Redispatch 101

Agenda

- Redispatch Fundamentals
- How Attachment M Works
- Discretionary Redispatch Events
- NT Redispatch Events
- Impact of Redispatch on FCRPS

Need for Redispatch

- BPA plans the transmission system and sells transmission to cover N-1 contingencies.
- Congestion events typically occur as a result of multiple contingencies causing flows to exceed the SOL.
- During a system condition, BPA follows the NERC Curtailment Priorities when implementing curtailments to relieve a SOL exceedance.
- BPA implemented the tools to enable NT redispatch in 2011.
- Prior to 2011 BPA did not provide NT redispatch across flowgates.

NERC Curtailment Priorities

BPA currently does not offer non-firm products beyond hourly nonfirm

1	1NS	Secondary nonfirm PTP (PTP that has been redirected)
2	2NH	Hourly Non-firm PTP
3	3ND	Daily Non-firm PTP
4	4NW	Weekly Non-Firm PTP
5	5NM	Monthly Non-Firm PTP
6	6NN	Secondary NT and Conditional Firm PTP service when in conditional status
7	7F /7FN	Firm PTP and NT (PTP tags curtailed /NT tags stay in whole but generation is redispatched, to the extent available to alleviate NT flows based on pro-rata share of flows across constraint).

Note: * Discretionary Redispatch is normally requested, if requested, prior to any curtailments.

TLR Introduction

- A generator's impact on a flowgate relative to a reference bus is measured by its Transmission Loading Relief (TLR) or Generation Shift Factor (GSF).
- The impact on a defined interface of a transaction between two points is its Power Transfer Distribution Factor (PTDF).

TLR Introduction, cont.

- The TLR is the ratio impact to the loading on a specific flowgate based on an Increase (INC) at the generator and a like Decrease (DEC) at a reference bus (Grand Coulee for BPA studies).
- A positive TLR will increase the loading.
- A negative TLR will decrease the loading and provide relief.

