DRAFT-Regional Dialogue Implementation Framework:

The Slice/Block Product

FCRPS Resource Characteristics and Slice Delivery Limit Refinements

October 11, 2007

Intro / Background

- As of September 30, 2007, BPA and the Slice purchasers completed the 6th full year of Slice implementation, with 4 years remaining under the current contract. When the current 10-year term is complete, BPA will begin implementing a new, refined, long-term Slice product (beginning in 2011).
- One aspect of the product that needs refinement is the determination of Slice delivery limits, which is the focus of this presentation.
- Through processes that included review of the first 3 and ½ years of Slice implementation, subsequent public meetings during the fall of 2005, publication of BPA's Policy Proposal in July, 2006, and ultimately, the publication of BPA's Final Policy and ROD in July, 2007, a series of concepts have been developed to address current challenges related to Slice delivery limits (along with other aspects of the product).
- These concepts are summarized by the Policy statements included on the following slide.

Policy Statements

- BPA's Final Policy stated "BPA will develop and offer a Slice product that is similar to the original Slice product, but with a number of refinements".
  - Consistent with the original Slice product, the post-2011 Slice product will entitle purchasers to energy equal to a specific percentage of system output, net of system obligations, and will allow purchasers to change hourly delivery schedules up to 30-minutes prior to each hour, within established delivery limits that reflect operating flexibility.
  - One aspect of the term "refinements" is to develop Slice delivery limits that better reflect the variable operating characteristics and constraints of the Federal Columbia River Power System (FCRPS).
- BPA's Final Policy also established BPA would design the post-2011 Slice product based on the Alternative 2 concepts outlined in the Policy Proposal, published in July, 2006.
  - The Alternative 2 concepts were developed in response to concerns raised in BPA's review of the Slice product in 2005, and issues raised in meeting including BPA, Slice customer representatives, and non-Slice customer representatives in the fall and winter of 2005.
  - The expected outcome of applying the Alternative 2 concepts is that some post-2011 delivery limits will be more restrictive than the current delivery limits.

Objectives of this Presentation

- Provide examples of current challenges related to Slice delivery limits when compared to system operating characteristics.
- Provide an overview of the operating characteristics of the Federal Columbia River Power System (FCRPS) generating projects.
  - Special focus is applied to the 10 dispatchable hydro projects, which provide the operating flexibility accessible in real-time
- In relation to the FCRPS operating characteristics, describe in further detail additional ideas and thoughts underlying the Alternative 2 concepts that pertain to development of Slice delivery limits.
  - BPA believes these concepts and ideas would provide an improved approach to determining delivery limits, and that they would better reflect the operating characteristics of the FCRPS projects
  - ★ Note: These are being presented at the conceptual level. Before we go any further into developing detailed proposals, we want to hear your feedback.

Current Slice Delivery Limit Challenges

- System flexibility is variable, subject to changing operating constraints, characteristics, and conditions. However, some of the delivery limits developed under the current Slice product are fairly static and do not adequately reflect the changing nature of the hydro system.
  - The hourly ramp-up limit (max rate of change) for Slice is constant value, based on a historical determination of system maximum ramping capability. In order to ramp the system at this maximum rate, the BPA hydro scheduler must intentionally and purposefully configure the system such that it is possible, and once utilized the ramping capability the next hour is reduced.
  - The Slice hourly maximum generation is based on the sum of the individual projects' one to two-hour capabilities, as if each project is operated independently and can peak coincidentally. Since the hydro projects are hydraulically connected, the ability to operate each project at its maximum generation coincidentally is rarely possible.
  - The Slice hourly minimum reflects the theoretical minimum generation requirements as if each project can be reduced to its minimum allowable generation coincidentally. This is also not attainable most of the time.

Current Slice Delivery Limit Challenges

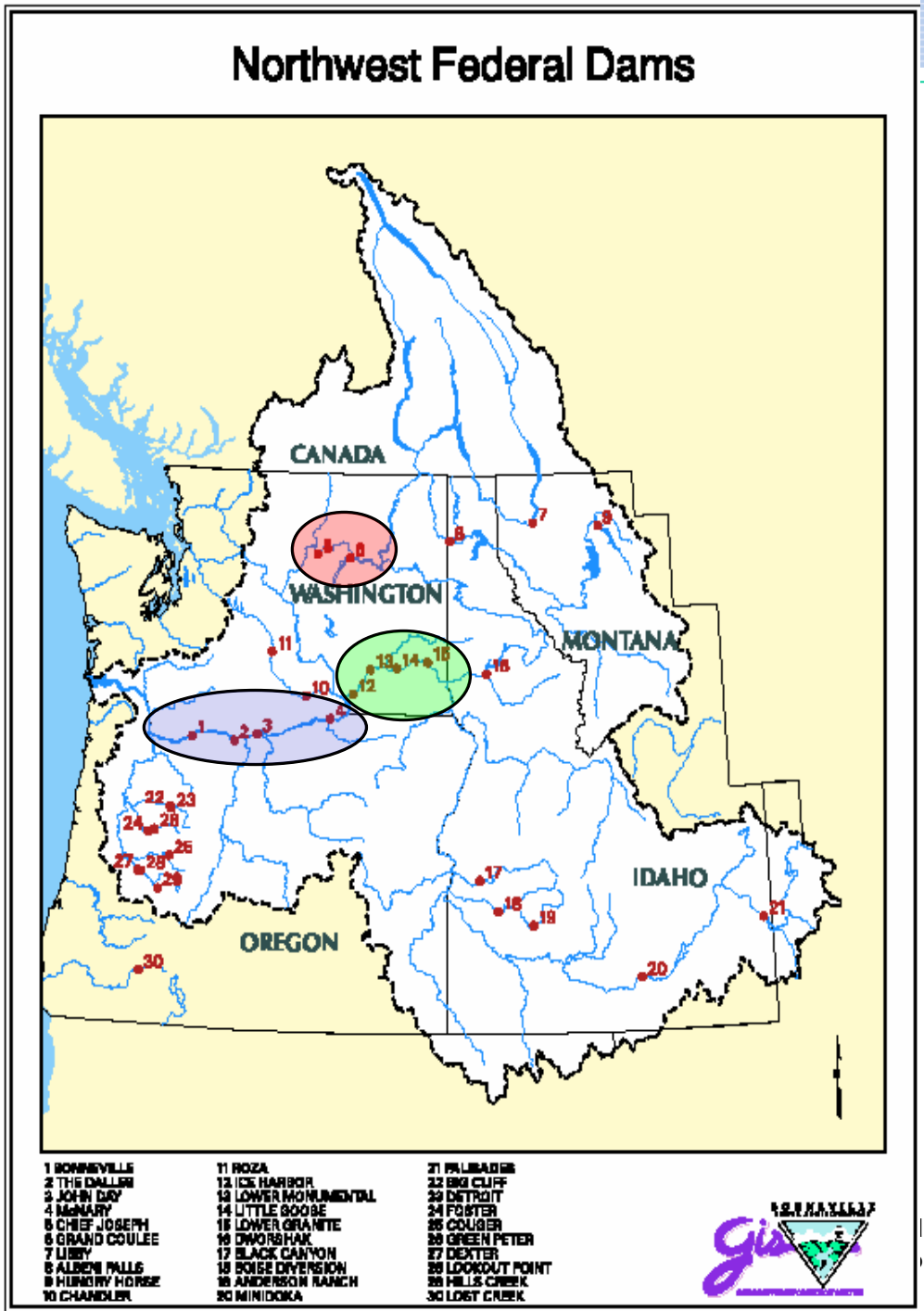
- Certain system operating characteristics are not adequately reflected in Slice delivery limits or scheduling parameters.
  - The hydraulic link between Grand Coulee releases and lower Columbia inflows (water released from Grand Coulee reaches the lower Columbia about a day later). If Coulee is actually operated near its maximum discharge on a given day, the next day the lower Columbia inflow will be high. Failing to reflect this characteristic allows Slice customers to schedule maximum system energy one day and minimum system energy the next day.
  - The impacts from the non-federal operation of the mid-Columbia projects on the lower Columbia operation (they impound or release water released from Grand Coulee, thus reducing or increasing lower Columbia inflow). If the Mid-C parties impound a large quantity of Coulee water, the lower Columbia inflow (and output) will be less than the amount assumed in the daily minimum generation.

