Rulemaking 12-03-014 (LTPP Local Reliability Track I)

Exhibit No. _____

Witness Andrew Hoffman

Commissioner Michel P. Florio

ALJ David R. Gamson

ENERNOC, INC.

LOCAL RELIABILTY TRACK I
SUPPLEMENTAL TESTIMONY OF ANDREW HOFFMAN

Rulemaking 12-03-014
Long Term Procurement Plans (LTPP)
Track 1 (Local Reliability)

July 25, 2012

ENERNOC, INC.
SUPPLEMENTAL TESTIMONY OF ANDREW HOFFMAN
RULEMAKING (R) 12-03-014:
LONG TERM PROCUREMENT PLANS (LTPP): LOCAL RELIABILITY TRACK I

By oral ruling at the Prehearing Conference (PHC) held in the Long Term Procurement Plans (LTPP) Local Reliability Track 1 on July 9, 2012, Administrative Law Judge (ALJ) Gamson directed that citations in Opening Testimony to weblinks (URL) or on-line documents would not be accepted. To the extent that a party wished to rely on such cited material, ALJ Gamson directed that a hard copy version of relevant pages must be provided by Supplemental Testimony served by July 25, 2012.

By this Supplemental Testimony, EnerNOC, Inc. (EnerNOC) provides the relevant pages from on-line or weblink citations used in the Opening Testimony of Andrew Hoffman served on behalf of EnerNOC on June 25, 2012. The footnotes where such citations occurred are noted, followed by the relevant pages from the cited document.

ENERNOC OPENING TESTIMONY OF ANDREW HOFFMAN
JUNE 25, 2012

Footnote 5, at Page II-4

PJM Demand Side Response

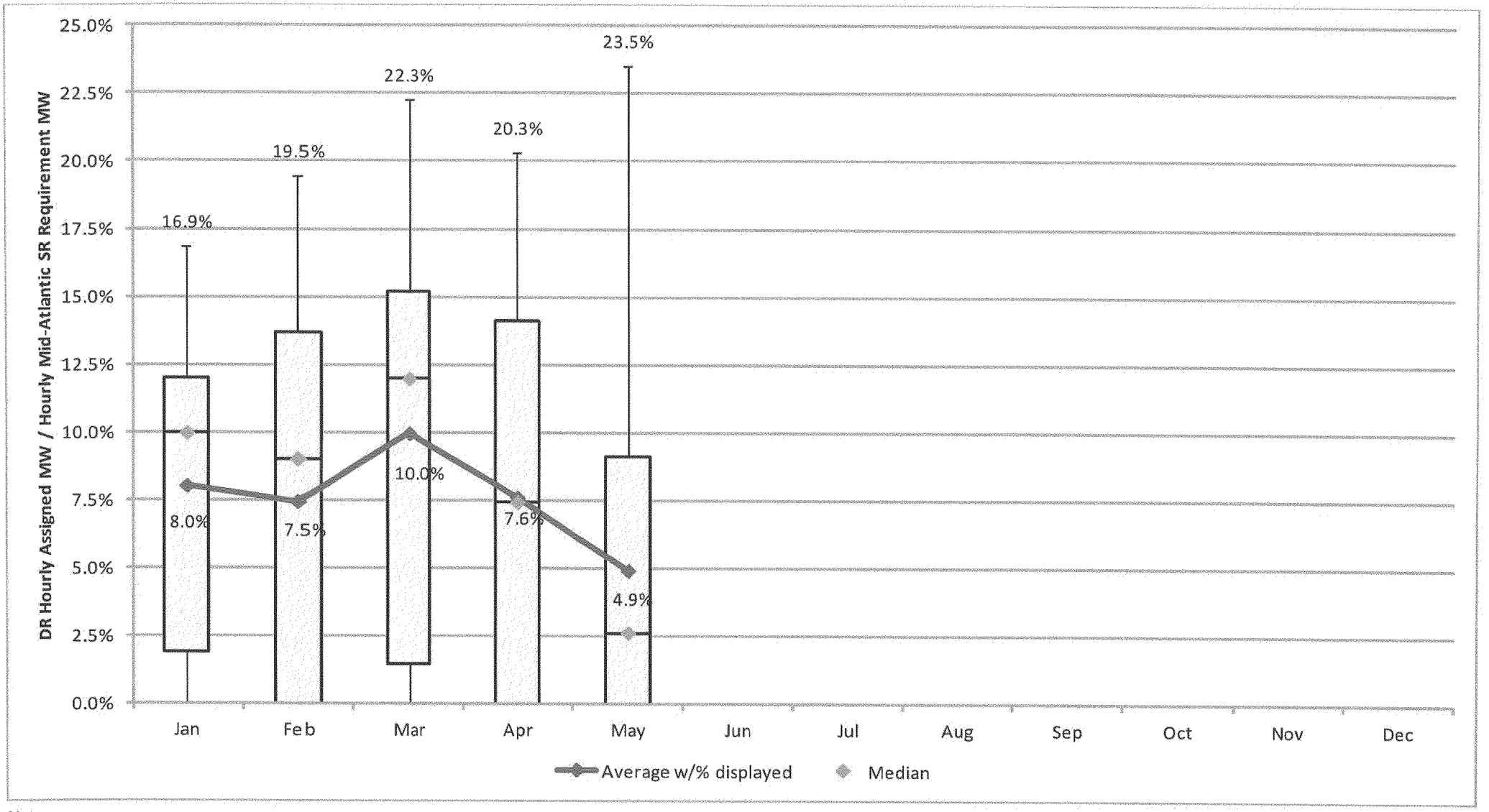
Load Response Activity Report
Pages 1 and 20

June 12, 2012

Load Response Activity Report
June 2012

James McAnany
PJM Demand Side Response
June 12, 2012

2012 DR Synchronous Reserve Penetration Distribution (Box-plot) for Mid-Atlantic Reserve Zone



Note:

1) Demand Response are Tier 2 resources.

2) Percents shown on upper whisker are maximum hourly DR percentage of Total Mid-Atlantic SR requirement.

ENERNOC OPENING TESTIMONY OF ANDREW HOFFMAN
JUNE 25, 2012

Footnote 6, at Page II-5

PJM Advanced Technology Projects

Cover Page

A 105-gallon electric water heater has been installed in PJM's Technology Center to provide hot water to the building. Simultaneously, the water heater responds instantly to changes in grid needs when its controller receives a pricing and regulation signal from PJM dispatch. The device began communicating with the grid and responding to the PJM frequency signal in December 2010.

PJM also is tracking more than 30 other alternative energy pilots across the region that are being proposed or developed. They include categories such as batteries, PHEVs, compressed air energy storage, flywheels and smart home/smart building.

Most of the projects focus broadly on energy storage or demand response, testing innovative approaches with the potential for PJM to enhance future reliability, market efficiency and operational flexibility.

PJM's advanced technology initiatives reflect its history of forward thinking aimed at anticipating the future and identifying how to prepare for the challenges facing the industry ahead.