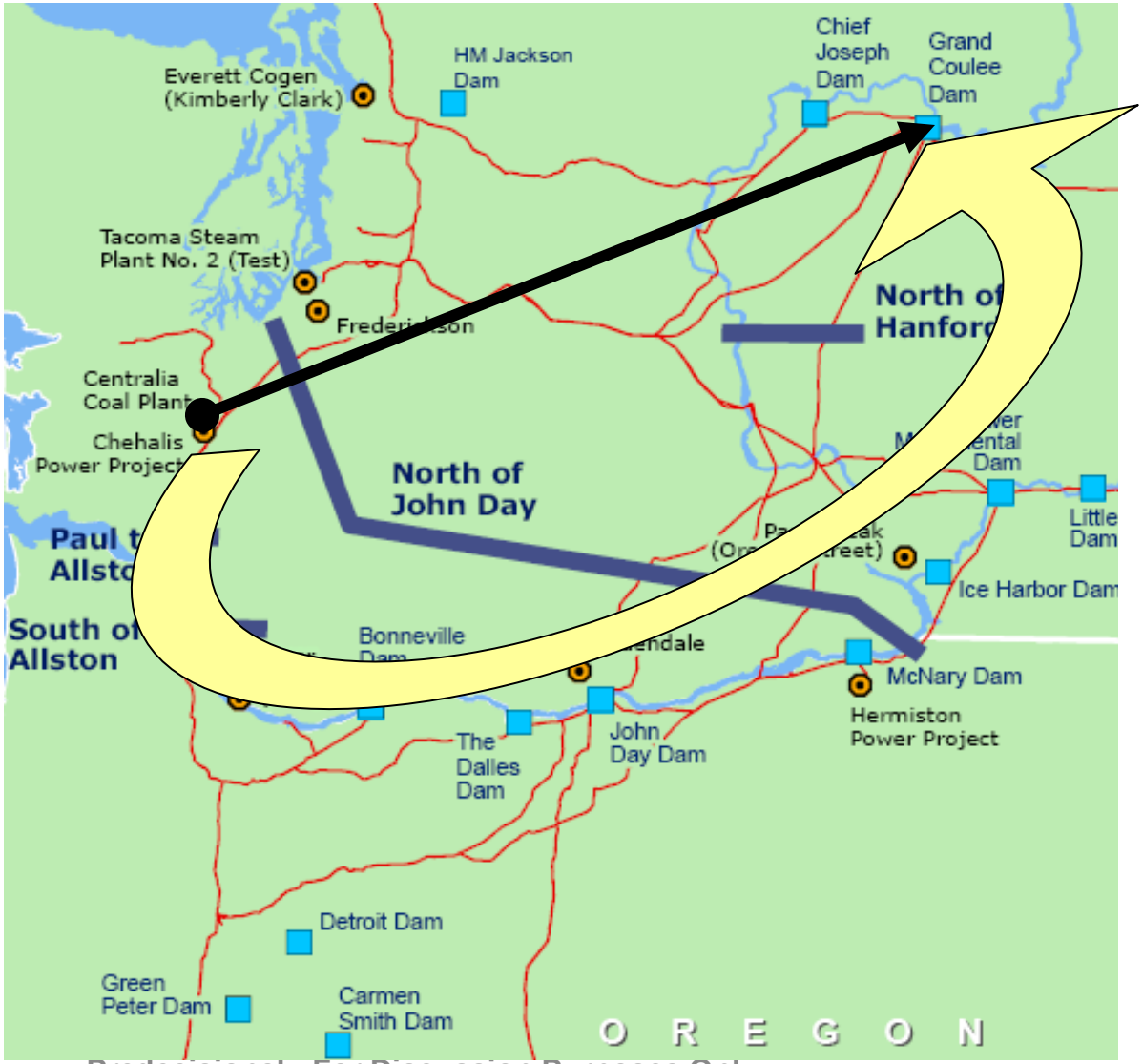
TLR Chart

- Each generator will have a TLR for each flowgate.

Generator	Acronym	Paul-Allston	North of John Day	North of Hanford
Carmen	CAR	-0.204	-0.819	-0.563
Centralia	CNT	0.352	-0.749	-0.232
Chehalis	CHP	0.389	-0.748	-0.250
Chief Joseph	CHJ	0.012	-0.007	-0.005
Grand Coulee	GCL	0.000	0.000	0.000
John Day	JDA	-0.156	-0.834	-0.611
The Dalles	TDA	-0.169	-0.808	-0.580

Paul to Allston TLR

CNT: 0.352

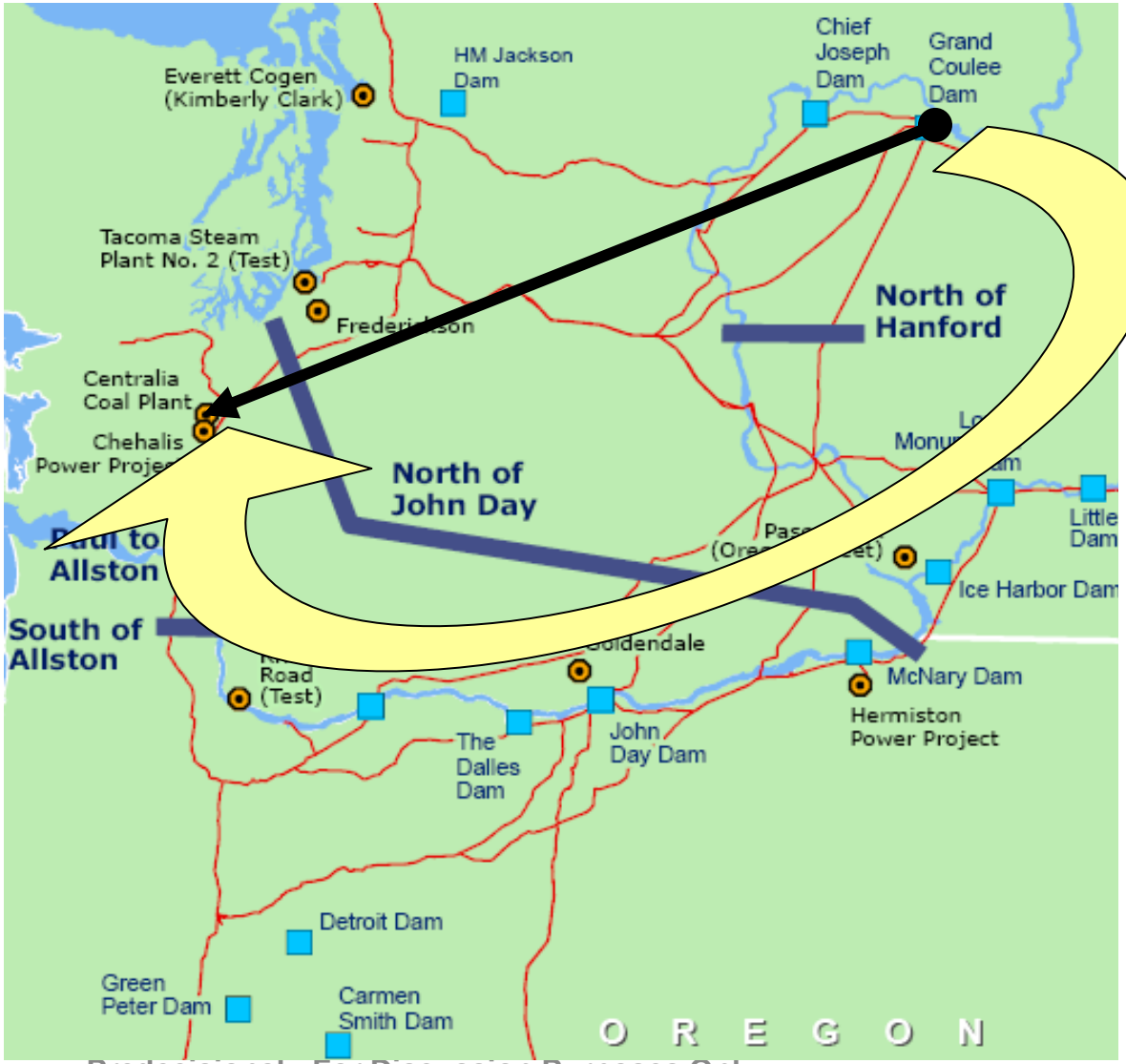


Impact

- For an INC of 1 MW at Centralia and a DEC of 1 MW at Grand Coulee, the loading on the Paul to Allston flowgate will increase by 0.352 MW.
- Similarly, for a Centralia DEC of 1 MW and an INC of 1 MW at Grand Coulee, the loading on the Paul to Allston flowgate will decrease by 0.352 MW.