Current Slice Delivery Limit Challenges

- Processes and procedures currently in place to effect changes to Slice delivery limits are manual and labor-intensive, which leads to an inability to effectively revise or change limits as conditions change.
  - If system constraints or conditions change during real-time, the PS hydro scheduler, in addition to determining prudent river operations, must immediately inform the PS Slice scheduler of the change. The PS Slice scheduler must in turn determine the extent to which the change should affect Slice delivery limits. Once this analysis is complete, the PS Slice scheduler must open the Slice computer application, page down to the appropriate detail level, manually insert the appropriate change, save and close the document, then re-submit the information to the customers. This process is too cumbersome to be effective.
- The BPA hydro scheduler is responsible for guiding the operation of the FCRPS projects within their variable operating limits and parameters. In order to provide similar conditions for Slice customers, Slice delivery limits should change frequently, as operational conditions and constraints change.

FCRPS Resource Characteristics

- The FCRPS generating system consists of 30 hydro projects, one nuclear project, and several miscellaneous projects, such as wind and solar.
- The generating levels at 20 of the hydro projects (and all other projects) are established one or more days ahead of time. These projects are characterized as "non-dispatchable" projects.
  - The significant projects included in this category are CGS (nuclear), Libby, Dworshak, Hungry Horse, the Willamettes, and the south Idaho (upper Snake) hydro projects.
  - The operating flexibility accessible at these projects is incorporated into the pre-determined generation schedules.
  - Slice customers receive energy each hour equal to a specific percentage of the scheduled non-dispatchable project output.
- The generating levels at the ten remaining hydro projects are established and adjusted on real-time, subject to the limitations and requirements of all applicable operating constraints. These projects are characterized as "dispatchable" projects.
  - The operating flexibility available to Slice customers from these projects is defined by various minimum and maximum delivery limits.
  - Slice customers receive energy equal to a specific percentage of the dispatchable project output over time, but have flexibility to schedule this energy within their specific percentage of the established delivery limits.



- The dispatchable projects consist of:
- the 4 lower Columbia Projects (#1-4),
- the 4 lower Snake projects (#12-15),
- Chief Joseph (#5), and Grand Coulee (#6)
- There are numerous non-federal projects not shown on this map that are intertwined within the federal projects and impact their operations.

Operating Constraints and Delivery Limits

- The FCRPS generating projects are subject to numerous operating limitations, referred to as operating constraints.
- Operating constraints come in the form of power constraints and non-power constraints.
- Power constraints are related to project limitations, such as the number and size of generators, forebay operating ranges, and hourly rate of change (discharge) limits.
- Non-power constraints are related to non-power uses, such as navigation, flood control, recreation, and fish requirements.
- Slice will provide flexibility through rights to change hourly schedules up to 30 minutes prior to the start of each hour within defined Slice delivery limits.
- Slice delivery limits will reflect FCRPS operating flexibility bounded by operating constraints and prudent operating practices, as determined by BPA.

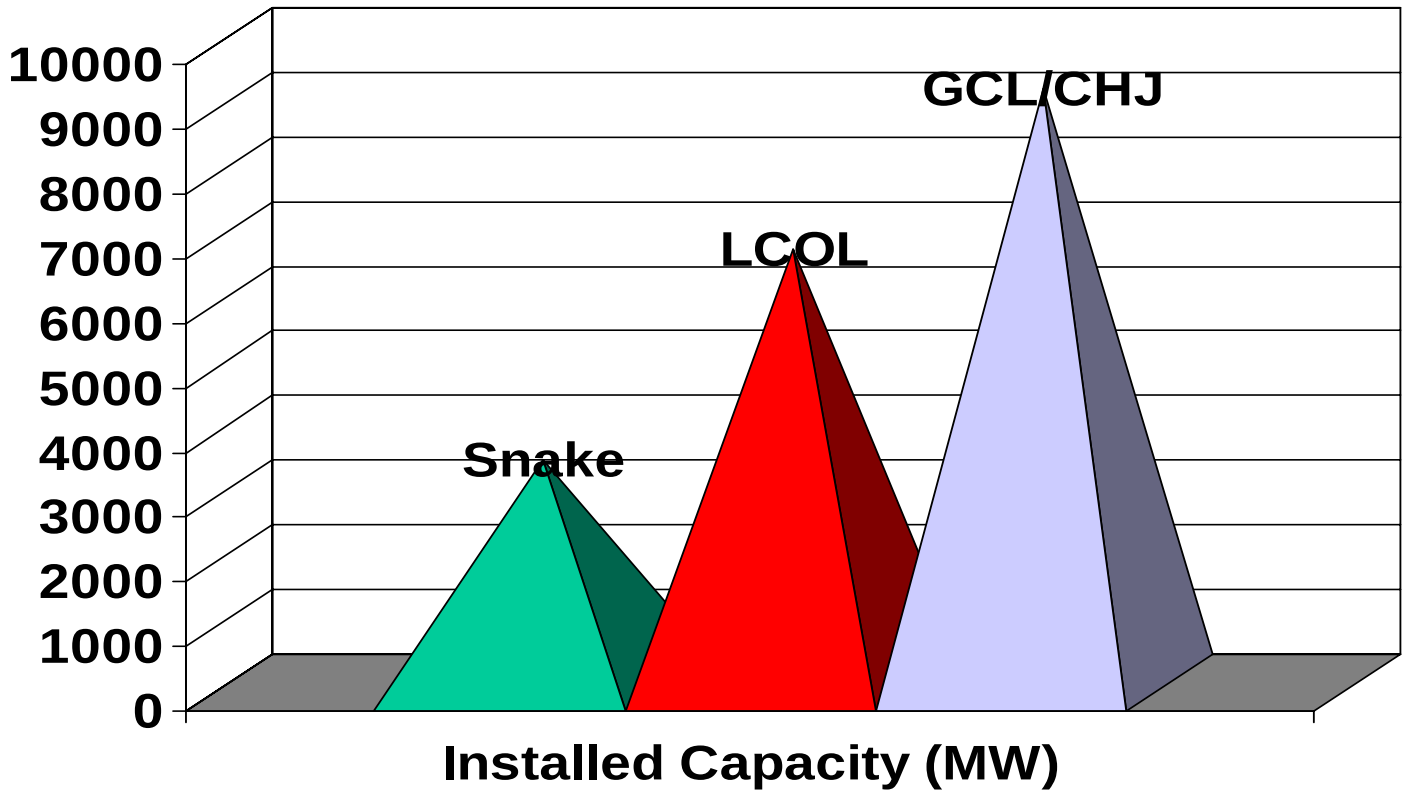
Current Slice Delivery Limits

- The current Slice deliveries (schedules) are bounded by a series of limits, which reflect the types of limitations that exist on the system.
  - Hourly Max Generation (The most Slice energy that can be scheduled for a given hour)
  - Hourly Min Generation (The least Slice energy that can be scheduled for a given hour)
  - HLH Max Generation (The most Slice energy that can be scheduled during HLH - volume)
  - LLH Min Generation (The amount of Slice energy that should be scheduled during LLH in order to minimize the risk of elective spill - volume)
  - Daily Max Generation (The most Slice energy that can be scheduled over a given day)
  - Daily Min Generation (The least Slice energy that can be scheduled over a given day)
  - Max Ramp Rate Up (The largest increase in Slice schedules from one hour to the next)
  - 1-HR Ramp Rate Down (The largest decrease in Slice schedules from one hour to the next)
  - 2-Hr Ramp Rate Down (The largest decrease in Slice schedules across two hours)
  - Pondage Up (The most energy that can be scheduled in excess of Daily Max)
  - Pondage Down (The most energy that can be scheduled below Daily Min)
  - Upper Storage Bound (The most Slice storage a customer can accumulate)
  - Lower Storage Bound (The most Slice draft a customer can utilize)
- PS expects to develop very similar types of limits for the post-2011 contract.