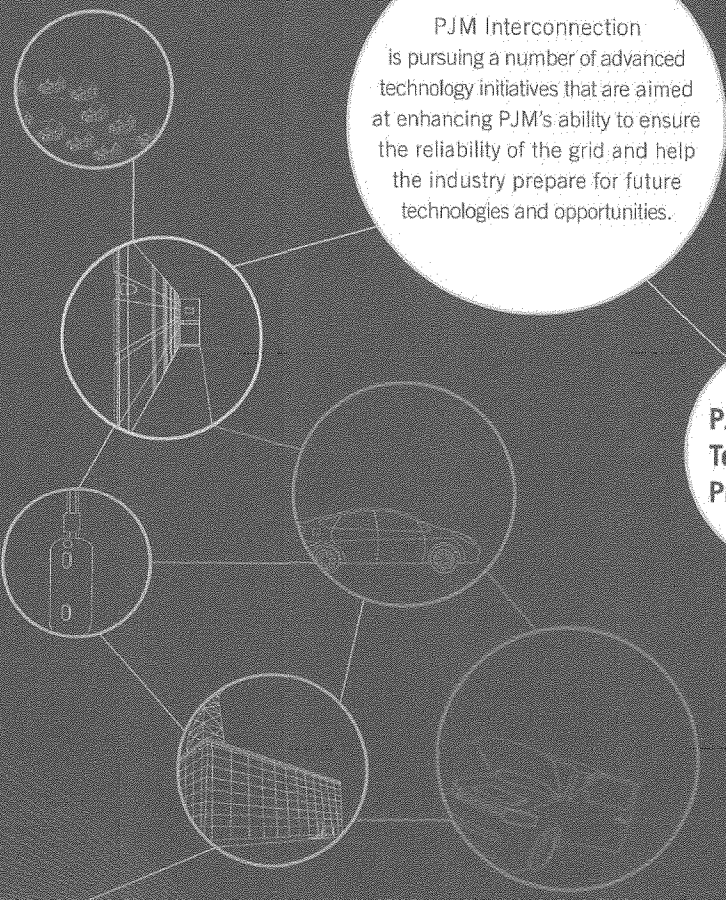
PJM Interconnection
Valley Forge Coporate Center
955 Jefferson Avenue
Norristown, PA 19422

866-400-8980

www.pjm.com

PJM Interconnection is pursuing a number of advanced technology initiatives that are aimed at enhancing PJM's ability to ensure the reliability of the grid and help the industry prepare for future technologies and opportunities.

PJM's Advanced Technology Projects



ENERNOC OPENING TESTIMONY OF ANDREW HOFFMAN
JUNE 25, 2012

Footnote 10, at Page II-6

National Grid

Short Term Operating Reserve
General Description of Service

December 16, 2011

SHORT TERM OPERATING RESERVE

General Description of the Service

16th December 2011

1. Introduction

This document provides a summary of the service of Short Term Operating Reserve (STOR) as set out in detail in the Standard Contract Terms (SCTs) Issue #6, dated 22nd November 2011, which will come into effect on the 1st April 2012.

The document is intended as a guide to the service of Short Term Operating Reserve and for full details of contractual provisions, the reader should refer to the SCTs. This document will be issued within each Invitation to Tender, and will be modified to reflect any future change to the SCTs.

In the unlikely event that there is inconsistency between this document and the SCTs, then the SCTs will take precedence.

2. Background to Reserve Requirements

At certain times of the day National Grid needs access to sources of extra power, in the form of either generation or demand reduction, to be able to deal with actual demand being greater than forecast demand and/or unforeseen generation unavailability. These additional power sources which are available to National Grid are referred to as 'Reserve' and comprise synchronised and non-synchronised sources.

National Grid procures the non-synchronised requirement primarily by contracting for Short Term Operating Reserve**,** which is provided by a range of service providers by means of standby generation and/or demand reduction.

The need for Short Term Operating Reserve varies depending on the time of year, the time of week and time of day, being a function of the system demand profile at that time. To reflect this**,** National Grid splits the year into a number of Seasons, for both Working Days (including Saturdays) and Non-Working Days (Sundays and most Bank Holidays), and specifies the periods in each day that Short Term Operating Reserve is required. These periods are referred to as Availability Windows.

3. Overview of Short-term Operating Reserve

3.1 Introduction

Short-Term Operating Reserve is a contracted Balancing Service, whereby the service provider delivers a contracted level of power when instructed by National Grid, within pre-agreed parameters. The main, minimum capability requirements for the service are as follows:

- Minimum Contracted MW capability = 3MW.
- Contracted MW must be achievable no later than 240 minutes after instruction from National Grid.
- Contracted MW must be deliverable for no less than 2 hours.

The service can be provided by both BM and non-BM participants. Utilisation of the service from BM participants is via the Balancing Mechanism. For non-BM service providers, a bespoke monitoring and despatch system, STOR Despatch, is installed (formerly known as SRD - Standing Reserve Despatch).

3.2 Forms of the service

There are two forms of the STOR service:

i) Committed Service.
ii) Flexible Service.

Under the Committed Service, a service provider must make the service available* for all Availability Windows within the contracted term. Both BM and non-BM service providers can offer the Committed Service.
(* - apart from when the unit/site is technically unable to provide the service and subject to the rejection by the service provider (in relation to an existing STOR Contract) of new Availability Windows introduced in a Subsequent Year).

The Flexible Service is only open to non-BM service providers. Flexible service providers have greater freedom as to how many hours they wish to make the service available, and when that availability is offered. However, National Grid may choose to reject Flexible Service availability and, provided the rejection is issued in the defined timescale, National Grid will not make Availability Payments for rejected Flexible Service availability.

3.3 Payment Structure

There are two forms of payment that National Grid will make as part of the service:

1. **Availability Payments**. Where a service provider makes its unit/site available for the STOR service within an Availability Window, National Grid will pay for that availability on a £ / MW / hr basis.

2. **Utilisation Payments**. Where National Grid instructs delivery of STOR from a unit/site, then it will pay for the energy delivered on a £ / MWhr basis. (This includes the energy delivered in ramping up to and down from the Contracted MW level). For BM service providers this payment will be effected through the Balancing Mechanism.

A service provider has the option to elect to link their Availability and/or Utilisation Prices applicable in Subsequent Years (i.e. for years 2 to 15) to a standard indexation methodology. This methodology - to be specified in the provider's STOR Framework Agreement - may be either a specific methodology agreed with National Grid or a standard methodology selected from the Indexation Principles Document which will be published by National Grid in due course.

3.4 Contract Structure

The service is procured by National Grid by means of a periodic tender process, and each tender contains the service provider's plant technical data as well as the prices for the service.

In order to be able to tender for the service, a STOR Framework Agreement must first be entered into between National Grid and the prospective service provider. This will give effect to the Standard Contract Terms in force at the time, in respect of any accepted tender(s).

The STOR Framework Agreement will list the units/sites that a service provider may wish to tender at some stage in the future, and tenders may only be submitted in respect of units/sites listed in a STOR Framework Agreement.

In the event that National Grid accepts a tender, then the formal acceptance letter to the service provider will create the contract (STOR Contract). Each STOR Contract incorporates the technical and price details specified in the tender and tender

acceptance letter and will be governed by the STOR Framework Agreement and the SCTs.

3.5 Tender Rounds

It is envisaged that 3 tender rounds will be run each year. Providers are invited to tender for both flexible and committed service.

National Grid is currently inviting both the flexible and committed services to be tendered for 1 or more Seasons in up to 2 complete financial years.

The tender (completed and submitted by service providers) will contain all of the required technical parameters associated with the service, as well as the Availability and Utilisation Prices.

3.6 Long Term Tenders

National Grid has concluded that the current suspension of the Long-Term STOR market should continue until at least 31st December 2012 (up to and including STOR Tender Round 18). This decision will be further reviewed in light of any strategic decisions included within DECC's White Paper on Electricity Market Reform.

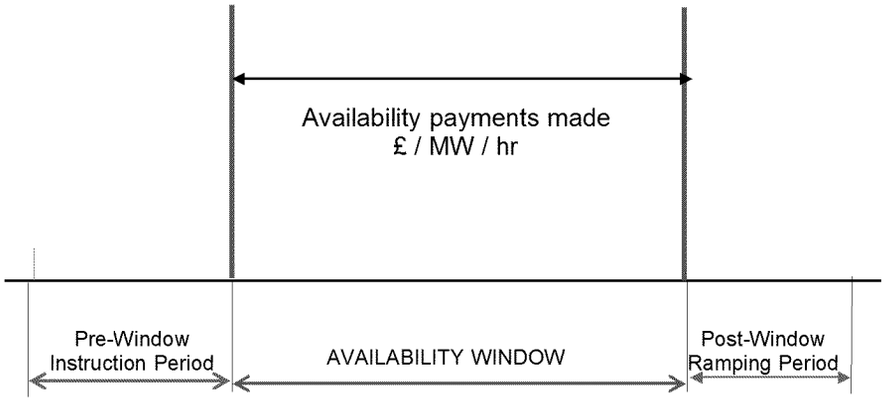
There is a facility in the SCTs for supplemental contract terms associated with longer term committed service provision, namely indexation (see 3.3 above) and provisions to allow completion of necessary works (see 5.5 below).

