updates.

Unitil's CIS system was installed in the late 1990's. Unitil has begun a process to evaluate replacement CIS systems and will start a project to implement a new CIS system beginning this year. This project may last approximately 2 years.

c) Describe:

i. Any characteristics that enable or facilitate grid modernization goals and objectives.

The new system will be able to meet all of the known billing and customer information requirements.

ii. Any characteristics that represent challenges or barriers to grid modernization goals and objectives.

There are no known challenges or barriers with the new system.

iii. Any additional upgrades necessary to enable or facilitate grid modernization goals and objectives.

There are no known additional upgrades required with the new system.

iv. Approximate cost estimates for any such upgrades, to the extent they are available.

The integration plan of the new CIS system has not been fully identified as of yet. The cost of the project will be based upon which system is ultimately selected. It may take approximately 2 years to implement a new CIS system.

v. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Not applicable.

Functionality: Network System Utilization

Enabler: Metering System

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the system your company has.

Unitil has a Landis and Gyr (Hunt Technologies) TS2 AMI system which uses powerline carrier as its means for two-way communication between the Command Center and the metering endpoints. The two-way communication of the AMI system allow for daily customer meter readings, outage reporting, meter diagnostics, on-demand reads, demand resets, remote read-in/read-outs, etc.

b) Describe the year of installation; years of any significant upgrade; current plan for retirement or replacement, and current plans for changes or updates.

The AMI system was installed in 2006. There are no significant upgrades scheduled at this time.

c) Describe:

i. Any characteristics that enable or facilitate grid modernization goals and objectives.

The design and operation of the AMI system facilitates Unitil's grid modernization goals by providing customer load data for more accurate system planning, customer outage data on a real time basis for use in conjunction with our OMS, and a communications infrastructure which can be used for other automation schemes (i.e. capacitor bank controls, etc).

ii. Any characteristics that represent challenges or barriers to grid modernization goals and objectives.

The communications infrastructure is limited in what it can do and the speed at which it can be accomplished. For instance, the communication infrastructure is not robust enough to use in protection schemes or automatic load restoration schemes. These types of schemes would require a different means of communication.

iii. Any additional upgrades necessary to enable or facilitate grid modernization goals and objectives.

There are no known upgrades scheduled at this time other than routine software version upgrades.

iv. Approximate cost estimates for any such upgrades, to the extent they are available.

There are no planned upgrades other than routine software version upgrades.

v. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Unitil's AMI system is primarily used on the distribution system.

Functionality: Network System Utilization

Enabler: Meter Data Management System (MDM)

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the system your company has.

Unitil has a home grown MDM system which is primarily focused on meter reads and billing information.

b) Describe the year of installation; years of any significant upgrade; current plan for retirement or replacement, and current plans for changes or updates.

Unitil's home-grown MDM has been in place for several years. Unitil plans on purchasing an MDM with the integration of a new CIS system as described above.

c) Describe:

i. Any characteristics that enable or facilitate grid modernization goals and objectives.

Unitil's existing MDM is basic and is essentially designed to manage meter readings and some billing information.

ii. Any characteristics that represent challenges or barriers to grid modernization goals and objectives.

This system does not facilitate grid modernization which is one of the reasons for implementing an MDM with the CIS.

iii. Any additional upgrades necessary to enable or facilitate grid modernization goals and objectives.

The new MDM will be specified for the functionality required to facilitate grid modernization objectives.

iv. Approximate cost estimates for any such upgrades, to the extent they are available.

The integration plan of the new CIS system has not been fully identified as of yet. The cost of the project will be based upon which system is ultimately selected. It may take approximately 2 years to implement a new CIS system. The MDM will be implemented as part of this project.

v. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Not applicable.

Functionality: Network System Utilization

Enabler: OMS-AMR/AMI Integration

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the system your company has.