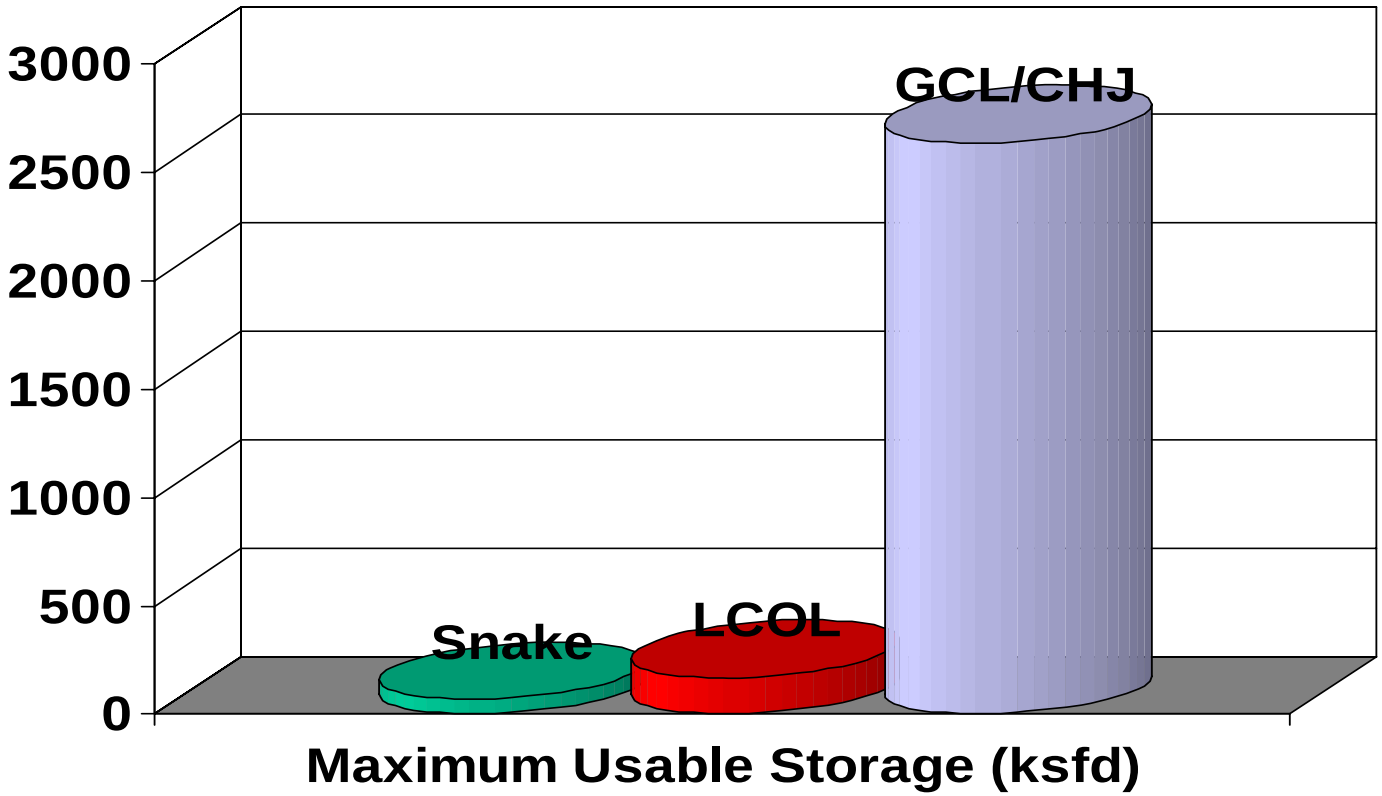
Dispatchable Project Flexibility

- Of the ten dispatchable projects, nine are run-of-river projects with limited, short-term storage capability. The remaining project (Grand Coulee) is a large reservoir with significant storage capability. Access to Coulee's storage varies throughout the year due to operating constraints (fish and flood control).
- The four lower Snake run-of-river projects are subject to numerous operating constraints, are close in proximity to one another, and have little storage capability (small ponds). These projects provide limited operating flexibility (extremely limited during the fish season, April - August).
- The four lower Columbia run-of-river projects are also subject to numerous operating constraints and are close in proximity to one another, but have more storage capability than the Snakes. These projects provide more operating flexibility than the Snakes (also are more constrained during fish season).
- The storage reservoir (Grand Coulee) and its re-regulating project (Chief Joseph) are generally subject to fewer operating constraints. These projects typically provide significant amounts of operating flexibility.
- The following graphs illustrate relative capabilities of Coulee/Chief (GCL/CHJ), the lower Columbia (LCOL), and the Snake complexes.

Dispatchable Project Capacity



Dispatchable Project Storage



Snake and Lower Columbia Focus

- A significant focus for delivery limit refinements will be placed on the Snake and lower Columbia projects. This is especially important for these projects because of their limited operating flexibility given they are subject to numerous operating constraints, many of which appear in real-time. The goal is to establish delivery limits that more accurately reflect their operational capabilities and limitations, and that the delivery limits not be static, but change as conditions change.
- The next 3 slides provide examples of BPA hydro scheduler log notes that demonstrate the types of issues that impact (limit) operations at the Snake and lower Columbia projects.

Examples of Constraints Encountered in Real-time

JDA - Apr 25,2007 13:15

Project held at MXGN provided by operator. [1470 MW ~ 9 units @ 152 MW & 1 unit @ 110 MW]. Based on project staff interpretation of Mar 2007 FPP (Page JDA-17, Section 2.5.1.2 d.3.).

- The John Day operator established maximum generation at 1470 MW based on his staff's interpretation of the Fish Passage Plan. Though BPA manages the overall operation of the dispatchable projects through generation requests, the project operators have final say over the operation of their individual projects.

System Condition - Apr 30,2007 23:50

Had a drop of over 1800MW for HE1. With the need to have room for JDA for HLH and LWG inflow around 80 kcfs I couldn't make the drops. Had to ask Marketer to sell below trigger thru HE5.

- John Day may have been "capable" of reducing further, but doing so would have jeopardized the HLH operation on the following day. This is where professional judgment plays a role in establishing prudent project operating limits, given varying conditions.

Examples of Constraints Encountered in Real-time

MCN Spill - May 03,2007 16:17

Project generation reduced to 610 MW to facilitate line switching. Temporary increase in spill % prior to operator manual adjustment.

- Example of how a non-power constraint (transmission outage) can impact generating limits and spill implementation on real-time.

IHR - May 03,2007 20:23

Had to shut a unit down for a bit due to overheating so the spill will be above 30% for HE 20 and possibly HE 21. The operator expects the unit will be back within a couple of hours. LMN is full, so it can't be reduced. LWG is empty and I'm beginning to reduce there and at LGS. If the IHR unit ends up forced out longer the spill amount will need to be increased. IHR MXGN without it is only 400 MW and at 30% spill that's only a little over 80 kcfs QO.