4. STOR - Operation of the service

4.1 Availability Window

The Availability Window is defined as being the period during which the service provider is required to be available to operate at Contracted MW. As a result of this, there is the possibility that a STOR Instruction may be issued prior to commencement of the Availability Window (i.e. in order to achieve Contracted MW by the time that the Availability Window starts).

In addition, where delivery of Contracted MW is up to the end, or close to the end, of the Availability Window, there may be energy delivered outside the Window whilst the unit/site is returning to its default state. These pre- and post-window phases have been expressly defined under the service, and are explained by the following diagram.



The Pre-Window Instruction Period is equal to the Response Time, which is a tendered parameter. Response Time is defined as being the time that it will take a unit/site to reach the Contracted MW level after the service provider receives an Instruction from National Grid.

The Post-Window Ramping Period is the time required for the unit/site to return to its default state, following the Instruction from National Grid. It is equivalent to the Cease Time, which is also a tendered parameter.

Where a service provider declares availability from a unit/site, Availability Payments are made for the duration of the Availability Window, unless, in the case of a Flexible Service window, the availability is rejected by National Grid.

4.2 Committed Service

A Committed Service provider makes the service available to National Grid in all Availability Windows over the contract term. The only acceptable reason for unavailability is where the unit/site is technically unable to provide the service (for example plant breakdown or planned maintenance) and where the service provider has rejected (in relation to existing STOR Contracts) new Availability Windows in Subsequent Years.

Initial availability Declarations for each week ('week' being the 7 days from Monday 05:00 Hours) are made to National Grid no later than 10:00 Hours on the previous Tuesday. (Declarations may be made via OC2 for BM service providers, and via STOR Despatch for non-BM service providers).

Declarations are made on a per whole Availability Window basis. i.e. a service provider is available for the whole window, or none of it.

A Re-declaration in respect of a particular Availability Window may be made at any time (but always based on technical capability) until shortly before the start of an individual Availability Window. Re-declarations must be made as soon as the change in technical capability becomes apparent to the service provider.

4.3 BM Unit Data submissions

For a BM service provider its BM Unit data submissions will need to be consistent with its availability Declaration, and its tendered prices and technical parameters.

4.4 Utilisation of the service

Where National Grid issues a STOR instruction, the service provider must start to provide Reserve within the Response Time and continue provision until the earliest of the following times:

i) National Grid issues a cease instruction;
ii) Expiry of the service providers' Maximum Utilisation Period;
iii) the end of the Availability Window.

4.5 Non-BM service providers and Optional Windows

Within STOR there is the opportunity for non-BM service providers to offer a service outside of Availability Windows.

All periods outside Availability Windows (and the associated pre- and post- Window periods) are defined as 'Optional Windows'.

Service providers may indicate for each day their availability in Optional Windows. Where they indicate availability National Grid may utilise the service at the Optional Energy Utilisation Price. Please note that no Availability Payments will be made for service availability within any Optional Windows.

4.6 Flexible Service (non-BM service providers only)

In its week ahead Declaration, a Flexible Service provider may choose the Availability Windows in which it wishes to make the service available to National Grid. (Unlike the Committed Service, the service provider may elect at this stage to make the service unavailable for any reason).

Between the initial Declaration and Friday 10:00 Hours, the service provider may issue a Re-declaration at any time, again for any reason.

Where at 10:00 Hours on each Friday, Flexible Service availability is being declared in respect of Availability Window(s) in the following week, National Grid will assess whether to accept or reject the declared Flexible Service availability. National Grid may reject any Flexible Service availability up to 16:00 Hours, in which case no Availability Payments will be made in respect of such rejected window(s).

Where availability in any Availability Window(s) is offered as at Friday 10:00 Hours, and is not rejected by National Grid, the service provider is then committed to providing the service in such windows. The availability may only then be withdrawn for technical reasons. From this point, the service obligations apply in the same way as for the Committed Service. National Grid also becomes committed at this time to paying for the accepted availability (providing there is no subsequent Re-declaration withdrawing the availability).

Where availability has been rejected by National Grid, the service provider may continue to offer the availability. If it does so and National Grid actually utilises the service, then the Reserve energy provided will be paid for at the Optional Energy Utilisation Price.

5. SERVICE MONITORING

In order to confirm that National Grid is paying for the service as agreed, it monitors availability and delivery. Where a service provider fails under the service terms then the associated consequence is set out in the SCTs. Broadly speaking, failures fall into 3 categories:

i) Availability Declarations
ii) BM Unit Data submissions
iii) Delivery failures

5.1 Availability Declarations failures

These apply where a Committed Service provider fails to comply as follows:

i) unavailability is for reasons other than related to the technical capability of the plant.
ii) the service provider does not re-declare as soon as it is apparent that there is change in the unit/site's technical capability.

(iii) there is a late Re-declaration of unavailability ("late" meaning after Gate Closure in respect of the Pre-Window Instruction Period, associated with a specific Availability Window).

Note these failures also apply for Flexible Service providers where availability has been accepted.

The consequence of these failures is to withhold Availability Payments associated with the affected Availability Window.

5.2 BM Unit Data submissions

BM Unit parameters that are monitored in the relevant periods to verify availability in line with the requirements of the STOR Contract are as follows:

- Maximum Export Limit (MEL)
- Physical Notification (PN)
- Offer Price
- Bid Price
- Stable Export Limit
- Dynamic Parameters (i.e. Run Up / Run Down rates etc.)

MEL is monitored to check availability and the failures / consequences are as per the previous paragraph.

PN – if a positive PN is submitted, the Availability Payment is withheld for the entire availability window.

Offer/Bid Price. The Offer Price submitted in the Balancing Mechanism must be identical to the tendered Utilisation Price and the Bid Price must be not less than the Offer Price. Failure to submit a compliant Offer Price in a Settlement Period will result in that Settlement Period's Availability Payment being withheld. Failure to submit a compliant Bid Price may result in the STOR service provider refunding to National Grid the difference between the tendered Utilisation Price and the non-compliant Bid Price multiplied by the volume of energy delivered following the issue of an instruction to provide STOR.

SEL must be no greater than MEL. Dynamic Parameters must be consistent with the Technical Parameters specified in STOR Contract. If not, Availability Payments will be withheld for each Settlement Period in which the failure occurred.

5.3 Delivery Failures

These comprise:

i) Late achievement of Contracted MW.

ii) Delivery of less than the energy associated with the STOR instruction.

iii) Non-continuous delivery of Contracted MW.

A 10% tolerance applies in respect of these delivery failures. Failure under each of these would result in withholding of Availability Payments for the Availability Window in question.

5.4 Monthly Price Adjustment

In the event of one or more service failures within a month, then the availability price for that month will be reduced. For each Availability Window containing a failure, there will be a 1% reduction applied to the price, subject to a limit of 30%.

5.5 Mandatory Works Provisions

In order to guarantee an income before committing to any capital monies, providers may tender for STOR before installation of an asset. In this case, a set of standard works provisions are required to be agreed and included in the service provider's STOR Framework Agreement prior to the submission of the tender. National Grid will monitor work progress in accordance with the mandatory works provisions and commence payment from the commencement of provision of the service.

Where there is a delay in the mandatory works provisions a provider can provide National Grid with a Cure Plan. The Cure Plan will set out the proposed actions that the reserve provider intends to undertake to remedy the delays or, where this is not possible, specify a reasonable extension to the Works Programme.

Following submission of a Cure Plan to National Grid the STOR Contract will be suspended from the Target Completion date until the earlier of:

- successful commissioning;
- National Grid determining (acting reasonably) that the Reserve Provider had abandoned the works or was otherwise non-compliant with the Cure Plan;
- any revised Target Completion Date determined by an Expert; or
- the long stop date.