Unitil's OMS system is integrated with Unitil's AMI system. The two-way communication design of Unitil's AMI system allows meter specific outage information to be passed from the AMI system to the OMS system. This information is used to verify existing and restored outages.

b) Describe the year of installation; years of any significant upgrade; current plan for retirement or replacement, and current plans for changes or updates.

Unitil's OMS-AMI integration occurred following the initial rollout of the OMS system. In 2011, the AMI system was integrated and training provided to the OMS operators.

c) Describe:

i. Any characteristics that enable or facilitate grid modernization goals and objectives.

This integration allows for Unitil to identify outages in its OMS system without the requirement for customer calls. Outage information down to the individual customer level allows for a more managed restoration response.

ii. Any characteristics that represent challenges or barriers to grid modernization goals and objectives.

None identified.

iii. Any additional upgrades necessary to enable or facilitate grid modernization goals and objectives.

There are no known upgrades scheduled at this time other than routine software version upgrades.

iv. Approximate cost estimates for any such upgrades, to the extent they are available.

There are no known upgrades scheduled at this time other than routine software version upgrades.

v. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Unitil's OMS-AMI integration is used primarily on the distribution system.

Functionality: Network System Utilization

Enabler: Communication Systems (Fiber, Micorwave, Radio, etc.)

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the system your company has.

Unitil's communications systems which are primarily used for grid modernization activities are telephone line communication for the SCADA system and powerline carrier technology for the AMI system. Unitil also uses typical T1 and fiber based communications architecture between and within the Unitil company offices.

b) Describe the year of installation; years of any significant upgrade; current plan for retirement or replacement, and current plans for changes or updates.

The AMI communication infrastructure was installed with the AMI system in 2006. The telephone lines for SCADA are installed as new sites are added to the SCADA system. Unitil is currently evaluating the various communication options with respect to the different grid modernization technologies and will implement as the new technologies are implemented.

c) Describe:

i. Any characteristics that enable or facilitate grid modernization goals and objectives.

The communication infrastructures in place are reliable and effective for the uses in which they have been implemented. Future grid modernization projects may more than likely require different communication requirements and systems that Unitil does not currently have in place.

ii. Any characteristics that represent challenges or barriers to grid modernization goals and objectives.

Future grid modernization projects may more than likely require different communication requirements and systems that Unitil does not currently have in place.

iii. Any additional upgrades necessary to enable or facilitate grid modernization goals and objectives.

There are no specific upgrades identified at this point.

iv. Approximate cost estimates for any such upgrades, to the extent they are available.

There are no specific upgrades identified at this point.

v. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Unitil's existing communication systems are used at the transmission, distribution, substation and individual customer load levels.

Functionality: Distribution System Optimization

Enabler: Fault Detection, Isolation, Restoration

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Unitil only has one instance of FDIR on its system. The FDIR that Unitil has in place is a combination of reclosers equipped with fault and voltage detection. If the primary source for the circuit downstream of this point experiences a fault and ultimately zero voltage, the primary source will be automatically switched to and adjacent circuit, restoring all of the customers beyond this point.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

One installation with 2 reclosers.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

One installation on 36 circuits.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

One installation with 2 reclosers.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

This is installed on a distribution circuit.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Typical costs for an installation such as this may be between $100,000 and $250,000 depending upon the number devices involved and the complexity of the system. There will continue to be ongoing hardware, maintenance, training, integration, back office, network and communication costs as long as this system is in service. These costs are not known at this time.

Functionality: Distribution System Optimization

Enabler: Automated Feeder Reconfiguration

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Unitil does not have any automated feeder reconfiguration systems installed.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

Unitil does not have any automated feeder reconfiguration systems installed and does not have any defined plans at this point to install such a system.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

Unitil does not have any automated feeder reconfiguration systems installed.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

Unitil does not have any automated feeder reconfiguration systems installed.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Unitil does not have any automated feeder reconfiguration systems installed.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Unitil does not have any automated feeder reconfiguration systems installed. Unitil has not designed a project such as this and therefore do not have any relevant cost comparison information. The total cost would depend upon the number devices involved and the complexity of the system.