- IHR is the project farthest downriver on the Snake. It also has the smallest hydraulic capacity of the 4 projects. This note is a good example of the issues the BPA hydro scheduler deals with while operating the 4 Snakes as a system of hydraulically-connected projects.

Example of a Special Operation

Sep 28,2007 08:52 CBTN

ATTN: BONNEVILLE AND BPA

SUBJECT: BONNEVILLE FOREBAY OPERATION FOR TREATY GILL NET FISHING

1. REQUEST THAT BONNEVILLE POOL BE OPERATED AS FOLLOWS:

HARD CONSTRAINT: ELEV 75.0 - 76.5 FEET

SOFT CONSTRAINT: ELEV 75.5 - 76.5 FEET

EFFECTIVE: 0600 HRS WED, 3 OCT - 1800 HRS SAT, 6 OCT 2007

2. THE GOAL OF THIS OPERATION IS TO LIMIT WEAR AND TEAR ON GILL NET EQUIPMENT BY HOLDING THE POOL AS STEADY AS POSSIBLE.

- Instead of the normal 5-foot BON operating range, only 1.5 feet are available.
- In order to maintain a steady pool at BON, the TDA and BON discharges need to be roughly in sync. Since TDA has very limited storage capability, JDA's discharge must also be roughly in sync with TDA, thus this single operation limits the flexibility at three plants (and possibly MCN).
- Special operations like this are common for the Snake and LCOL projects.

Snake and LCOL Operational Summary

- The Snake and LCOL projects are affected by numerous operating constraints which often come and go, or change, in real-time, and restrict access to their operating flexibility.
- Access to their operating flexibility is further restricted by their operating characteristics, including their limited storage capability, their close proximity to one another, and the fact that they are operated as a system of hydraulically-connected projects, not independent projects.
- ☆ In order to accurately represent the limited operating flexibility accessible at these projects, the associated Slice delivery limits should reflect amounts very similar to their expected generating levels.
  - ☆ The expected generating levels would naturally reflect the impact of all operating constraints, characteristics, and conditions that apply to these projects.

Coulee and Chief Operational Summary

- Grand Coulee and Chief Joseph are typically subject to fewer operating constraints than the Snake and lower Columbia projects.
  - This is especially true for Grand Coulee
  - No fish spill, no 1% peak efficiency limits, no MOP operations, very few special operations (forebay / tailwater)
- This allows access to a significant portion of their operating flexibility.
- Operationally, BPA tends to use Coulee as the system flex project. In other words, if the market heats up, or loads are greater than expected, BPA will increase Coulee's output.
- The delivery limits for Coulee/Chief should be established such that Slice customers can utilize this flexibility in the same manner.
  - Note, there are times when Coulee is constrained, such as during March/April when the project is typically drafting heavily for flood control.

Post-2011 Slice Product Concepts

- The remaining slides describe the Alternative 2 concepts that are related to Slice delivery limits, as outlined within BPA's Policy Proposal, with additional detail explaining each concept and examples of further developed proposals and ideas, where applicable.
- Text within quotations represents text from the Policy proposal (they appear in the same order as the Policy proposal).
- Text in bullet format represents BPA's additional comments.

Alternative 2 Concepts

"Slice delivery limits would be defined by sustainable energy over a specified time period"

- This statement basically means that hourly delivery limits should not reflect available capacity, but capacity that can be supported with energy.
- Capacity is the amount of power that can be produced at a given instant in time.
- Sustainable energy is the amount of power that can be produced continually over an interval of time.
- For example, John Day (JDA) has 16 generators rated at 155 MW Each. Total capacity at John Day, therefore, is 2480 MW (16 * 155).
- JDA's h/k (MW per kcfs of discharge) is roughly 7.5, so in order to produce 2480 MW the project must discharge about 330 kcfs (2480 / 7.5).
- The length of time 330 kcfs discharge can be sustained depends upon many factors:
  - JDA's inflow (McNary's discharge)
  - The amount of water stored in JDA (the forebay operating range varies by season)
  - The storage space, discharge capability, and other operating constraints in effect at downstream projects (The Dalles and Bonneville)
  - Other operational constraints at JDA, such as, hourly rate of change limits, special forebay operations, tailwater restrictions, fish spill, and 1% peak efficiency requirements.

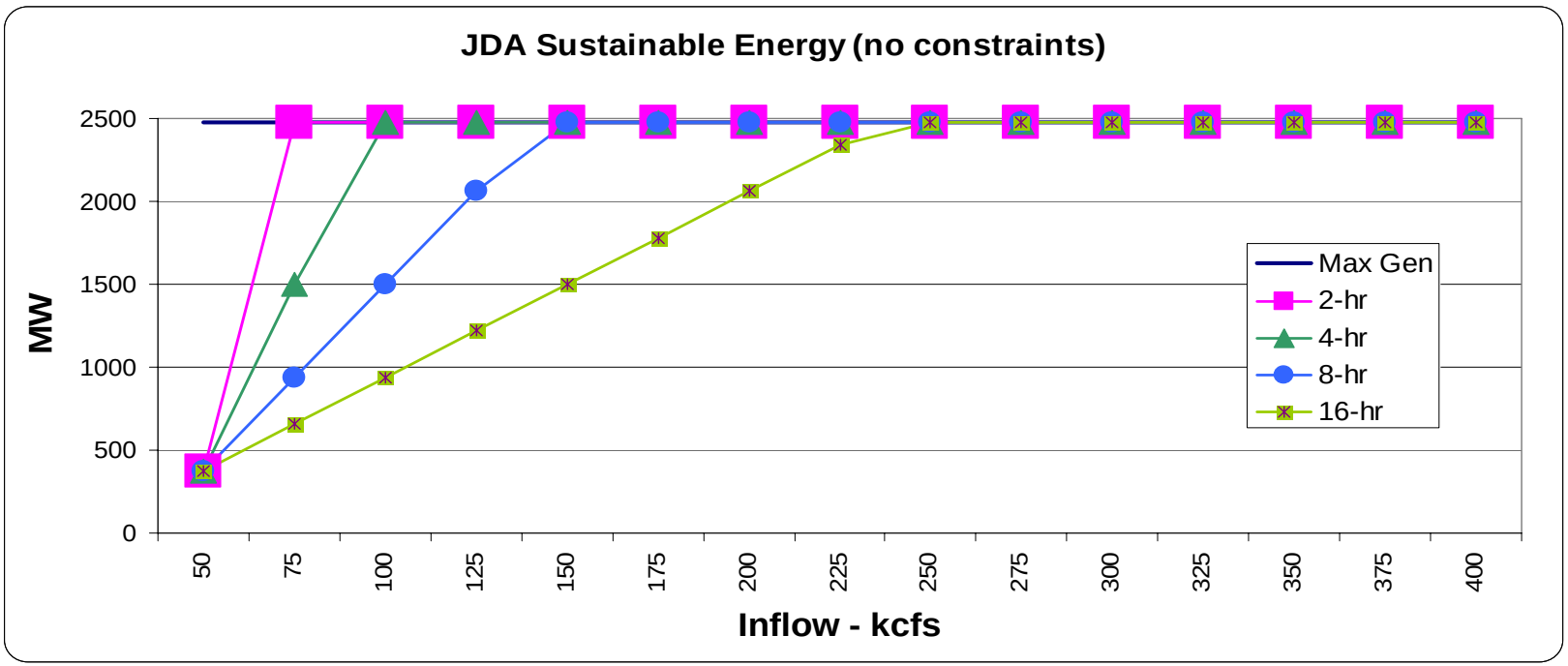
JDA Sustainable Energy Example

- Assume JDA's pool is full, the inflow is 150 kcfs, and it is the only project on the lower Columbia. With no other operational constraints, a 330 kcfs discharge could be maintained 4 to 5 hours, then the project would be empty.
- Each additional operating constraint that applies to JDA reduces its sustainable capability (either the MW amount or the duration).
- Operating constraints in affect at other lower Columbia projects also impact the JDA capability (MCN, TDA and BON have a lower discharge capability and smaller ponds than JDA).