During the suspension period no Availability Payments will be made. Where a delay

is due to Force Majeure the period of suspension will be excluded from the seasonal availability payment reconciliation to ensure that the Reserve Provider is not unduly penalised. If the Cure Plan is accepted and completed to National Grid's satisfaction the unit may return to service. If the plan is not accepted or completed to National Grid's satisfaction then National Grid may go ahead with the termination of the contract.

5.6 Termination rights

National Grid has the right to terminate a contract for the provision of STOR in the following circumstances:-

i) persistent failure to make available or provide STOR from a contracted unit/site;

ii) either (in the case of a BM provider) the BM provider ceases to be the lead party for a contracted BM unit or (in the case of a non-BM provider) a site either becomes a BM Unit or is a BM Unit and in either case actively participates in the Balancing Mechanism;

iii) where a contracted unit/site contracts to provide another service and this interferes with the ability of the contracted unit/site to provide STOR;

iv) there are, in respect of a contracted unit/site, either three or more service failures in a season or eight or more service failures in a 12 month period (in this circumstance there is a long stop date of 60 days within which National Grid must notify it's intention to terminate the STOR contract);

v) a contracted unit/site fails two or more tests to prove that the unit/site has the capability to provide STOR;

vi) where new availability windows are introduced, a provider may elect to retender for the existing windows together with the new windows. If the retender is accepted by National Grid, a new STOR contract will be formed to replace the existing service terms;

vii) in certain circumstances where a provider fails to complete or commission the unit/site in accordance with the standard work provisions set out in the STOR Framework Agreement by the commencement of the STOR Contract; or

viii) in the circumstances specified in the STOR Framework Agreement.

5.7 Remedial Plan

Before exercising any termination right for multiple Events of Default, failed Reproving Assessments or Force Majeure, National Grid must notify the Reserve Provider of its intention to terminate. The Reserve Provider then has 20 Business Days to prepare, at its own cost, and submit a Remedial Plan.

As soon as National Grid gives this notice of its intention to terminate, the STOR Contract is suspended until the earlier of:

- the Reserve Provider failing to submit a Remedial Plan within the required timescales;
- National Grid rejecting the Remedial Plan and the Reserve Provider not disputing the decision within the required timescales;
- the Remedial Plan is completed to National Grid's reasonable satisfaction;
- National Grid determining that the Reserve Provider has abandoned the remedial works or is otherwise in non-compliance with the Remedial Plan; or
- the long stop date.

During the suspension period no Availability Payments will be made. As with the Cure Plan, where a delay is due to Force Majeure the period of suspension will be excluded from the seasonal availability payment reconciliation to ensure that the Reserve Provider is not unduly penalised.

If the remedial plan is accepted and completed to National Grid's satisfaction the unit may return to service. If the plan is not accepted or completed to National Grid's satisfaction then National Grid may go ahead with the termination of the contract.

6 SUBSTITUTION / REPLACEMENT

Where a service provider wishes to substitute the contracted unit or site temporarily, then it may request that the STOR Contract be amended to effect this substitution.

Replacement is similar to substitution, but results in a permanent change to the contracted unit/site for the remainder of the STOR Contract term.

7 WEEKLY & ANNUAL UTILISATION LIMITS

Within its tender a service provider may indicate weekly and annual limits on the number of times National Grid may utilise the service or indicate an annual limit on the number of hours National Grid may run the Unit(s) for. Should either of these limits be reached then the service provider may notify National Grid of a revised Utilisation price to apply for the remainder of the week / financial year, as applicable.

8 RECONCILIATIONS

8.1 Seasonal Delivery Reconciliation

National Grid assesses the aggregate MWh energy delivered across all utilisations within a Season for each contracted unit/site. Where there is a shortfall of total delivered MWh against STOR-instructed MWh, then National Grid applies a reconciliation against Availability Payments made in respect of that Season.

Where the total delivered MWhs is greater than 95% of STOR-instructed MWhs then no Seasonal Delivery Reconciliation applies.

Where there are very few utilisations within a Season the reconciliation is scaled to reduce the amount repayable.

8.2 Availability reconciliation

For Committed Service providers a high percentage availability is expected, on the basis that there can only be unavailability for reasons relating to the technical capability of the plant.

In the event that the aggregate availability within any financial year is less than 85%, then a process applies whereby a proportion of the Availability Payments paid over the term becomes repayable. The basis of the reconciliation is 1% repayment for each percent of availability less than 85%.

The Availability Reconciliation takes account of any reconciliation already carried out under the Seasonal Reconciliation process.

A form of Availability Reconciliation also applies to Flexible Service providers. It only applies in respect of availability that has been declared at the week ahead stage and has not been rejected by National Grid. This is the stage at when a Flexible Service

provider becomes committed to its declaration. The 'actual' availabilities are assessed for the Availability Windows in which the service provider had week ahead availability accepted by National Grid. Where across any financial year there is less than 85% of the availability which the provider committed to provide at the week ahead stage, then reconciliation of Availability Payments will apply.

9 ROLE OF AGENTS AND AGGREGATORS

9.1 Agents

A service provider may procure that an Agent administers its tender, availability declarations and settlements process on its behalf. The STOR Standard Contract Terms contain specific schedules dealing with this arrangement.

9.2 Aggregator

A service provider may choose to be an aggregator. The role of an aggregator is to develop and operate multiple sites (STOR Sub Sites) and offer these to National Grid as single STOR site(s). This role is specifically different to that of an agent in that an aggregator is responsible for;

- Framework Agreement and Formation of a contract.
- Despatch of multiple sites.
- Availability Declarations.
- Metering and Monitoring.
- Settlements.

For more information on the aggregator role please see the following documents;

- Specimen STOR Aggregator Framework Agreement
- Description of Aggregator Special Conditions

10 FURTHER USEFUL INFORMATION

- **STOR End of Year Report for 09/10**
  http://www.nationalgrid.com/NR/rdonlyres/41B8C2BF-4A3B-471B-9FF8-6EBE9C51C9BF/44264/STOR_End_of_Year_Report2009_10.pdf

This report, amongst other things, details how many hours NG utilised STOR for in 09/10.

The End of Year Report for 10/11 will be available on our website shortly.

- **STOR Supplemental Information**

  http://www.nationalgrid.com/NR/rdonlyres/2BB0E857-2F2C-4238-8F3F-03900866B2F3/40678/STOR_Supplemental_Information.pdf

  This report presents historic utilisation data under three main sections; duration of historic call offs, historic utilisation by response time, and historic utilisation by location. It should be noted that STOR is a capacity product and the utilisation volumes will vary from day to day and year to year. This document gives examples of the number & length of call offs you can expect and how this is dependent on your tendered utilisation price and response time.

- **STOR Market Information for Tender Round 15**

  http://www.nationalgrid.com/NR/rdonlyres/3F56DE61-F432-41AC-9FD6-6CA3A6F4BE0B/50015/TR15_MIR_final.pdf

  A market report is produced after each tender round and is designed to give existing and potential STOR participants an overall view of the tenders received in each tender round. The report provides details of tendered utilisation and availability prices and National Grid's resultant forward contracted position; together with further details on type, size and dynamics of the tendered plant.

- **All of the information above, as well as many other useful documents, can be found on the STOR page of our Website:**

  http://www.nationalgrid.com/uk/Electricity/Balancing/services/STOR/

If you have any STOR queries then please contact your Account Manager or email us at energy.operations@uk.ngrid.com.

ENERNOC OPENING TESTIMONY OF ANDREW HOFFMAN
JUNE 25, 2012

Footnote 11, at Page II-7

National Grid

Frequency Control by Demand Management

2012

nationalgrid

Frequency Control by Demand Management (FCDM)

Frequency Control Demand Management (FCDM) provides frequency response through interruption of demand customers. The electricity demand is automatically interrupted when the system frequency transgresses the low frequency relay setting on site. The demand customers who provide the service are prepared for their demands to be interrupted for a 30 minute duration, where statistically interruptions are likely to occur between approximately ten to thirty times per annum.