Functionality: Distribution System Optimization

Enabler: Integrated Volt/VAR Control, Conservation Voltage Reduction

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Unitil accomplishes its system level VAR control through monitoring the VAR flow at the substation level. SCADA is used to switch substation capacitor banks to maintain a VAR flow within a specified range.

Unitil manages localized circuit level power factor and voltage support through the use of distribution capacitor banks that are automatically controlled on a combination of voltage, VAR, temperature and time of day settings. Unitil does not have any CVR installed on its system.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

4 of 11 substation capacitor banks have SCADA control. Approximately 40 of 135 distribution capacitor banks have an automated control.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

Approximately 75% of the distribution circuits capacitor banks with an automated control.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

40% substation capacitor banks have SCADA control. Approximately 30% distribution capacitor banks have an automated control.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

VAR control is used at the substation and distribution circuit level.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Typical costs for an installation such as this may be between $50,000 and $150,000 depending upon the number devices involved and the complexity of the system. There will continue to be ongoing hardware, maintenance, training, integration, back office, network and communication costs as long as this system is in service. These costs are not known at this time.

Functionality: Distribution System Optimization

Enabler: Remote Monitoring & Diagnostics (equipment conditions)

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Unitil does not currently have any remote monitoring and diagnostics system installed.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

Unitil does not currently have any remote monitoring and diagnostics system installed.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

Unitil does not currently have any remote monitoring and diagnostics system installed.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

Unitil does not currently have any remote monitoring and diagnostics system installed.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Unitil does not currently have any remote monitoring and diagnostics system installed, but this would most typically be installed in substations if Unitil had any.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Unitil does not have any remote monitoring and diagnostic systems installed. Unitil has not designed a project such as this and therefore do not have any relevant cost comparison information. The total cost would depend upon the number devices involved and the complexity of the system.

Functionality: Distribution System Optimization

Enabler: Remote Monitoring & Diagnostics (system conditions)

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Unitil's SCADA system captures voltage, current and status information from the devices connected to the SCADA system. Typical devices connect to the system are breakers/reclosers, transformer LTCs, and capacitor banks.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

SCADA is installed in 4 of 11 substations. This includes remote monitoring on 4 capacitor banks, approximately 45 breakers/reclosers and 6 transformers.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

40% of the system.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

Approximate: substation capacitor banks – 50%, transformers – 35%, breakers/reclosers – 60%

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

All of this equipment is located in transmission and distribution substations.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

The installation of remote system monitoring at a substation is very specific to the size of the substation and the amount of equipment that you are trying to connect to the SCADA system. Typical costs for Unitil may range between $50,000 to $200,000 per location depending on the size and complexity of the substation.

Functionality: Distributed Resource Integration

Enabler: Remote Distributed Generation Disconnect

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Unitil does not have any remote distribution generation disconnect at this time. Unitil is in the process of installing a remote disconnect at two recently installed DG installations which will include a recloser, direct transfer trip and SCADA. This remote disconnect will be accomplished through Unitil SCADA system in conjunction with the customers equipment.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

Unitil is in the process of installing two remote distributed generation disconnects.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

0%

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

0%

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

This enabling equipment will be installed between the customer location on the distribution system and the substation that the customer is served from.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Typical costs for an installation vary depending upon the number devices involved and the complexity of the system. There will continue to be ongoing hardware, maintenance, training, integration, back office, network and communication costs as long as this system is in service. These costs are not known at this time.

Functionality: Distributed Resource Integration

Enabler: Voltage Regulation

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Unitil uses traditional voltage regulation to manage voltage on its distribution circuits. Unitil has not been required to install advanced voltage regulation technologies which can be used by utilities to manage fluctuations in voltage caused by large amounts of distributed generation relative to the amount of load in a given section of the utility grid.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

None.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

None.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

None.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

None.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Unitil does not have any advanced voltage regulation installed on our distribution system designed to manage fluctuations in voltage caused by large amounts of distributed generation relative to the amount of load in a given section of the utility grid. Unitil has not designed a project such as this and therefore do not have any relevant cost comparison information. The total cost would depend upon the number devices involved and the complexity of the system.

