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October 23rd, 2012

DECISION MEMORANDUM

TO: Council Members

FROM: Ken Corum, Senior Economist Power Division

SUBJECT: Recommendation for Council co-funding support for a pilot program to explore power system balancing with demand response from data centers

PROPOSED ACTION: Contribute \$20,000 cash and the equivalent of \$20,000 in consultation and analysis services of Council staff towards a pilot project to investigate use of demand response at data centers for power system balancing. The project will be funded 50% by Bonneville Power Administration's (Bonneville) Technology Innovation program and 50% by other parties including the research team. The team and contributing parties could grow as the project proceeds. The project will be conducted by Ecofys, US, Inc., Energy Focused Resources, Lawrence Berkeley National Laboratory, and Excipio.

The pilot project will test and demonstrate the rapid development and deployment of controllable loads from data centers. The goal of the project is to provide balancing services in the Bonneville balancing area and localized benefits to Bonneville's load-serving utilities. The total cost of the pilot project is projected to be \$1,750,000. The Council's contribution will be contingent on the project receiving funding from other entities, including BPA, sufficient for the pilot to move forward as proposed.

SIGNIFICANCE:

- The Pacific Northwest has seen rapid growth in the amount of electricity generated by renewable resources, primarily wind power. This growth is expected to continue, which has focused attention on increasing needs for balancing resources to accommodate variable-output generation.
- The Council's Sixth Power Plan recognized this situation, devoting a chapter to "Capacity and Flexibility Resources" and including in the Action Plan a number of items to understand and develop the ability to accommodate renewable generation

- In particular, the Council's Sixth Power Plan calls for the evaluation and demonstration of demand response as a possible source of ancillary services that can provide load following and/or wind integration.
- Since the adoption of the Sixth Power Plan, the concept of using demand response to provide balancing services has been tested in a BPA Technology Innovation project. That project has been led by Ecofys, using water heating, space heating and refrigerated warehouse loads. The project has recently concluded, and the results are encouraging. The concept is being pursued elsewhere as well, by an aggregator providing regulation with a portfolio of loads to the PJM regional transmission operator, an aluminum smelter providing regulation to the Midwest Independent System Operator, and a paper plant testing its ability to provide load following to Bonneville, to cite a few examples.
- The growing demand for electricity by data centers has received increasing attention recently. Some of the most visible developments have been in small towns and rural areas. Council staff has been following these developments and are working to incorporate them into the Council's load forecast and its estimates of demand response and conservation potential.

BUDGET/ECONOMIC IMPACTS:

- The Council's participation in the \$1,750,000 pilot program would be in the form of a cash contribution to the project of \$20,000 contingent upon the pilot receiving sufficient funding from other contributors to move forward as planned. The Council's participation in the pilot program would also consist of in-kind contributions by Council staff in the form of consultation services and analysis of information on data centers' loads as they come in. The work is anticipated to be performed in the 2013 and 2014 fiscal years.
- Some additional staff time to participate in a technical advisory panel would be necessary. This participation would not be a significant burden on the power planning division and would improve staff's understanding of technologies and program design issues involved in realizing ancillary services from data centers. The initial survey of existing and planned data centers and their characteristics is also likely to be helpful to Council staff in forecasting future demand for electricity and in estimating conservation potential of data centers.

BACKGROUND:

In its Sixth Power Plan, the Council turned its attention to the area of capacity and flexibility resources. Historically, sufficient capacity and flexibility have been available from the region's hydroelectric system. However, as constraints on the operation of the hydroelectric system have increased, as the region's total demand for electricity has grown, and as the amount of variable generation (primarily wind) has grown, there has been increasing attention paid to the issue of providing capacity and flexibility in the future.

The Sixth Plan addressed this issue in Chapter 12, "Capacity and Flexibility Resources," describing the potential sources of these resources. The Council recognized that institutional changes, including improvement in wind forecasting, shorter scheduling periods, and dynamic scheduling, should be pursued first. The chapter also described a number of flexible generation and energy storage technologies, including utility demand response programs, which could provide capacity and flexibility.

In the Sixth Plan's Action Plan, the Council included action items DR-2 and DR-3, which call for the evaluation and demonstration of demand response as a potential source of load- and wind-balancing.

ANALYSIS:

The project proposed by Ecofys and its team is focused directly on the evaluation and demonstration called for in the Sixth Plan's action items DR-2 and DR-3. The project will focus on data centers for several reasons:

1. Data centers represent relatively large electrical loads at each site, reducing the transactions costs of pursuing the demand response resource if it proves practical;
2. Data centers are extensively instrumented and controlled, so that controlling for varied forms of demand response does not require a high level of investment in enabling technology;
3. Data centers represent a growing load and thus a growing potential resource of demand response resources; and
4. Data centers are distributed widely across the power system, not only in urban centers, but in rural areas as well.

This project will begin by surveying the existing and planned data centers in the region, collecting information on the age of these centers, the equipment used by the centers, their load patterns and the kinds of data services provided by each center. Then the technical aspects of the centers' potential for providing demand response will be analyzed. The team will perform a "gap analysis" – an analysis of the necessary changes to equipment and operations that would be necessary for each center to provide its full potential of demand response. At this point (March, 2013) a rough economic evaluation of the value of demand response from data centers to Bonneville, utilities and center operators will help Bonneville decide whether the potential of data centers justifies continuing with the project.

Assuming a positive evaluation, the project will move ahead to the selection of one or more specific centers and the technology and operations changes that will be tested as proof of concept of data centers providing various forms of demand response to the power system. This stage is expected to be complete by September, 2013.

The second year of the project will test the selected sites for their usefulness to power system operators and the utilities involved. This stage will require close cooperation with the operators of the data centers to make sure that effects on their business are acceptable to them. During this state, control strategies will be tested and refined.

In the course of the project, protocols for controlling loads, optimal rates of increase and decrease of controlled loads, and communication options will be evaluated and refined. The economics of these loads as sources of ancillary services, lessons learned by project participants and Bonneville staff, and appropriate incentives and marketing to obtain participation from end-use customers will be evaluated. The project will help the region identify which technologies are market-ready and which still need development or field testing.

During the planning and execution of the project, Council staff expects to be involved in advisory and analytical tasks. This activity would represent in-kind contributions to the project with a value of about \$20,000 in the first year of the project. The work would benefit staff's preparation for the Council's Seventh Plan in the areas of demand response potential, the load forecast, and conservation potential.

The Council will receive copies of all deliverables of the project.

ALTERNATIVES:

- One alternative is for the Council to approve less than the \$20,000 financial contribution to the project. This would require that the project find other support to compensate, making it more difficult for the project to proceed. The shortfall might be made up by other parties and the project might go ahead anyway. If it did, Council staff would still be interested in the information developed by the project and might participate in consultation and analysis. While the Council's support is not large as a share of the total, it would be a sign of the Council's commitment to the Sixth Plan's action items pertaining to demand response and ancillary services and an endorsement of this project's relevance to those action items. Further, the Council's support could encourage utilities that have not yet decided to participate in the project to do so and thus increase the range of experience resulting from the project. The staff recommends this alternative, since it helps ensure the future of the project and since it gives the Council greater ability to shape the project.
- The other alternative is for the Council to give no financial support to the project. This would require that the project find other support to compensate. In addition, it would miss the opportunity for the Council to go on record supporting the development of understanding of a growing use of electricity in the region, with potential for cooperation with the power system to make the power system more flexible and efficient. Other parties might be less inclined to support the work if the Council declines.