Major Technical Requirements

A FCDM provider must:

- Be available 24 hours a day (declared for full Settlement Periods)
- Provide the service within 2 seconds of instruction
- Deliver for minimum 30 minutes
- Deliver minimum 3MW, which may be achieved by aggregating a number of small loads at same site, at the discretion of National Grid
- Have a suitable operational metering
- Provide output signal into National Grid's monitoring equipment

For more detailed information on FCDM please view the information in our **Balancing Services Contracts Information Pack.**

Alternatively please contact your Account Manager or Andy Walden of our Contracts team +44 (0)1926 655087, **andy.walden@nationalgrid.com**

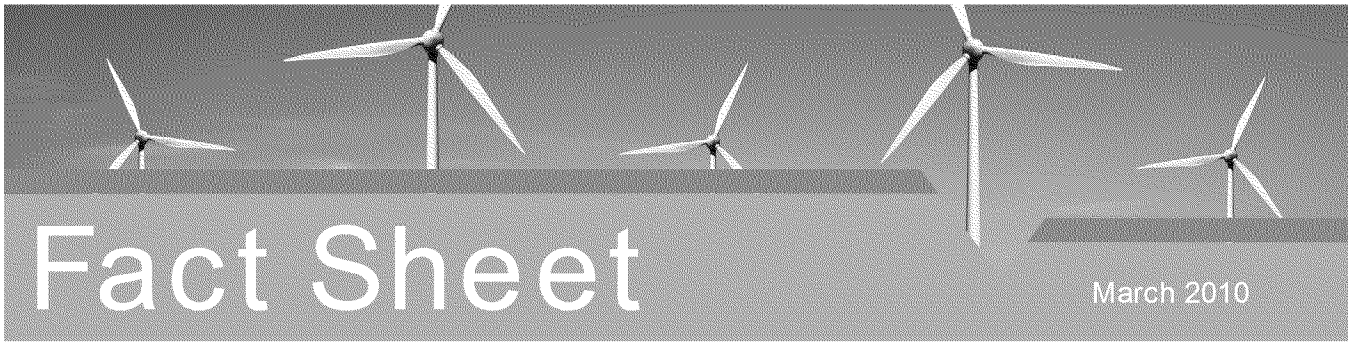
ENERNOC OPENING TESTIMONY OF ANDREW HOFFMAN
JUNE 25, 2012

Footnote 12, at Page II-8

Bonneville Power Administration (BPA)

Fact Sheet on BPA Wind Power Efforts

March 2010



Fact Sheet

March 2010

BPA's wind power efforts surge forward

As the nation seeks new sources of clean electricity, wind has emerged as the most mature and promising new resource. It is free of CO_2 emissions, relatively cost effective compared to other new generating resources and is, thus far, the most viable non-hydro renewable resource available on a large scale. Its assimilation into the U.S. and Pacific Northwest generation resource base is advancing rapidly, thanks to concerted efforts to meet and overcome challenges to dealing with wind's variability.

Others, primarily independent companies, are developing wind resources. The Bonneville Power Administration's major role is to provide the reliable transmission that delivers electricity from wind farms, often located in remote areas, to the region's communities. Bringing a variable and difficult to predict energy resource, such as wind, onto the power grid in large amounts is one of the great engineering and economic challenges in the power industry today. BPA is maintaining a remarkable pace of connecting wind power onto its transmission system and has among the highest levels of wind power in its transmission system compared to load of any grid balancing authority in the country.

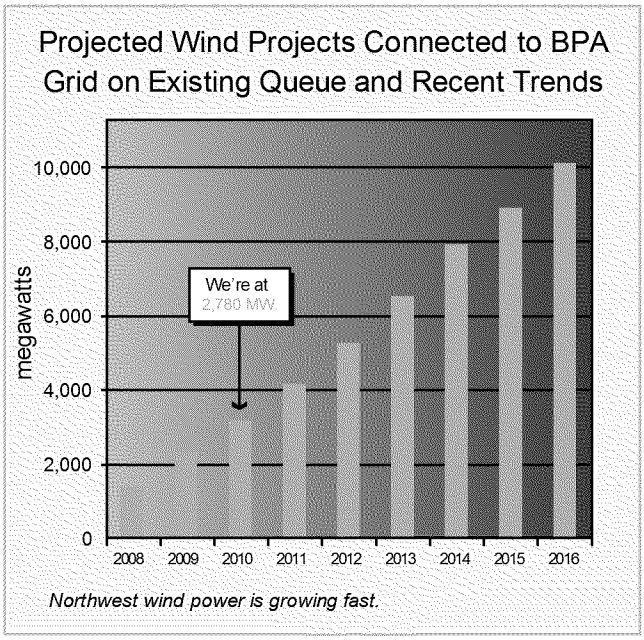
Growth rate fuels progress

All but one of the states in BPA's service territory have enacted renewable electric generation standards for their retail utilities. These requirements, coupled with those of other Western states, have set off a "gold rush" of wind developers to the region.

The growth rate of wind interconnections is astounding. In 2009 alone, the amount of wind power integrated into BPA's transmission system went from 1,500 megawatts to more than 2,500 megawatts. It is now above 2,700 megawatts. In the next two years, BPA expects a near doubling of wind on its system. By 2013, BPA may have more than 6,000 MW of wind power on its system.

As wind power continues to grow, the energy industry faces dramatic change. This is an exciting time for the industry, and BPA is helping lead the nation into a new age of renewable power.

BPA and the region's wind community have been working aggressively to adapt to wind power's rapid growth. In 2009, the agency released an accelerated



Northwest wind power is growing fast.

18-month work plan for wind integration activities. BPA's Wind Integration Team is tackling five projects to better manage large amounts of wind power in BPA's balancing authority area. All of these projects, summarized below, are on or ahead of schedule.

Making it work

Given the challenges, how can 6,000 megawatts of wind, and perhaps more ultimately, successfully operate in a balancing area with just under 11,000 megawatts of peak load? BPA is focusing its efforts in four areas to make it work.

- Building transmission to support wind integration.
- Using existing transmission capacity in new ways.
- Exploring new sources of generation capacity reserves.
- Developing partnerships with other utilities and the wind power community.

Building transmission to support wind integration

The region needs new transmission to meet growing demand for energy, particularly renewable energy. Because BPA owns and operates three-quarters of the region's high-voltage transmission, the agency plays a vital role in facilitating the development of renewable energy. Simply put, wind and other resources will not be developed unless transmission is available to get those resources to market. This is particularly challenging because, on average, wind projects in the BPA service territory only operate at about 30 percent of their capacity.

To determine transmission needed to support additional wind generation, as well as to shore up reliability, BPA initiated a new process called Network Open Season in 2008 to better manage the queue of customers seeking BPA's transmission services. Previously, many potential developers had sought to reserve transmission for plants still in the planning stage or plants that might never be built. The result was a long and unmanageable queue. Under Network Open Season, BPA offers firm network transmission service to customers who request it, but the customers must make a financial commitment for that service. This winnows out the speculative requests for transmission.

In 2009, BPA confirmed financial commitments for 6,410 megawatts of transmission service requests. Three-quarters of the requested service capacity were for wind generation.

BPA was able to accommodate more than 20 percent of the requests with existing capacity. It was also able to offer a new "conditional firm service" to provide still more transmission service from existing capacity of the system. Conditional firm allows some curtailment of service under certain conditions. This allowed BPA to make the most efficient use of its existing system before proposing new construction.

