TO: **City Council, North St. Paul**
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RE: **Demand-Side Management**

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1. Issue: Demand-Side Management in North St. Paul

The city of North St. Paul is pursuing ways to manage electricity use in their city, particularly at times of high electricity consumption. The city's municipal utility is considering demand-side management (DSM) as a tool to reduce the amount of electricity used by its customers at certain times of the day. By reducing the electricity use at certain times of the day, North St. Paul can reduce their risk of outages and reduce electricity bills. This brief aims to explore and evaluate different options for North St. Paul in implementing DSM.

2. Overview: Demand-Side Management (DSM)

Demand-side management (DSM) is a term used to describe programs aimed at encouraging energy consumers to modify or reduce their level and/or pattern of energy use during peak demand periods, which can help prevent such outages from occurring (Energy Information Administration, 2002). DSM programs aim to redistribute load on the electrical power system in time by moving some load away from peak periods to non-peak periods and/or reduce overall load (Strbac, 2008). By redistributing demand away from the peak hours and/or days of the year or by reducing overall demand, DSM can reduce the cost to develop additional capacity to meet increasing demand during peak periods as overall demand increases with time (Davito, Tai, & Uhlaner, 2010). This is a concern because, despite increases in efficiency, electricity consumption continues to rise year after year. It is economically advantageous to intelligently redistribute load and attempt to reduce overall demand rather than to construct new power sources indefinitely (Palensky & Dietrich, 2011). Overall, the Federal Energy Regulatory Commission estimates that use of the full range of current demand response technologies could result in a 20% reduction in peak demand (Federal Energy Regulatory Commission, 2009). Here, DSM will be used to describe both demand redistribution, sometimes classified as demand response, and demand reduction or energy efficiency programs.

i. Demand Response

Demand response programs are incentive-based programs that encourage electric power customers to temporarily reduce their demand for power at certain times of the day (Davito, Tai, & Uhlaner, 2010). One example of a particular type of demand response is time-of-use pricing, which refers to the application of a static rate schedule that charges higher prices for use during peak periods. This approach assumes that customers will adjust their use patterns to minimize

costs by shifting some energy usage to periods of time when rates are cheaper. (Palensky & Dietrich, 2011).

ii. Energy Efficiency

Energy efficiency refers to programs that are aimed at reducing the energy used by specific end-use devices and systems. These programs reduce overall electricity consumption rather than focusing on the timing of electricity use. Such savings are generally achieved by substituting technologically more advanced equipment to produce the same level of end-use services with less electricity. Examples include energy efficient appliances (such as Energy Star-certified appliances), lighting programs, high-efficiency heating, ventilating and air conditioning (HVAC) systems or control modifications, efficient building design, advanced electric motor drives, and heat recovery systems.

3. DSM and North St. Paul

North St. Paul is comprised of 5,685 residential customers and 525 commercial customers. Because of North St. Paul's demographics, the city uses less energy during the day than a city with more industry because much of the city's population leaves to go to work. Electricity use in the city peaks around 5-6 pm, when residents are returning to their homes.

Currently, North St. Paul offers rates to commercial and residential customers that are based on seasonal electricity use during different times of the year. Higher prices are charged in the summer to encourage customers to cut back on electricity use during the season when demand is most high. The city also previously offered a program to residential customers where their air conditioning and electric heating units were automated to cycle during peak energy demand times. This program was discontinued three years ago because the economic benefits associated with the program were not sufficient to justify the costs.

The city currently offers a DSM program that focuses on time of use (TOU). This is a special rate for electricity that is offered to commercial customers and is based on the time of day. Electricity is cheapest during the night, is most expensive during the day and evening on weekdays, and is priced at an intermediate rate for weekends and holidays. This encourages commercial customers to run processes at night and on holidays and weekends to reduce weekday demand on the system. North St. Paul uses this pricing scheme because the city purchases much of its power from Minnesota Municipal Power Agency (MMPA), and MMPA charges North St. Paul rates that vary based on the time of day. The price that North St. Paul pays MMPA for electricity is not publicly available information. If North St. Paul is only passing on some of the increased costs of electricity use during peak periods to customers, shifting electricity use to off-peak times or reducing overall electricity use could potentially save the city money.