☆ A specific proposal detailing how sustainable energy would be incorporated into Slice delivery limits has not been developed. One idea would be to develop a series of volume limits, such as 2-hour, 4-hour, 8-hour, and so forth, based on sustainable energy.

Sustainable Energy

The graph below illustrates, for different inflow levels, how sustainable energy decreases as the time interval increases.



Alternative 2 Concepts

"Slice energy would be scheduled in full hourly increments"

"The Slice product would not include within-hour load following, dynamic scheduling or ancillary services. Generating capacity and energy provided from the FCRPS to TBL for Interconnected Operating Services would come "off the top," and revenues BPA Power receives from BPA Transmission for those generation inputs would be shared in proportion to the customers' Slice share"

- Slice will not be designed as a load-following product, or a transfer of federal resource control to Slice purchasers.
  - Slice will be designed to meet a customer's annual net requirements load based on critical water conditions, and to offer system flexibility through hourly schedule change rights, within established hourly delivery limits.
  - Dynamic scheduling and self-supply of ancillary services (using federal resources) will not be available under the Slice product.

Off-the-Top Obligations

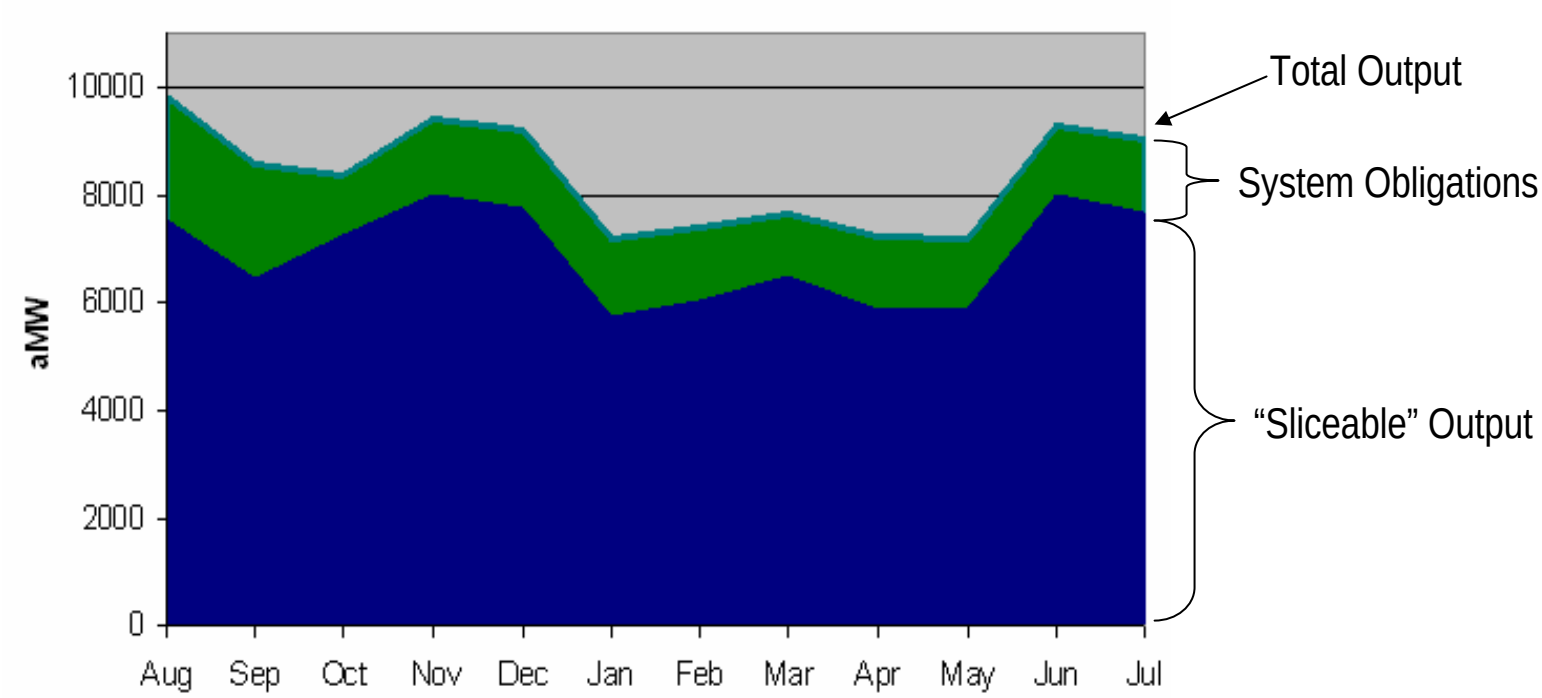
"Off-the-top obligations would reduce the amount of FCRPS output provided from the Slice system (a defined set of Federal resources) and include system obligations similar to those defined in the existing Slice contract such as fish obligations, Canadian Entitlement, plus other obligations such as those that pertain to regional reliability, regional requirements and prudent system operation"

- System obligations are currently defined as obligations imposed on BPA by statutes, treaties, or contracts that support FCRPS operations.
- System obligations are applied equally to Slice customers and PS on behalf of non-Slice customers.

★ Note: Off-the-top obligations can either reduce maximum generating capability, or increase minimum generation requirements.

System Obligations

This graph illustrates the concept of system obligations that come off-the-top before FCRPS output is “Sliced”:



Off-the-Top Obligations

"Examples of other obligations may include system capability needed for wind integration, system optimization, generation redispatch and operational uncertainty"

★ Note: This is not an exhaustive list of potential "other obligations".

- System capability needed for wind integration will be included in the IOS services PS provides to TS, which is defined as a system obligation.
- Redispatch procedures are yet to be developed, but their impact would be shared proportionally with Slice customers.

"Prudent system operation includes additional capacity buffers deemed necessary based on the professional judgment of BPA hydro duty schedulers. Off-the-top obligations related to operational uncertainly and prudent system operations (buffers) do not have direct costs or revenues and would be applied proportionally to Slice and non-Slice customers"

- The uncertainty buffer concept is described on the following slide.

Operational Uncertainty Buffer

- Operational uncertainty results from the unpredictable nature of loads (load following customers), contract change rights (PAC Peaking, Slice), stream flows, weather, Federal resources, or non-federal resources that impact the FCRPS.
  - BPA currently limits its marketing activities as a method to manage this uncertainty.
  - BPA's products must be designed in a way that allows BPA to manage this uncertainty in a prudent manner and share the impact with all customers.
- The idea behind an operational "buffer" is to quantify and reflect instances when operational uncertainty leads to restricted operating flexibility, so the impacts can be applied proportionally to Slice customers through Slice delivery limits.
  - BPA does not intend to use this buffer to favor Slice or PS marketing
  - BPA will track and log applications of the buffer
  - Judgment of the BPA hydro scheduler will be considered a Federal Operating Decision
- Operational uncertainty can come "off-the-top", where resource capability is set-aside in case loads increase or intermittent resource output decreases unexpectedly.
- Operational uncertainty can be placed "on-the-bottom", where resource output is increased (above minimum levels) in case loads decrease or intermittent resource output increases unexpectedly.

