DG Installation Scenarios – Utility Cost Analysis.

Dakota Electric Association - October 6th 2002.

The following was compiled for the Distributed Generation Rate Work Group. The following scenarios are using Dakota Electric Association's existing filed rates. For the scenarios provided, not all of the information required to answer the costs involved with the interconnection and operation has been provided, so for all of the scenarios the following assumptions were made.

- Stated customer load was considered the maximum annual demand level.
- On the scenarios where there was no energy purchased by DG customer, it is assumed that under normal operation
    - No kW (demand) will be recorded on utility's meter during normal operation.
    - The customer's generation will provide all of the Vars required by the customer's load and that no additional kVars will be transferred to or from the utility's distribution system.
- For all of the scenarios, the customer is responsible for all of the costs required to create the generation interconnection with the utility.

Dakota Electric's existing standby rates were developed 15-20 years ago. It is important to note that with the separation between Dakota Electric and Great River Energy, the present Standby rates only include distribution costs and do not include transmission or generation costs.

Scenario A)
Customer Load = 1 MW
On-Site Generation Capacity = 1 MW
No Energy purchased by Customer, during normal operation

For this scenario the following assumptions were made

- Under normal operation of the generation, the customer will not purchase energy from the utility and will be disconnected from the utility during normal operation. This would be a temporary parallel installation. The paralleling between the utility and the generation would only be when the load is transferred between the generation and the utility. This would be when generation maintenance is required or if a generation failure occurs.

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- The customer wants to receive power from utility if the generation fails and during times of generation maintenance.

<u>Installation Costs</u>

- Customer pays for all generation interconnection costs.

Operating Costs

This customer would normally provide their own energy needs and would transfer over to the utility as needed. So since we don't know when the customer would require utility service, the utility must install enough distribution facilities to supply this customer's peak load during the utility's peak load period. Equipment such as transformers, wire etc. will need to be installed to supply this customer's load, even if they do not utilize these facilities. These costs would be recovered through standby service charges. The customer would contract with Dakota Electric for the kW level of standby service required. For this 1 MW level of standby service the customer would pay Dakota Electric a $20/month fixed charge and $1.90 per monthly contracted kW of standby capacity.

For all energy used by the customer, the customer would pay Dakota Electric the normal rate which applied for that month. The 12 month demand ratchet does not apply, since customer is paying for the standby service. The fixed charge for this rate would also apply.

Scenario B)

Customer Load = 5 MW
On-Site Generation Capacity = 1-2 MW
Customer purchases energy levels above those supplied by the generator.

For this scenario the following assumptions were made

- The generation is continuously paralleled with the utility distribution system. Interconnection protection must be designed to prevent back-feeding of the utility's distribution system if the customers load level falls below generated amount.

Installation Costs.

- Customer pays for all interconnection costs.
- Customer would pay for all modifications required to the distribution system, including modifications to allow the distribution system protection system to work with the added distributed generation system.

Operating Costs

Customer would pay for all the energy and demand used, from the utility, under applicable rate schedule. Rate demand ratchet would apply if the customer did not contract for standby service.

The customer would have the option of either contracting for standby service, to have the utility carry the extra load when the generation would be off line, or they would need to install a system to ensure that the demand, on the utility, did not exceed the non-generation supplied load level (3 MW's). If the customer does not contract for this

standby capacity, then the utility would only install transformation and distribution feeders necessary to carry the normal load.

Scenario C)
Customer Load = 250kW
On-Site Generation Capacity = 1 MW (Wind)
Customer is purchasing their energy from the utility.

For this scenario the following assumptions were made

- The generation is continuously paralleled with the utility distribution system.
- With generation sales to the transmission level, the load and generation must be metered separate per MISO/FERC requirements.

Installation Costs.

- Customer pays for all interconnection costs.
- Customer would pay for all modifications required to the distribution system, including modifications to allow the distribution system protection system to work with the added distributed generation system.