Functionality: Distributed Resource Integration

Enabler: Load Leveling and Shifting

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Unitil does not have any load leveling or shifting systems installed which would alter the pattern of demand to more closely match output from non-dispatchable, intermittent distributed resources such as solar PV.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

None.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

None.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

None.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

None.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Unitil does not have any load leveling or shifting schemes installed on our distribution system designed to alter the pattern of demand to more closely match output from non-dispatchable, intermittent distributed resources such as solar PV. Unitil has not designed a project such as this and therefore do not have any relevant cost comparison information. The total cost would depend upon the number devices involved and the complexity of the system.

Functionality: Distributed Resource Integration

Enabler: Streamline DG Interconnection

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Unitil uses the distributed generation interconnection process that was developed as part of the MA DG Working Group. Unitil believes that the current process is a streamlined process which strives to work with the customers to move the process forward as expeditiously as practicable. The amount of time it takes to evaluate a distributed generation application is proportional to the size and complexity of the application, amount of existing and proposed DG on the circuit, and the amount of applications ready for processing.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

Not applicable.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

Not applicable.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

Not applicable.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Not applicable.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Not applicable.

Functionality: Distributed Resource Integration

Enabler: Intentional Islanding (microgrid) control

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Unitil does not have any intentional islanding or microgrid schemes installed on the system.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

None.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

None.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

None.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

None.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Unitil does not have any intentional islanding or microgrid schemes installed on the system. Unitil has not designed a project such as this and therefore do not have any relevant cost comparison information. The total cost would depend upon the number devices involved and the complexity of the system.

Functionality: Demand Optimization

Enabler: Access to Customer Information

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

This enabler has not been fully defined as of yet. However, Unitil believes that this enabler is describing access to real-time customer information (i.e. load, outage, etc.) by the customer. For instance, if the customer knows their usage at any given time, they can make different decisions about what they are using and when they are using it. Unitil's OMS system can provide customer outage information in near real time. Unitil's AMI system provides individual customer load every day, but for the previous day.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

See description above.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

See description above.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

See description above.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

See description above.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Unitil has not evaluated a project to provide real time information to customers. The total cost would depend upon the number devices involved and the complexity of the system.

Functionality: Demand Optimization

Enabler: Home Area Network Communications Capability

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

The home area network provides customers with access to granular usage data and price signals. The HAN communications capability refers to the technology located in the customer's meter needed for data to travel between utility and customer. Unitil's used the home area network communications technology in its recent TOU Pilot. Since the pilot was completed, Unitil has removed the technology that was installed at participating customer's residences.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

Unitil does not have any HAN equipment installed at this time.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

Unitil does not have any HAN equipment installed at this time.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

Unitil does not have any HAN equipment installed at this time.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Unitil does not have any HAN equipment installed at this time.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Unitil's TOU pilot was successful in developing an estimate for the amount of load shifting that can be expected. It was also successful at developing an overall estimate for the equipment and installation in the field. Unitil's pilot found that each of these installations can cost between $1,000 and $3,000 per customer installation. There will also be back office and systems integration costs which are not known at this time. The total cost would depend upon the number devices involved and the complexity of the system.

Functionality: Demand Optimization

Enabler: Utility/3rd Party DR Programs

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

A load control demand response program is one where a signal is sent to a customer device (e.g. water heater or air conditioner) telling that device to reduce energy consumption. A two-way signal allows the sender of the signal to confirm whether the device has responded or the customer has decided to over-ride the signal. Unitil does not have any utility or 3rd party DR programs in place. However, as part of Unitil's TOU Pilot project, this technology was evaluated and determined that it could be successfully implemented. Unitil has subsequently removed all of the equipment associated with the pilot.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

None.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

None.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

None.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

This would be used at the customer load.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Similar to the HAN, Unitil's TOU pilot was successful in developing an estimate for the amount of load shifting that can be expected with this technology. It was also successful at developing an overall estimate for the equipment and installation in the field. Unitil's pilot found that each of these installations can cost between $1,000 and $3,000 per customer installation. There will also be back office and systems integration costs which are not known at this time. The total cost would depend upon the number devices involved and the complexity of the system.