Off-the-Top Obligations

"BPA Power revenues resulting directly from off-the-top obligations would be shared proportionally with Slice customers"

"The amount, value and distribution of any revenue or credit provided to Slice and non-Slice customers for Integrated Operating Services (IOS) provided to BPA's FERC-regulated transmission services function is a matter of rate design and cost recovery and would be established in BPA rate proceedings"

- These off-the-top concepts are currently applied to Slice, but will be expanded to recognize that BPA sometimes sets aside additional system capability needed for prudent system operations, based on the professional judgment and expertise of the BPA hydro scheduler.

Simplified / Improved Product

"Provisions that determine Slice delivery limits would be developed in a manner that enables simplified and improved implementation of the Slice product while maintaining the allocation of energy and hourly scheduling flexibility concept, consistent with principle #3."

- "Slice purchasers bear an allocation of FCRPS costs and risks and receive a commensurate amount of applicable FCRPS resource energy, hourly scheduling flexibility, and specific BPA power revenues"

- Implementation of the current Slice product is cumbersome and involves significant manual processes. Also, there are provisions that require inordinate process time and accounting efforts given the apparent value to the customers (some provisions are rarely, if ever used). Streamlining or automating processes would improve and simplify implementation of the product.
- The allocation of energy and hourly scheduling flexibility concepts are fundamental to Slice and will be maintained in the future Slice product.

Unused Provisions and Schedule Changes

"Eliminate Slice delivery provisions that have seen little or no use over the first 5 years of Slice implementation":

- This concept relates to provisions of the Technical Operating Procedures (TOP - Exhibit J). BPA intends to use the existing TOP document as a starting point for revision, rather than starting from scratch. One aspect of revising the TOP will involve identifying and removing such provisions.

"Timing of real-time change rights would be based on the then-current BPA Power scheduling practices":

- Changes to hourly Slice schedules are entirely at the discretion of the Slice customer (as long as they are within delivery limits) until 30-minutes prior to the start of each hour.
  - If BPA Power scheduling practices change, BPA will work with the Slice customers to develop hourly Slice schedule change procedures that are consistent with the revised scheduling practices.

Slice Delivery Limits (Coulee/Chief)

"Recognizing that a majority of system storage and shaping flexibility exists at the Grand Coulee/Chief Joseph storage complex, PBL would develop detailed Slice delivery limits that emulate that flexibility":

- As described in previous slides and graphics, a significant amount of the "dispatchable" operating flexibility typically exists at these two projects.
- BPA's idea is to determine detailed delivery limits for the Coulee/Chief complex separately from the Rest of System (ROS) limits and have Slice customers schedule this energy separately from ROS energy.
  - Slice customer schedules would not directly feed into BPA's determination of generation requests for specific projects. The Coulee/Chief and ROS concepts apply only to the development of Slice delivery limits.

Slice Delivery Limits (Coulee/Chief)

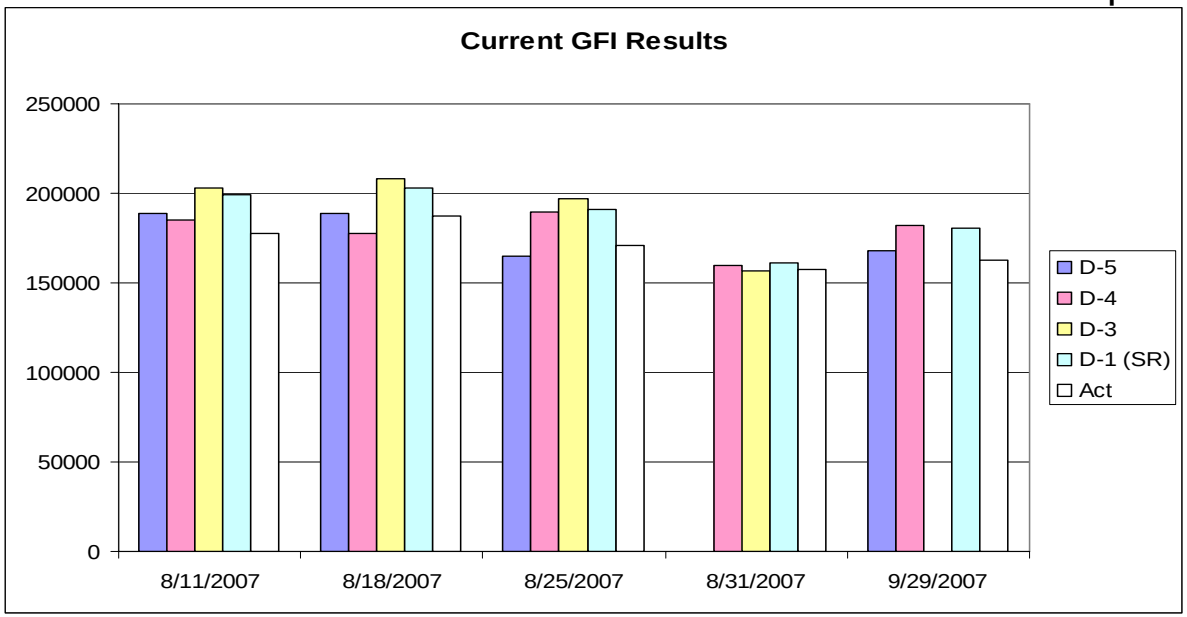
- BPA would develop a model or simulator for the purpose of determining detailed delivery limits for Coulee/Chief.
  - The model would calculate hourly Mins and Maxs, ramp limits, LLH minimums, and possibly other limits.
  - BPA is currently assessing how such a model might be designed
- Additional studies would be performed to determine daily Min and Max limits, based on overall minimum and maximum system constraints that apply at the time (similar to today).
- At times when the min or max system constraint is a flow constraint at a lower Columbia project, and flexibility exists to draft or fill lower Columbia projects to meet that constraint, customers would be allowed to flex their Coulee/Chief schedules (Coulee Chief Flex account) outside of the Min or Max daily quantities (similar to the current Pondage concept).
  - This would likely be based on a moderate lower Columbia storage quantity.

Slice Delivery Limits (Coulee/Chief)

Scheduling Coulee/Chief energy separately would allow potential application of:

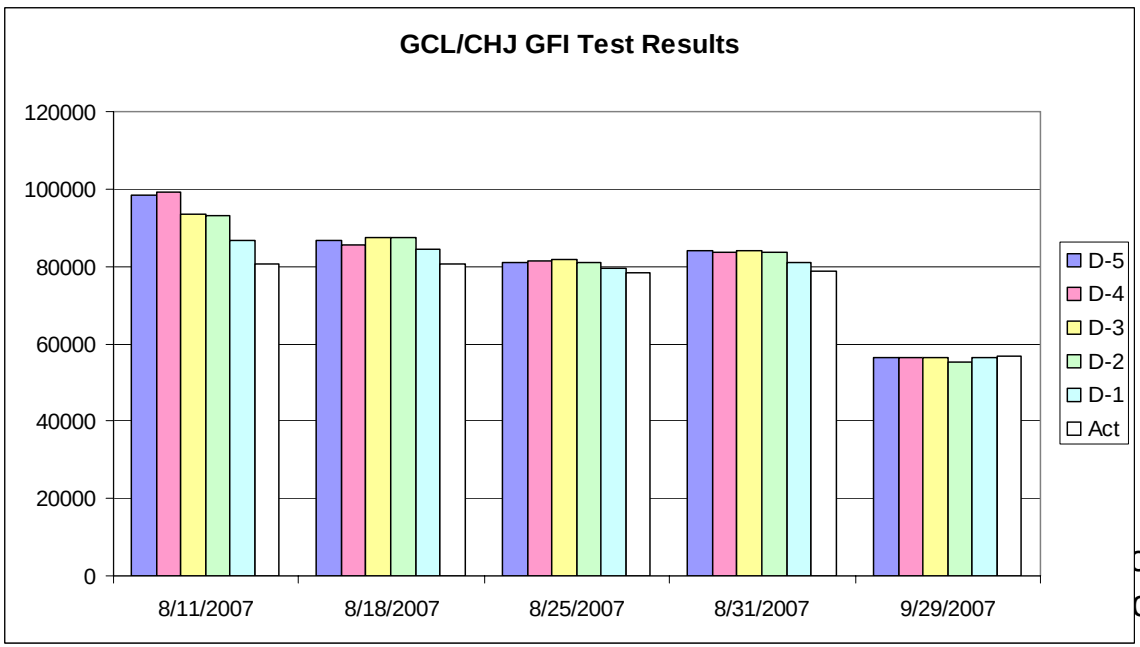
- Accurate reflection of the various operational constraints within delivery limits
- The rolling 24-hour Coulee draft limit
- Within-day storage bounds
- A Coulee/Chief Generation From Inflow (GFI) based solely on Coulee inflow and the Coulee/Chief h/k (test results on next slide)
- A Coulee/Chief storage bound based solely on Coulee storage space and the Coulee/Chief h/k
- The hydraulic link between Coulee/Chief and the lower Columbia complex (one-day lag)
- Spill deration thresholds (Coulee/Chief discharges that result in spill at downstream projects)
- A simple application of Coulee/Chief Flex (simplified Pondage)