Operating Costs

Customer's load would be metered separate from generation and the generation output would be metered separate from the load.

Customer would pay for all the energy and demand used by the load per the filed rates.

Generation would be metered separate and all energy and capacity would be sold to whomever the customer contracts with.

The separately metered generation would require a contract with a transmission provider. Due to an all power requirements contract with Great River Energy, Dakota Electric is unable to purchase energy directly from the generation system. The customer could contract with GRE for the purchase of the power or with another party.

Customer would be required to contract with Dakota Electric for distribution services such as wheeling, losses and other distribution services required. Dakota Electric presently does not have such rates in place and these would need to be developed. There may also be transmission wheeling and other transmission charges, depending upon the transmission issues and how power is being transported to the buying party.

Scenario D)
Customer Load = 5 MW
On-Site Generation Capacity = 10 MW
Customer is not purchasing energy from utility under normal operation of the generation.

For this scenario the following assumptions were made

- The generation is continuously paralleled with the utility distribution system.
- With generation sales to the transmission level, the load and generation must be metered separate per MISO/FERC requirements.

Installation Costs.

- Customer pays for all interconnection costs.
- Customer would pay for all modifications required to the distribution system, including modifications to allow the distribution system protection system to work with the added distributed generation system.

Operating Costs
Customer's load would be metered separate from generation and the generation output would be metered separate from the load.

The difference between the load and generation would be calculated or directly metered. The customer could sell the extra generation on the system.

The customer would either need to contract with the distribution utility for (5 MW's) standby service to supply the load when the generation is less then the load level or establish an automatic system to ensure that the load never exceeds the on-line generation level.

The generation would require a contract with a transmission provider. Due to an all power requirements contract with Great River Energy, Dakota Electric is unable to purchase energy directly from the generation system. The customer could contract with GRE for the purchase of the power or with another party.

Customer would also be required to contract with Dakota Electric for distribution services such as wheeling, losses and other distribution services required. There may also be transmission wheeling and other transmission charges, depending upon the transmission issues and how power is being transported to the buying party.

Scenario E)
Customer Load = 1 kW
On-Site Generation Capacity = 3 kW (Solar)

This installation appears to fall under the PURPA law and is a qualifying facility. Minnesota State Law requires the utility to provide net metering for this qualifying facility. (<40kW)

At the end of each month, if the power used by the customer is greater than the energy generated by the solar generator, then the customer pays the utility the retail rate for the energy used from the utility. If the power generated is greater than the power used for any month, then the customer may bank that excess energy for the following month or receive payment for that excess generated energy. This is decided up front in the State mandated interconnection agreement.

Typically, these small solar systems are interconnected using an inverter and if it meets UL and IEEE standards, no further modifications to the utility feeder protection is required.

Scenario F)
Customer Load = 500 kW
On-Site Generation Capacity = 90 kW (3-separate generators)

Utility views multiple power sources interconnected to the same service as one generation system. So the number of generators, just like the number of solar panels does not change the interconnection requirements or energy charges

Customer purchases energy levels above those supplied by the generator.

For this scenario the following assumptions were made

- Assumption is that the generation is continuously paralleled with the utility distribution system. Interconnection protection must be designed to prevent back-feeding of the utility's distribution system if the customer's load level falls below generated amount.

<u>Installation Costs.</u>
- Customer pays for all interconnection costs.
- Customer would pay for all modifications required to the distribution system, including modifications to allow the distribution system protection system to work with the added distributed generation system.

<u>Operating Costs</u>
Customer would pay for all the energy and demand used from the utility per the filed rate schedule. The rate demand ratchet would apply, if the customer does not contract for standby service.

The customer would have the option of either contracting for standby service to have the utility carry the extra load when the generation would be off line, or they would need to

install a system to ensure that the demand, on the utility, did not exceed the non-generation supplied load level (410 kW). If the customer does not contract for this standby capacity, then the utility would only install transformation and distribution feeders necessary to carry the normal load.