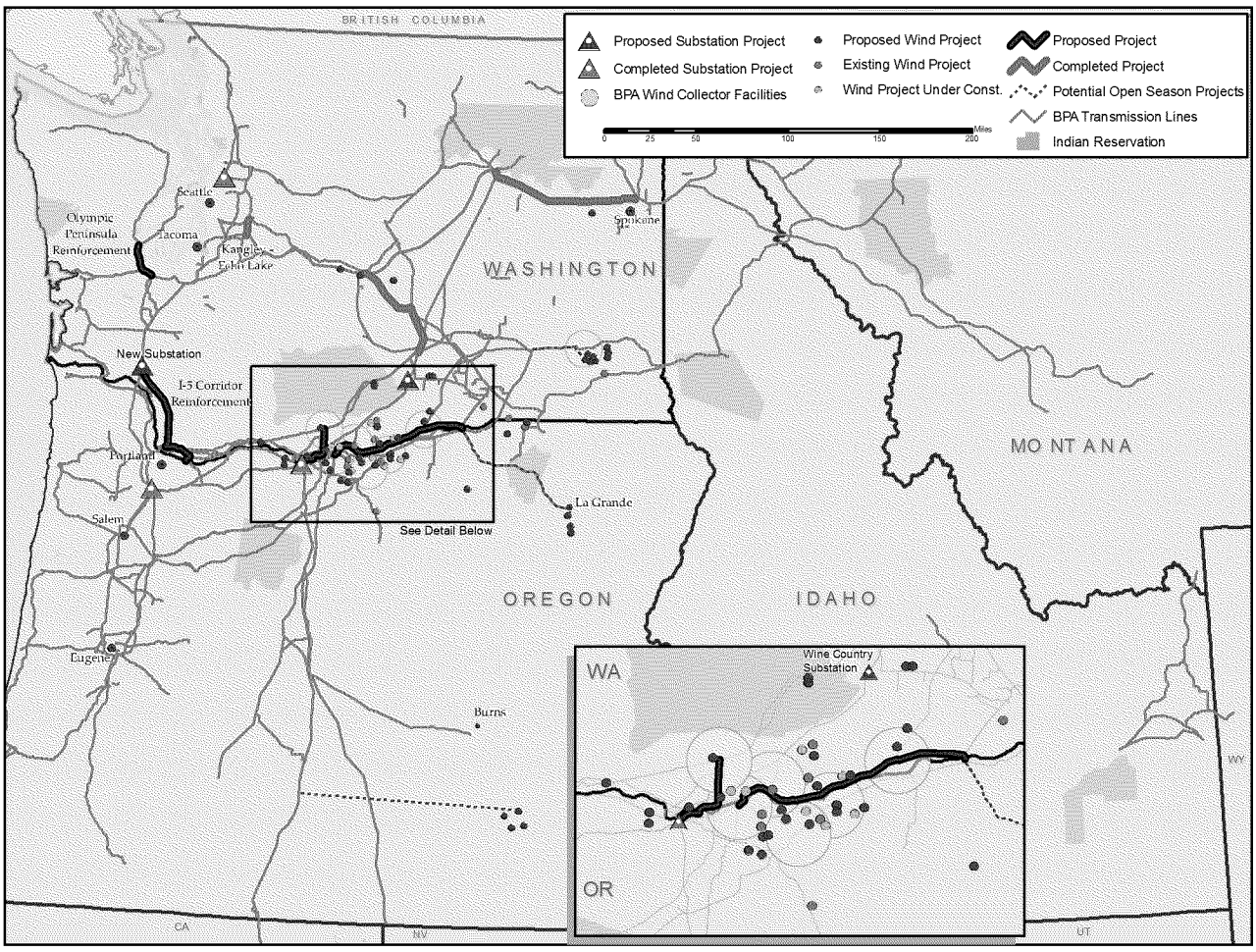
Network Open Season did show, however, that BPA needs to move forward with four new transmission projects. Together, these projects would bring 1,800 megawatts of new wind generation to the region. BPA is ahead of schedule on the construction of the first project and is conducting environmental work on the others. The feasibility of these projects was enhanced by access to increased borrowing authority granted BPA under the American Recovery and Reinvestment Act. BPA will pay this money back with interest to U.S. taxpayers, but the expanded borrowing authority provides increased capital for critical projects. BPA is completing its second Network Open Season and plans to conduct the process annually.

BPA wind initiatives are stretching the capability of the existing system.

Changing grid management for wind power integration

BPA's Wind Integration Team is developing new processes and systems to wring as much efficiency as possible out of existing transmission and generating reserve assets. Basically, BPA is stretching the capability of the existing system through efficiencies from operational improvements. If these initiatives succeed and are implemented over the long term,

Completed and Proposed BPA Transmission Line & Wind Projects



Most of the wind power in the Northwest is clustering in the heart of BPA's grid.

they could make a significant dent in the amount of balancing reserves needed to support a tripling of the wind generation interconnected to BPA's system.

New protocols manage extreme wind ramps

BPA has seen unscheduled wind generation swings of more than 1,000 megawatts in less than an hour on its system. New operating protocols introduced in 2009 help manage sudden fluctuations in wind generation. When wind picks up and unscheduled generation threatens to deplete BPA's balancing reserves, BPA dispatch now automatically sends an electronic signal to wind plants to reduce their generation to scheduled levels. So far, BPA dispatchers have applied the protocols several times a month. Likewise, when large decreases in scheduled wind generation deplete BPA's ability to provide balancing energy, BPA revises the wind schedules downward, and receiving utilities must make up the difference with their own resources.

Shorter scheduling intervals

Historically, utilities schedule power deliveries by the hour. As a pilot project, BPA is allowing within-hour changes to power schedules for wind projects that are exceeding their hourly schedule. Intra-hour scheduling can help wind generators avoid curtailment of excess generation and could make it possible for them to sell excess power that otherwise might be limited. This has the potential to help reduce reserve requirements and generation imbalance charges. BPA is evaluating possible expansion of this project.

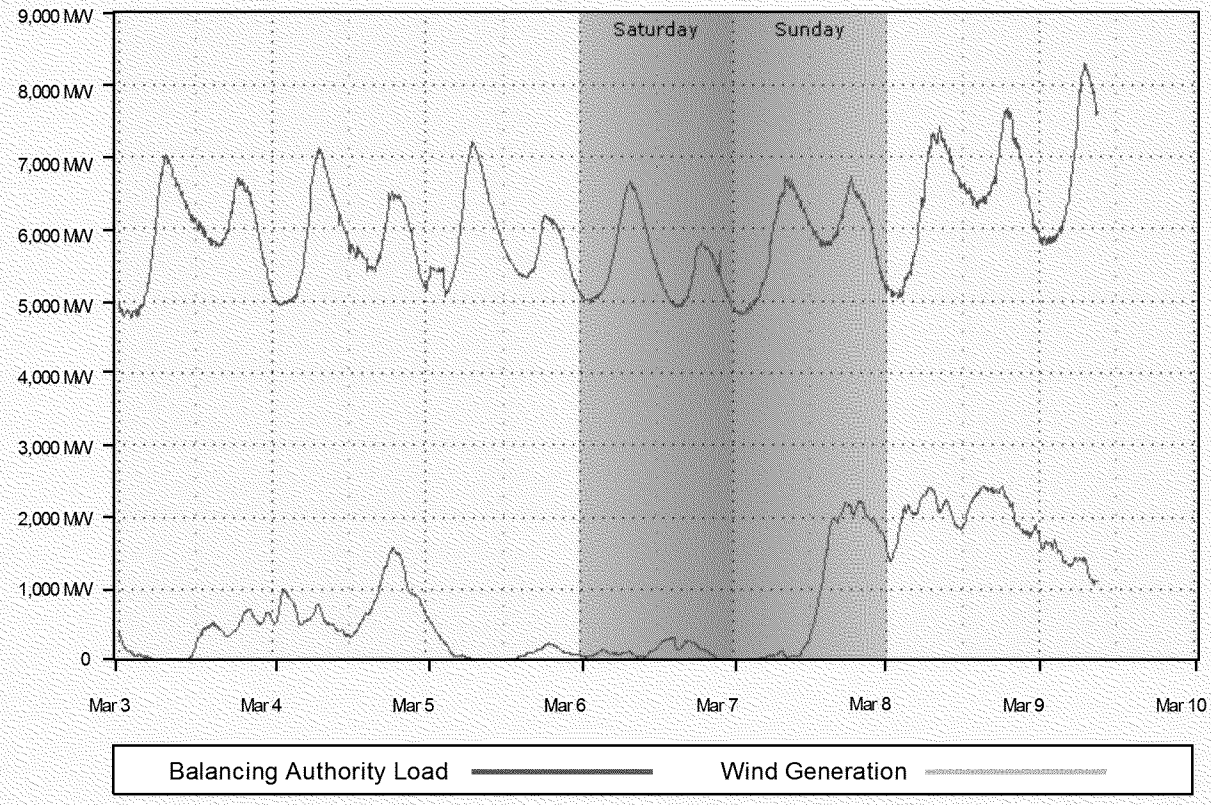
The challenge

Wind is a variable power resource that is hard to predict. That's a challenge because, unless generation matches demand second by second, the transmission system will destabilize. If the system becomes unbalanced, blackouts can result. Think of it in terms of a computer. We use surge protectors to prevent a sudden increase in electricity. Some sensitive electronic equipment also incorporates voltage sag protectors. Without these protections, equipment can suffer the equivalent of a "black out."