Current and GCL/CHJ GFI Comparison



This graph displays a trend in the current GFI calculation across a series of days (day -5 to day 0).

Notice the volatility in the value over time under the current methodology.



This graph displays a trend in the GCL/CHJ GFI calculation over the same series of days (and for the same subject days).

Notice the reduced volatility or improved trends for each day that was tested based on the proposed approach.

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Coulee/Chief Limits

The following delivery limits would be established for scheduling of Coulee/Chief complex energy:

	Maximum	Minimum
Hourly	X	X
Daily	X	X
LLH Period		X
HLH Period	X	
Hourly Ramp Up	X	
Hourly Ramp Down	X	
Storage Bounds	X	X
Daily Flex	Maybe	
Cumulative Flex	X	

Rest of System Delivery Limit Concepts

"Recognizing that there is much less storage and shaping flexibility at the Snake and lower Columbia run-of-river complexes, BPA's Power Business Line (PBL) would develop simplified delivery limits that emulate that flexibility":

- As described in previous slides and graphics, operational flexibility accessible at these projects is heavily constrained and limited.
- BPA's idea for simplified delivery limits for the Snake and LCOL is to incorporate their forecasted operation into the Rest of System (ROS) delivery limits (further explanation on next couple slides).
  - ROS would reflect the expected or scheduled generation for all Slice projects, except Coulee/Chief, as adjusted for System Obligations

Rest of System Delivery Limit Concepts

- Customers would receive their % share of forecasted ROS energy output with an ability to increase or decrease within defined limits (ROS Flex).
  - The planned operation of the Snake and LCOL projects would reflect the use of flexibility, but recognizing there is an ability to vary that flexibility, and recognizing there may be additional flexibility, a ROS Flex concept would be established (replaces Pondage).
  - The simplest ROS Flex concept would be to determine a constant value by which customers can adjust the expected ROS value up or down.
- Determine a Max cumulative flex amount
  - The amount of ROS Flex a customer can accumulate would be limited, and would likely be based on a moderate LCOL storage quantity.
- ROS ramping ability could simply be based on the delta between hourly ROS Min and Max limits, as adjusted for hourly flex, and may be limited to a specified quantity, or a percentage of the delta.

Additional ROS Concepts

- Expected ROS values would be updated at regular intervals to capture changing operational conditions and to minimize deviations.
  - Customers will need to comply with updated delivery limits
- Deviations between forecast and actual ROS output could:
  - Affect ROS flex account balances
  - Affect GCL/CHJ storage account balances
- These ROS concepts would allow for application of the following:
  - ROS limits will reflect the impact of all operational constraints and operating characteristics of all ROS projects
  - Impacts to the lower Columbia output from Mid-Columbia draft or fill is applied equally to PS and Slice customers
  - Customer-specific allocation of ROS energy on a given day would be based on customer-specific Coulee/Chief energy scheduled the previous day
  - Development and application of a simple Flex concept (Pondage)
  - Simple ramp-rate calculations
  - Simpler and improved GFI calculation (GCL/CHJ only)

Proposed ROS Limits

The following delivery limits would be established for scheduling of Rest of System energy:

	Maximum	Minimum
Hourly	X	X
Ramp Up	X	
Ramp Down	X	
Hourly ROS Flex	X	
Daily ROS Flex	Maybe	
Cumulative ROS Flex	X	

Hydraulic Link Concept

"PBL would establish Slice delivery limits that consider the hydraulic link that exists between the Coulee/Chief storage complex operation and the lower Columbia run-of-river complex operation":

- There is approximately a one-day hydraulic lag between Coulee/Chief and the lower Columbia, such that water released from Chief on a given day affects the lower Columbia inflow the following day. This characteristic will be incorporated into the Slice scheduling parameters.
- The idea is to adjust each Slice customer's allotment of day-total ROS energy on a given day based on their day-total schedule of GCL/CHJ energy from the previous day (the more GCL/CHJ energy scheduled one day, the more ROS energy allotted the next day).
  - An impact of incorporating the hydraulic link concept is a reduced ability to move from day-total Min and Max energy from one day to the next (see slide 45).

Hydraulic Link Example

- Today the Coulee/Chief actual generation was 70,000 MWh, and the Coulee/Chief discharge was 78.8 ksfd (total generation divided by the Coulee/Chief combined h/k).
- A 5% Slice customer scheduled 4,000 MWh of Coulee/Chief energy, which is 500 MWh above their 3,500 MWh allotment (5% of the 70,000 MWh).
- 500 MWh, divided by 37 (Coulee/Chief combined h/k), suggests this customer discharged (theoretically) an additional +13.514 ksfh of water from Coulee/Chief.
- Tomorrow, this extra water will run through the LCOL projects (theoretically), so the customer's base ROS energy allotment (5% of the expected ROS amount) will be adjusted by +13.514 ksfh * 24 (the LCOL effective h/k), or 324 MWh.
- This daily adjustment could be allocated evenly across all hours of the day.
- Use of ROS Flex would be relative to the adjusted ROS values.

Hydraulic Link Justification

- If BPA chooses to discharge a large quantity of water from Coulee on Oct 4, BPA must consider the impacts to October 5 in terms of a large lower Columbia inflow and generation level. If BPA chooses to reduce system generation on Oct 5, that day's lower Columbia inflow cannot be reduced, because of the one-day lag (the water's on it's way).
- Under current implementation, where Max Daily and Min Daily delivery limits reflect the entire system operating to the Min or Max flow requirement, Slice customers can choose to schedule Daily Max on one given day, then choose to schedule Daily Min on the next day. This is not possible in actual operations.
- As the next slide indicates, application of the hydraulic link concept will reduce the rate at which a Slice customer can adjust their day-total schedules between the Min Daily and Max Daily quantities.