North St. Paul also takes part in DSM programs through MMPA for its residential customers. One of these programs is a home energy audit. This program helps customers identify places where energy is being wasted and identify cost effective ways to save energy. In

another program, residential customers can apply for rebates on Energy Star© appliances ranging from dishwashers to light bulbs that meet energy consumption requirements (The Power, 2013).

The suggestions presented in this policy brief are targeted toward residential and commercial customers based on the demographics of North St. Paul's utility customers.

3. Policy Alternatives

Municipal utilities, such as North St. Paul, are interested in DSM programs because they enable the utilities to avoid turning on costly generation at peak hours by shaving some of the load demand. In Minnesota, some municipal utilities offer cash rebates or incentive programs for DSM. Many municipal utilities have successfully integrated DSM programs that would be viable options for North St. Paul to pursue.

i. Residential Programs - Voluntary Customer Participation

One type of program that is tailored specifically toward residential customers is one in which the customers can opt into a program that aims to shift the demand peak. Customers would be notified that a peak period is approaching with at least 30 minutes of warning. Customers can reduce their usage for that peak period using any means they choose and their energy bill is credited for the amount of energy that went unused during that peak period or some other financial incentive is provided. While participation is optional, fines for customers who opt into the program but fail to meet energy reduction goals can be implemented to encourage compliance (FEMP).

This program has been successfully implemented by Georgia Power, another municipal utility. This utility is larger than North St. Paul, but most of the customers are residential. Because Georgia Power's customers display similar demographic characteristics to North St. Paul's, this could be a good program for a utility whose services are meant for the residential sector. For DSM to be effective in the residential sector, the participation levels must be high. Encouraging residential participation through rebates or other rewards can encourage participation but offering significant rebates to large numbers of customers can affect a utility's bottom line. Such concerns must be carefully balanced.

ii. Appliance Cycling - Demand Response

Some municipal utilities in Minnesota have implemented different interruptible programs depending on the time of year. Specifically, this would include a separate plan for summer and winter seasons. In the summer, the demand occurs in the evening when people are returning home from work. The demand can be reduced using a system that allows for direct control of air conditioners, water heaters, and commercial generators. For example, air conditioners can be directly turned off by the utility for 15 minutes out of every hour. In the winter, there is a potential to be two different peaks that arise in residential cities. There can be a peak in the morning and one in the evening. The peaks are primarily due to heating as people get ready to go to work and come home from work. An interruptible program controlling electric heaters can

be implemented during this season. North St. Paul could also interrupt the electric heat of a home and switch the heating to a non-electric heat source. A non-electric heat source could be something as common as propane.

North St. Paul invoked a type of interruptible program by introducing air conditioners that could be cycled during peak hours of the day. By diversifying the programs and appliances affected during demand peaks, there is a potential for more economical benefit. Interruptible programs have been successfully implemented by Great River Energy in Minnesota, which has seen a reduction of $10-$20/MWh during peak hours of the day (Great River Energy).

iii. Commercial program - Third Party Demand Response

In Minnesota, utilities either design and manage DSM programs themselves or use the services of third-party businesses for this purpose. Services of one such business - Bright Energy Solutions are used by two dozen Minnesota Municipal Utilities to design and manage their DSM programs including rebates.

One way these third party businesses can help is by setting up programs in which customers can work with the third party to stipulate a set of demand response initiatives for that particular customer. The individual initiative is based on direct control mechanisms, such as reductions in lighting, heating, air conditioning, and manufacturing processes, which are placed under the control of the third party during peak demand periods. For example, when a peak demand period is determined to be approaching, based on energy use on a particularly hot summer weekday or cold winter weekday, North St. Paul would notify the third party that demand response should be initiated. The third party then would notify participating customers, who can then opt out of participation for that particular peak period if it would interfere with their operations. Based on the timing and number of peak periods during which a customer chooses not to opt out, the customer would receive a rebate from North St. Paul.

4. Concluding Remarks

The three options presented above would allow North St. Paul to control the demand at peak hours of the day. The authors recommend that North St. Paul implements a variety of programs aimed at the entire customer base for North St. Paul's utility to get the most flexibility and achieve the greatest impact. To achieve this, each of the programs adopted would also require a high level of customer participation to make a difference for North St. Paul's electricity use and bottom line. Utilizing education and outreach measures to inform the public of these options would be a good way to help make customers aware and get them more involved.

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