To maintain system balance in the high-voltage grid, utilities use balancing reserves, or generation held available to manage fluctuations between power load and power generation. In the Northwest, the hydro system has historically provided all the balancing reserves we need, because hydro generation can be increased or decreased quickly. But the hydro system has limits. To support continued large-scale wind power growth, we are learning to operate the existing system in new ways.

As with most coastal climates, Northwest winds are not steady. They tend to ramp up or down quickly and often unexpectedly. System operators are inventing new techniques to maintain the constant balance needed between power loads and generation levels. Some solutions already have been put in practice; others are on the way.

BPA Balancing Authority Load & Total Wind Generation
March 3–10, 2010



BPA now operates the hydro system to respond to and balance both variations in power loads and unexpected changes — up and down — in wind power output.

New wind forecasting applications

Wind output is difficult to predict, making it hard to schedule accurately. This uncertainty increases the amount of reserves BPA must hold to keep loads and generation in balance. BPA has installed 14 anemometers throughout the region to better predict wind availability and is using the data to develop a more accurate wind power forecast system for the Columbia Basin.

Dynamic transfer

Dynamic transfer is one of the most important techniques to reliably and cost-effectively integrate large amounts of variable renewable generation resources. This technique would allow a dispatcher in one balancing authority to control and take responsibility for supplying balancing reserves for a generator located in another balancing authority. A study identifying available dynamic transfer capacity on 11 key transmission paths completed in February 2010 found moderate amounts of available dynamic transfer capability. BPA is making this capability available to its customers on a pilot basis.

Managing large wind fleets is proving most efficient when handled across large geographic areas.

Customer-supplied imbalance reserves

Also known as self-supply, this project would allow wind generators in the BPA balancing authority area to supply their own imbalance reserves rather than relying on BPA for such services. BPA plans to launch this project on a pilot basis in October 2010, once the necessary technical adjustments are in place on both BPA and participating wind project systems. Wind project owners likely will use the Joint Initiative's Dynamic Scheduling System to facilitate supplying their reserves.

There are more than 30 discrete balancing authorities in the Western Electricity Coordinating Council (see box, page 6.). The result is numerous system operators, each of whom has individual requirements to maintain a constant balance between load and generation. This fragmentation is a challenge for the development of wind power in the Northwest, because wind generated in one balancing authority often serves consumers in another balancing authority that may be located across several intervening balancing authorities.

Exploring generation capacity reserves

Wind project operators in BPA's balancing authority pay for integration services for their projects, so that the consumers who pay to purchase wind power both receive the benefits of wind power and pay the costs of the resource. For 2010–2011, the rate reflects the costs of generation imbalance reserves provided from federal hydropower resources.

As the wind resource grows, even with efficiencies, new resources likely will be needed to provide balancing services for variable renewable resources. In preparation, BPA has begun to explore options for adding flexibility capacity.

Key terms

Balancing Authority: A balancing authority is an entity that is responsible for maintaining a constant balance between power load and power generation in a geographic area. It is usually a utility or other transmission provider such as a regional transmission organization. There are 14 balancing authorities in the Pacific Northwest. BPA's balancing authority area includes primarily rural portions of Oregon and Washington, plus small portions of northern Idaho and northwest Montana.

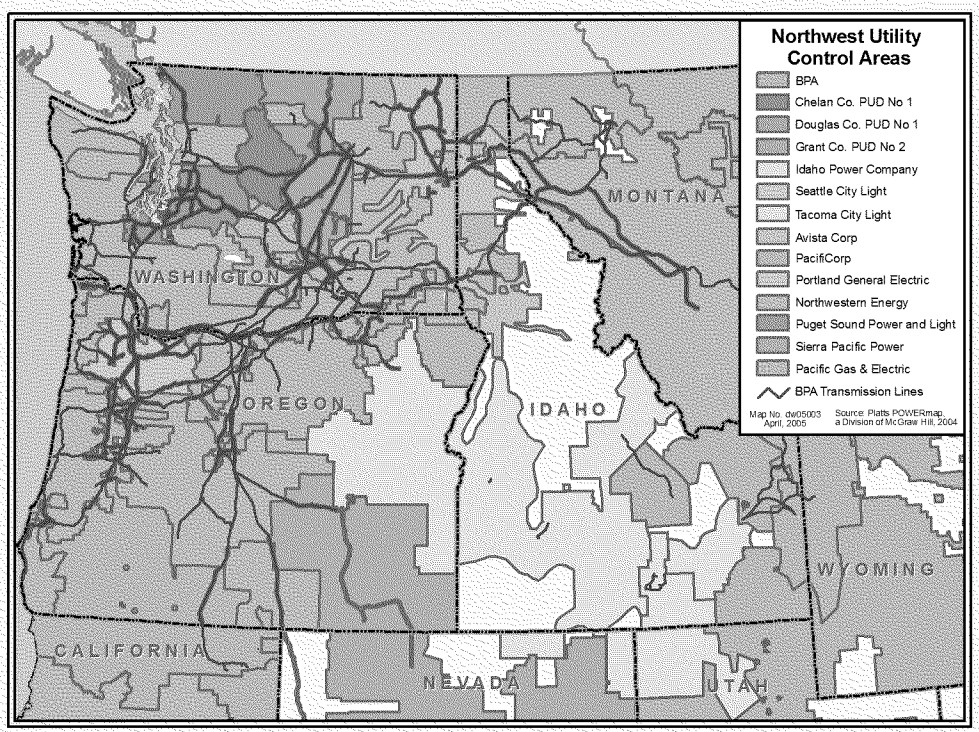
Balancing Reserves: Generation held available to be ready to use if needed to maintain the balance between power load and power generation as loads fluctuate and/or as real-time generation differs from scheduled generation.

Part of a much larger picture

Most of the Northwest's wind generation is in rural portions of eastern Oregon and Washington, while most consumers of wind power are in larger metropolitan areas in balancing authorities managed by other utilities. Worldwide, managing large wind fleets is proving most efficient when handled in unified systems that cover large geographic areas with millions of people and many, diverse power sources, such as in Spain and Texas.

Utilities in the Northwest are working together to realize similar benefits across their smaller balancing authorities. BPA is among many Western utilities participating in a Joint Initiative of ColumbiaGrid, WestConnect and the Northern Tier Transmission Group — entities managing and coordinating some transmission issues among utilities — to develop common approaches to wind integration. For example, the Joint Initiative is creating a common system for dynamically scheduling control of a wind generator from a resident balancing authority to another balancing authority where the wind power is being consumed.

On a still larger scale, utilities throughout the Western Interconnection — the interconnected power system of the Western United States, British Columbia, Alberta and small parts of Mexico — are working to redesign transmission and power resource planning and adapt the way the grid works to help meet state and national renewable power objectives. The Western Electricity Coordinating Council, the reliability organization for the Western Interconnection, is leading this effort.