Functionality: Demand Optimization

Enabler: Time Varying Pricing

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Time varying pricing or time-of-use rates is specifically designed to change customer behaviors with respect to their electricity usage patterns. Unitil recently completed a successful TOU Pilot where it was proven that time-of-use rates were successful at changing customer usage patterns. The pilot also indicated that a TOU rate without accompanying technology was not as successful as a TOU rate in conjunction with a HAN and a utility DR program. A basic TOU program is rather simple for Unitil to implement. The existing AMI system can handle up to 4 time periods and the meters can be reprogramed through the AMI system to support TOU rates. The existing billing system will handle 3 time periods, but the new billing system will support at least 4.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

All existing AMI meters can be reprogrammed remotely to implement TOU rates.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

All existing AMI meters can be reprogrammed remotely to implement TOU rates.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

All existing AMI meters can be reprogrammed remotely to implement TOU rates.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

This would be used at the customer load

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

The cost for Unitil to implement a basic TOU rate is rather small. Existing AMI meters can be reprogrammed remotely to accommodate up to 4 TOU rate periods. There would be some configuration costs for the AMI and billing systems to accommodate TOU rates.

Functionality: Demand Optimization

Enabler: Customer Choice

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

This enabler is not well defined and does not appear to fit with these questions.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

Not applicable.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

Not applicable.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

Not applicable.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Not applicable.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Functionality: Demand Optimization

Enabler: Advanced Load Forecasting

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Advanced load forecasting is the process of making more accurate and discrete predictions about future system loads based on customer usage data. Improved forecasts enable operators to better schedule and dispatch generation. Unitil at this point in time does not schedule and dispatch generation.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

Unitil at this point in time does not schedule and dispatch generation..

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

Unitil at this point in time does not schedule and dispatch generation..

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

Unitil at this point in time does not schedule and dispatch generation..

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

This would be used on the distribution system.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Unitil at this point in time does not schedule and dispatch generation. Unitil has not evaluated a project to produce advanced load forecasts. This could be as simple as daily peak load prediction or as complex as an hour load prediction for every customer. The total cost would depend upon the number devices involved and the complexity of the system.

Functionality: System Hardening

Enabler: Elevated Substations

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Utilities with substations in flood prone areas may have the desire to consider elevating the substation to alleviate the flooding concerns. Unitil does not have a history of flooding problems within substations. Therefore, Unitil has not evaluated a project to elevate a substation.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

None.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

None.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

None.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

This would be used at a substation.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Unitil does not have a history of flooding problems within substations. Therefore, Unitil has not evaluated a project to elevate a substation. The total cost would depend upon the number devices involved and the complexity of the substation.

Functionality: System Hardening

Enabler: Equipment Hardening (submersibles, spacer cables, undergrounding)

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Equipment hardening can be effective in certain circumstances. For instance, approximately 27% of the Unitil system is underground construction. This is a combination of inner-city underground feeders and secondary network as well as more traditional underground residential developments.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

Primary Open Wire Overhead Construction - ~400 miles
Covered Primary Wire – ~80 Miles
Spacer Cable – ~20 miles
Underground – ~180 Miles

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

Covered Primary Wire – ~12%
Spacer Cable – ~3%
Underground – ~27%

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

Not applicable.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

This type of equipment is located on distribution systems.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Undergrounding can be 10 to 20 times the cost of overhead construction depending on the size and complexity of the installation. Spacer cable also can be 2 to 5 times the cost of traditional overhead distribution construction. Both spacer cable and undergrounding has ongoing maintenance costs.