Hydraulic Link Impact – Low to High Scheduling

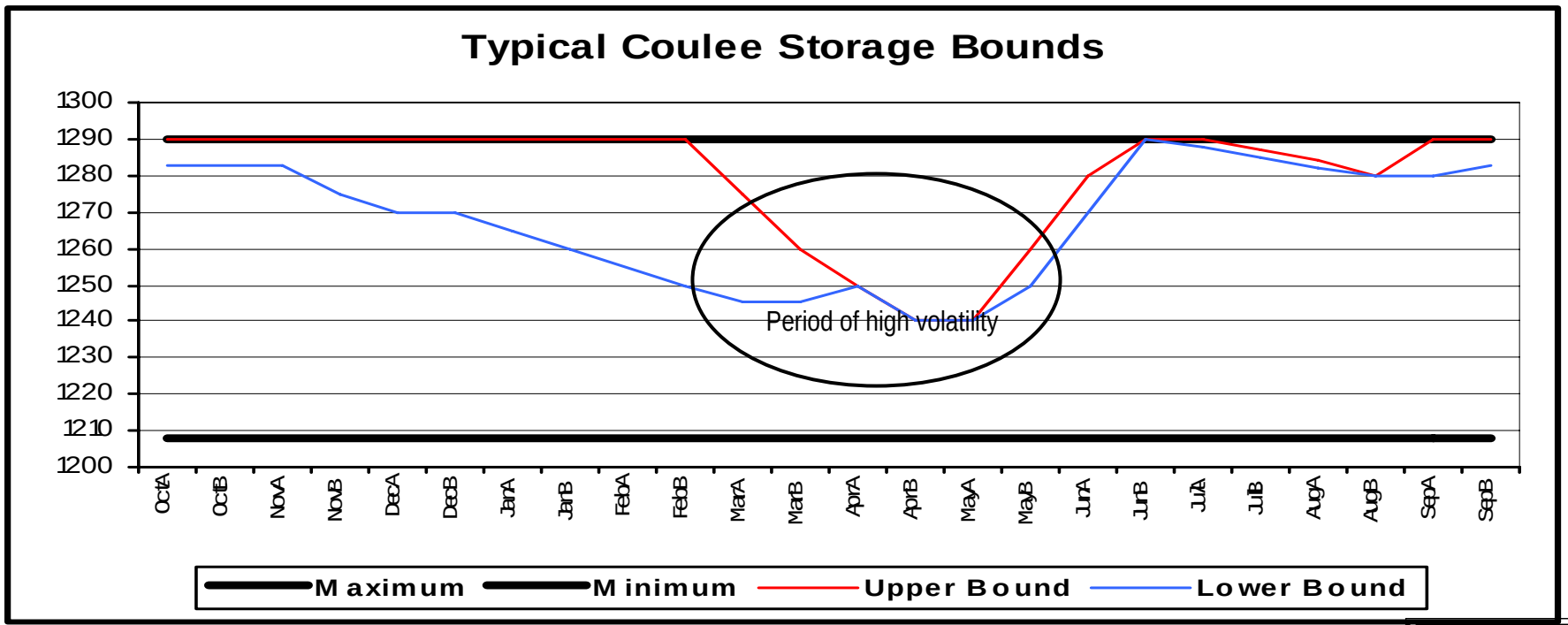
	A	B	C	D	E	F	G	H	I
1	Slice Customer % =	5%							
2									
3		9/1/2007	9/2/2007	9/3/2007	9/4/2007	9/5/2007	9/6/2007	9/7/2007	
4	Coulee/Chief Max Daily Limit MWh	6800	6800	6800	6800	6800	6800	6800	
5	Coulee/Chief Min Daily Limit MWh	3500	3500	3500	3500	3500	3500	3500	
6	Customer GCL/CHJ Sched MWh	3700	3700	3700	6500	6500	6500	6500	
7									
8	GCL/CHJ ANSSG MWh	4200	4200	4200	4200	4200	4200	4200	
9	Customer GCL/CHJ Delta MWh	-500	-500	-500	2300	2300	2300	2300	
10	GCL/CHJ h/k	37.0	37.0	37.0	37.0	37.0	37.0	37.0	
11	Customer GCL/CHJ Delta ksfh	-13.514	-13.514	-13.514	62.162	62.162	62.162	62.162	
12	LCOL h/k	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
13	Customer ROS Bias MWh	0	-324	-324	-324	1492	1492	1492	
14	Base ROS Amount MWh	5000	5000	5000	5000	5000	5000	5000	
15	Base ROS plus Bias MWh	5000	4676	4676	4676	6492	6492	6492	
16	ROS Sched MWh	5000	4700	4700	4700	6500	6500	6500	
17	ROS Daily Flex MWh	0	24	24	24	8	8	8	
18	ROS Cumulative Flex MWh	0	24	48	72	80	88	96	
19									
20	Total Customer Energy MWh	8700	8400	8400	11200	13000	13000	13000	
21									
22									

SRD Data | Customer Test - Low to High | Customer Test - High to Low

Storage Limits

"PBL would establish Slice storage limits that represent the storage space that exists only at those projects with significant and accessible storage space":

- Grand Coulee is the only dispatchable project that falls into this category.
- The storage operation applied to Coulee is fairly repetitive year-to-year. The volatile period is the late winter/early spring when the opposing flood control and fish requirements come into play.



Pre-Schedule Delivery Limits

"PBL would establish pre-schedule Slice delivery limits that reflect expected energy and storage capability based on forecasted stream flows, operational constraints, and off-the-top obligations":

- The forecasted operation of the Snake, lower Columbia and non-dispatchable projects, as well as the allowable range of operations at Coulee/Chief given expected conditions would be reflected in delivery limits.
- This is prior to pre-schedule, so BPA's loads are not yet set. However, BPA's operational objectives and applicable constraints would be reflected in the determination of pre-schedule Slice delivery limits.
- Pre-scheduled amounts of Slice energy must be within the established delivery limits.

Real-time Delivery Limits

"PBL would establish real-time Slice delivery limits that result from BPA customers' aggregate pre-schedule election, as well as actual stream flows, operational constraints, off-the-top obligations and other operating criteria as determined by the BPA hydro scheduler":

- At this point, BPA customers' aggregate pre-schedule election are incorporated into BPA's expected load, which in turn affects the initial configuration of system operations, which in turn affects Slice delivery limits.
- Changes in stream flows and system obligations will also impact system configuration and Slice delivery limits.
- The statement "other operating criteria as determined by the BPA hydro scheduler" refers to operational buffers or parameters needed to operate the system in a prudent manner or to achieve specific operational goals.
- Slice customers will need to adjust their Slice schedules to comply with updated delivery limits.

Updates to Delivery Limits

"PBL would update Slice delivery limits on a periodic basis in real-time to represent actual operating criteria and conditions":

- PBL intends to establish processes that calculate and submit updated Slice delivery limits at regular intervals in an effort to maintain consistency between the limits and changing operational conditions.
- This creates the potential for frequent changes to Slice delivery limits.
- Slice customers will need to adjust schedules in real-time to comply with updated delivery limits.

Concept Summary

Based on FCRPS operating characteristics and Alternative 2 concepts, the main aspects of BPA's concepts for determining Slice delivery limits are as follows:

- Establish two sets of delivery limits.
  - One set based on Coulee/Chief operating characteristics
  - One set based on Rest of System operating characteristics (all other Slice projects netted with System Obligations)
- Develop a model to determine detailed delivery limits for Coulee/Chief.
- Develop simplified delivery limits for the Snake and lower Columbia projects.
  - Incorporate their planned operation into the Rest of System limits, but allow some flexibility to reshape the Snake and lower Columbia component
- Update both sets of limits on a regular basis in real-time to capture the impact of changing conditions and constraints.
- Customers schedule energy separately for the two sets of delivery limits.
- Reflect within Slice scheduling parameters, the impact of the hydraulic link that exists between Coulee/Chief discharge and the lower Columbia inflow.
- Incorporate into Slice delivery limits the operational limitations imposed by BPA hydro schedulers, but in a manner that applies impacts equally to Slice delivery limits and PS functions.