BPA is the balancing authority responsible for maintaining a constant balance between the power load and power generation in the area shown in teal. (A balancing authority is also known as a control area.) Most of the wind power on line and planned for the Pacific Northwest is clustered in BPA's balancing authority at the eastern end of the Columbia River Gorge. However, 80 percent of the wind power in BPA's balancing authority area serves loads in other utilities' balancing authorities.

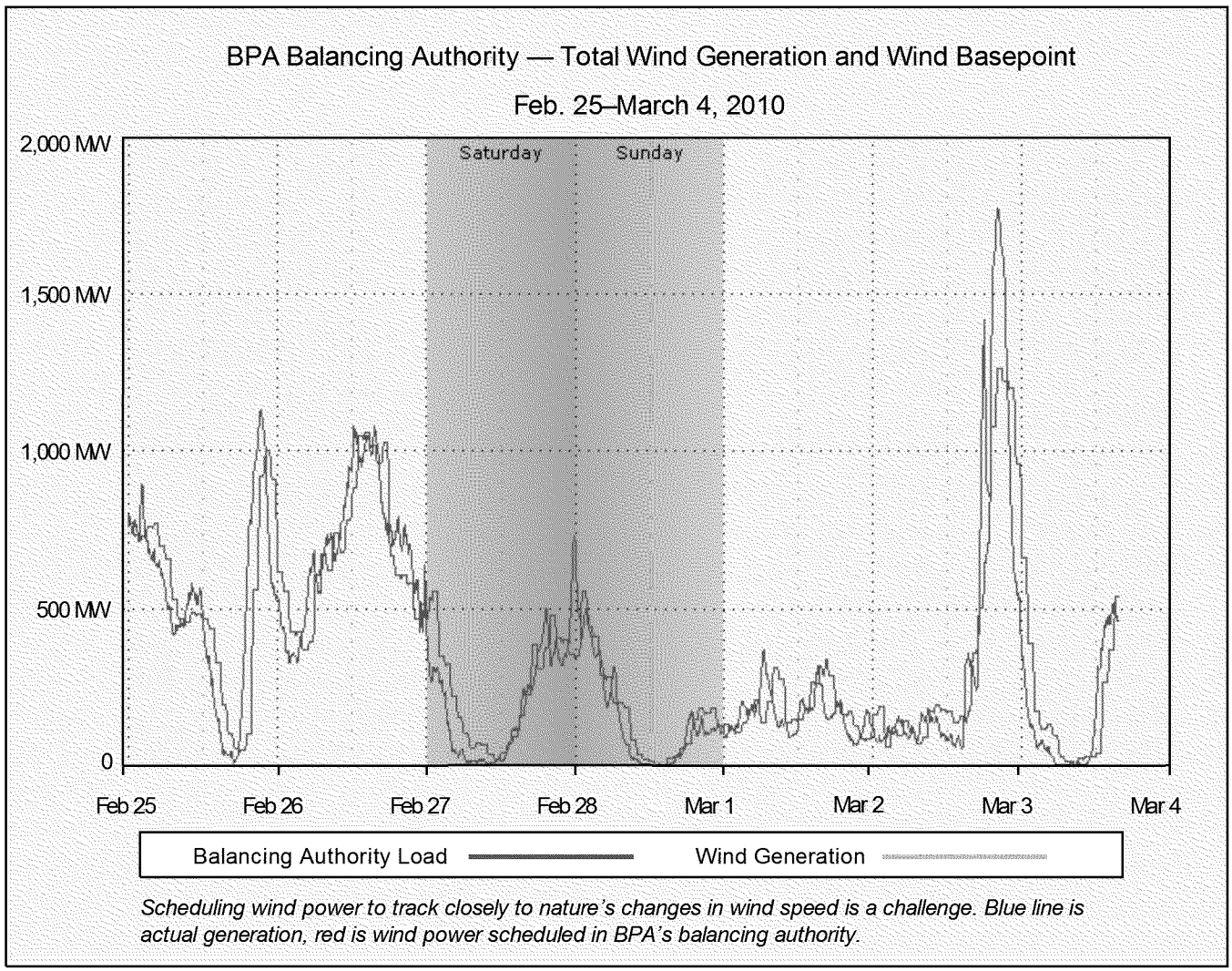
Energy storage technologies could be a valuable source of such flexibility to the degree they can absorb excess wind energy when it is not needed and return it to the grid during periods of greater demand. For example, BPA is working with the Pacific Northwest National Laboratory on its study of various options including pumped storage, compressed air storage, batteries and flywheels. PNNL is also examining residential applications such as hot water heaters as potential sources of energy storage for the grid.

BPA is working with the U.S. Army Corps of Engineers and the Bureau of Reclamation on the potential for pumped hydro storage in the Northwest. This represents a new application of an existing but evolving technology that could help fill the need for more frequent uses of ramping generation to respond to wind variability.

BPA has begun to explore options for adding flexibility capacity.

Follow our progress

To follow BPA's wind integration work or participate in its efforts, go to *www.bpa.gov/go/wind,* contact Eric King at *evking@bpa.gov* or call BPA at 1-800-622-4519.



Scheduling wind power to track closely to nature's changes in wind speed is a challenge. Blue line is actual generation, red is wind power scheduled in BPA's balancing authority.

BONNEVILLE POWER ADMINISTRATION
DOE/BP-4146 | MARCH 2010

ENERNOC OPENING TESTIMONY OF ANDREW HOFFMAN
JUNE 25, 2012

Footnote 13, at Page II-8

Bonneville Power Administration (BPA)

News Release: "Wind power on BPA system sets another new record"

March 22, 2012

Bonneville Power Administration

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Wind power on BPA system sets another new record

BPA's transmission lines continue to play vital role in developing wind power.

Wind turbines in the Bonneville Power Administration's transmission grid generated over 4,000 megawatts for the first time on Sunday, March 11, producing nearly twice as much energy as that generated by coal, gas and nuclear plants connected to BPA's system at that time.

Wind generation on BPA's system surpassed the 4,000 megawatt milestone at 3:22 p.m., reaching a new all-time peak of 4,039 megawatts about an hour and a half later. BPA expects to have 5,000 megawatts of this clean, emission-free, renewable resource connected to its system by 2013, several years ahead of earlier estimates.

The growth of wind power on BPA's grid continues to exceed expectations by adding almost 1,000 megawatts in just the last 12 months. That's more than almost any state in the country added last year. Because BPA owns and operates three-quarters of the Northwest's high voltage transmission, the agency continues to play a vital role in the extraordinary development of this renewable resource.

"We continue to collaborate with wind developers and others to interconnect and integrate wind," said Brian Silverstein, senior vice president for BPA Transmission Services. "This represents BPA's commitment to reliably and cost-effectively connect and balance a variable energy resource - one of the great engineering challenges of the 21st century."

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These efforts include expanding and reinforcing the agency's transmission system to support wind integration. Here are some examples:

- BPA recently completed a 79 mile long 500-kilovolt power line and is constructing another high voltage line. When the second is complete BPA will be able to offer approximately 3,000 megawatts of firm transmission service to wind facilities that have requested it.
- Like a freeway interchange BPA recently put into service another large substation to enable wind to get to the power grid. The Central Ferry Substation, located in Garfield County in southeast Washington, feeds energy from Puget Sound Energy's new Lower Snake River Wind Project into BPA's massive transmission system. The Snake River project is now providing 343 megawatts of clean, renewable power.
- BPA has developed a state of the art wind speed and wind generation forecasting system that forecasts up to three days in advance as opposed to the previous system that provided information only one hour ahead.
- BPA continues to expand a pilot program that allows customers to adjust schedules every 30 minutes. Traditionally, utilities schedule electricity generation on an hourly basis. But wind generation changes much more rapidly. This enables utilities and wind plant operators to save money by finding places to sell energy when they are producing more than they schedule. It also provides them the opportunity to find other resources to replace the energy if they are producing less than they have scheduled.

"Renewables such as wind are an important part of America's energy independence and an important part of the Northwest's energy future," said Silverstein. "We are proud of this accomplishment."

These investments have provided thousands of jobs in the region, many in rural communities that have suffered during this recession.