Functionality: System Hardening

Enabler: Distributed Generation/Storage

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Distributed generation with storage can provide some benefit to the distribution system if can be controlled and relied upon when the need presents itself. If a utility plans to rely on distributed generation, diversity of units is required to ensure an adequate amount of supply at a reduced amount of risk. Unitil has not installed any utility owned distributed generation and does not control any of the privately owned distributed generation systems that have been interconnected to the Unitil system.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

Unitil does not own nor control any of the DG units interconnected to the Unitil system.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

Unitil does not own nor control any of the DG units interconnected to the Unitil system.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

Unitil does not own nor control any of the DG units interconnected to the Unitil system.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

These are generally installed on the distribution system.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Unitil has evaluated the installation of DG on its distribution system. The costs associated with the DG systems that Unitil evaluated had a very large range of $5,000 to $100,000 per installed kW. The total cost would depend upon the technology involved and the complexity of the system.

Functionality: System Hardening

Enabler: Vegetation Management

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Unitil believes that a well-rounded approach to vegetation management will provide the best cost/benefit reliability improvement out of any other enabler listed in this document. A well-rounded approach to vegetation management includes: 1) circuit pruning; 2) hazard tree mitigation; 3) mid-cycle review; 4) forestry reliability assessment; 5) brush removal; and 6) storm resiliency work. The Storm Resiliency program targets critical sections of circuits for tree exposure reduction by removing all overhanging vegetation or pruning "ground to sky", as well as performing intensive hazard tree review and removal along these critical sections and the remaining three phase of the circuit. The goal of this program is to reduce tree related incidents and resulting customers interrupted along these portions in minor and major weather events. In turn, the aim is to reduce the overall cost of storm preparation and response, and improve restoration.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

Unitil is in the early stages of implementing this program.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

Unitil is in the early stages of implementing this program.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

Unitil is in the early stages of implementing this program.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Vegetation management is generally completed on the transmission and distribution systems.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

The implementation of a program such as this for Unitil would be between $1.5 and $2.0 million per year.

Functionality: Workforce Management

Enabler: Mobile Workforce Management Systems

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Unitil has mobile workforce management that it uses on the metering and customer related side of the business. This system has been in place for a couple of years. This system is a home grown system that can be modified to expand to other workforce management assignments.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

Not applicable.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

Not applicable.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

Not applicable.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Not applicable.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Unitil has not evaluated a project to expand its mobile workforce management system. The total cost would depend upon the complexity of the system.

Functionality: Workforce Management

Enabler: Mobile GIS Platforms

Responses to questions related to Grid Facing Taxonomy Matrix:

a) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

Unitil uses mobile GIS that for its distribution inspections. This system was developed in 2012.

b) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

i. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

Limited to a few tablets used by the plant inspectors.

ii. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

Limited to a few tablets used by the plant inspectors.

iii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

Not applicable.

iv. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

This is generally used for distribution system purposes.

c) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Unitil has not evaluated any upgrades or expansions to the mobile GIS platform. The total cost would depend upon the technology involved and the complexity of the system.

Functionality: Workforce Management

Enabler: OMS-ERP-CIS Integration

Responses to questions related to Grid Facing Taxonomy Matrix:

d) Provide a description of the "enabler" (i.e. this might be a device type) your company has.

This enabler is not well defined and does not appear to fit with these questions.

e) The level of deployment of this enabler on your system, to date and planned. In regards to the level of deployment of this enabler on your system, include, as appropriate.

v. The total number of units installed (note, the purpose is not to be 100% exact – rounded numbers are sufficient) of each enabler deployed; also, this could be broken down into additional "layers" of technology (such as voltage regulators, capacitor banks, etc.) and total planned over a reasonable timeframe (1-5 years?).

Not applicable.

vi. The percentage of the system on which this enabler is currently deployed and expected to be deployed.

Not applicable.

vii. The percentage of devices (e.g., capacitor banks, reclosers) which are automated, have remote sensors/ control, etc.

Not applicable.

viii. The location of the enabling equipment. (In other words, is it utilized at transmission, distribution line levels, at substations, and/or at customer load?)

Not applicable.

f) Relevant cost information (e.g., cost per unit, cost per feeder, or the estimated cost to deploy for whole system).

Additional Requests and Clarifications:

The above questions direct the utilities to look at the taxonomy/functionality matrix, and to provide an inventory of the enablers. However, we recognize that this is not a prescriptive list. As such, we would like to ensure that the inventory includes the following: just answer these as they stand. No need for anything special here……

1. **How many distribution substations do you have in service and how many of those are automated?**

   As described under the SCADA question, Unitil has 11 substations (1 transmission and 10 distribution). Four of these stations are equipped with SCADA for control and automation. The typical SCADA installation would include status and control of substation breakers or reclosers, motor operated switches, capacitor banks, transformer LTCs and telemetry where available.

2. **How many capacitor banks do you have in service and how many of those are automated?**

   As described in the questions about Integrated Volt/VAR Control, 4 of 11 substation capacitor banks have SCADA control. Approximately 40 of 135 distribution capacitor banks have an automated control that operates the capacitor bank based upon voltage, VAR, temperature and time of day/week settings.

3. **How many distribution system feeder circuits do you have in service and how many of those are automated?**

   The Unitil system has 36 distribution circuits and 7 – 69kV lines. SCADA system covers 14 of 36 distribution circuits and 6 of 7 – 69kV lines.

   a) Describe, at a high level (e.g., create categories) the level of automation on the feeders.

   Automation of circuits is limited to the substation breaker or recloser. The SCADA system will provide status and control of the breaker or recloser as well as any telemetry values that may be available. Unitil does not have any automation located out on the circuit as of yet.

4. **Please include relevant information regarding:**

   b) Technologies deployed.

   Unitil as an Areva's E-terracontrol SCADA system. This system was originally installed in the early 2000's and has been expended over time to include SCADA installations at four of Unitil's eleven substations. Unitil currently has plans to replace this system with an efacec ACS SCADA system that is currently installed in our other operating companies and more easily integrates with our SCADA system.

   Unitil does not have any other smart grid based technologies deployed other than the items listed in these responses.

   c) ARRA program investments.

   Unitil has applied for but has not been successful in receiving any ARRA funding grants.

   d) Percent of feeders covered.

   Unitil has 14 of 36 circuits with SCADA control of the substation breaker or recloser.

   e) Is it cost effective to make similar investment on all feeder circuits? If not, approximately what percent should have additional automation / communication?

   SCADA installation on distribution circuits is evaluated on a case by case basis. In some instances, the distribution circuit would not benefit from the installation of SCADA (i.e. small, compact, rarely experiences outages, etc.). In other instances, the installation of SCADA may have a direct positive impact on reliability or may assist with direct transfer trip protection schemes.

5. **This list should also include appropriate information (e.g., total number of units, level of deployment) of the following:**

a) SCADA (supervisory control and data acquisition).

Unitil as an Areva's E-terracontrol SCADA system. This system was originally installed in the early 2000's and has been expended over time to include SCADA installations at four of Unitil's eleven substations. Unitil currently has plans to replace this system with an efacec ACS SCADA system that is currently installed in our other operating companies and more easily integrates with our SCADA system.

b) Remote terminal units (RTUs).

Unitil's SCADA system is not designed with RTUs for the most part. The Unitil SCADA system is designed more like a computer network where the SCADA system is communicating directly with IEDs within the substation. There are only a couple of RTUs on the Unitil SCADA system.

c) Programmable logic controllers (PLCs).

Unitil's SCADA system is not designed with PLCs for the most part. The Unitil SCADA system is designed more like a computer network where the SCADA system is communicating directly with IEDs within the substation. There are no PLCs on the Unitil SCADA system.