Paul to Allston PTDF

CNT DEC:
GCL-CNT:
0.000-0.352=
-0.352



Example

- Redispatch is a balanced combination of increased and decreased generation.
- Add John Day (JDA).
- The TLR for the Paul to Allston flowgate relative to Grand Coulee is -0.156.

Paul to Allston

JDA: -0.156

Paul to Allston, cont.

CNT DEC: -0.352

JDA INC: -0.156

The MATH

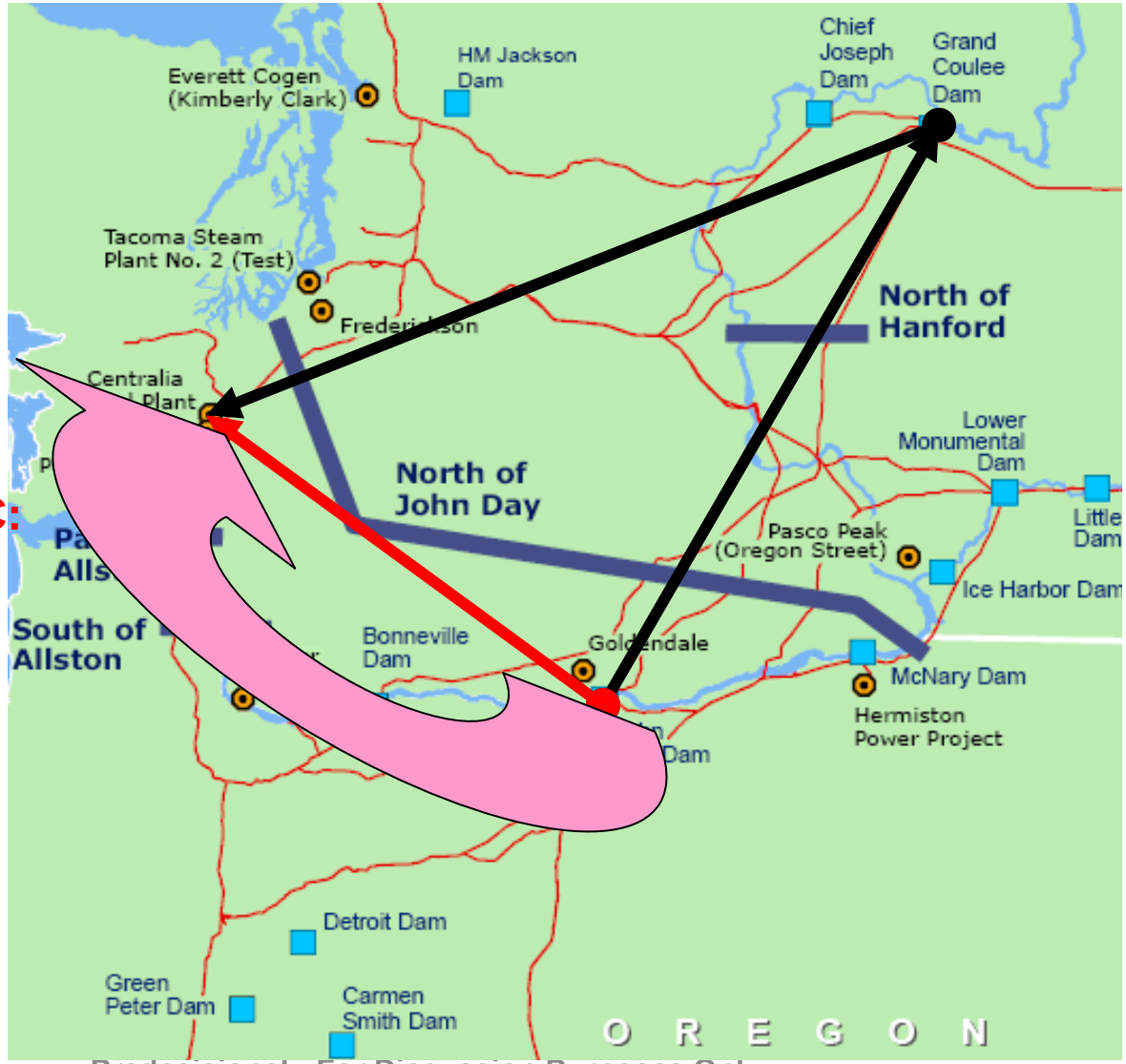
- For CNT DEC: GCL TLR – CNT TLR
- For JDA INC: JDA TLR – GCL TLR
- For the two combined:

  = (JDA TLR – GCL TLR) + (GCL TLR – CNT TLR)

  = JDA TLR – CNT TLR

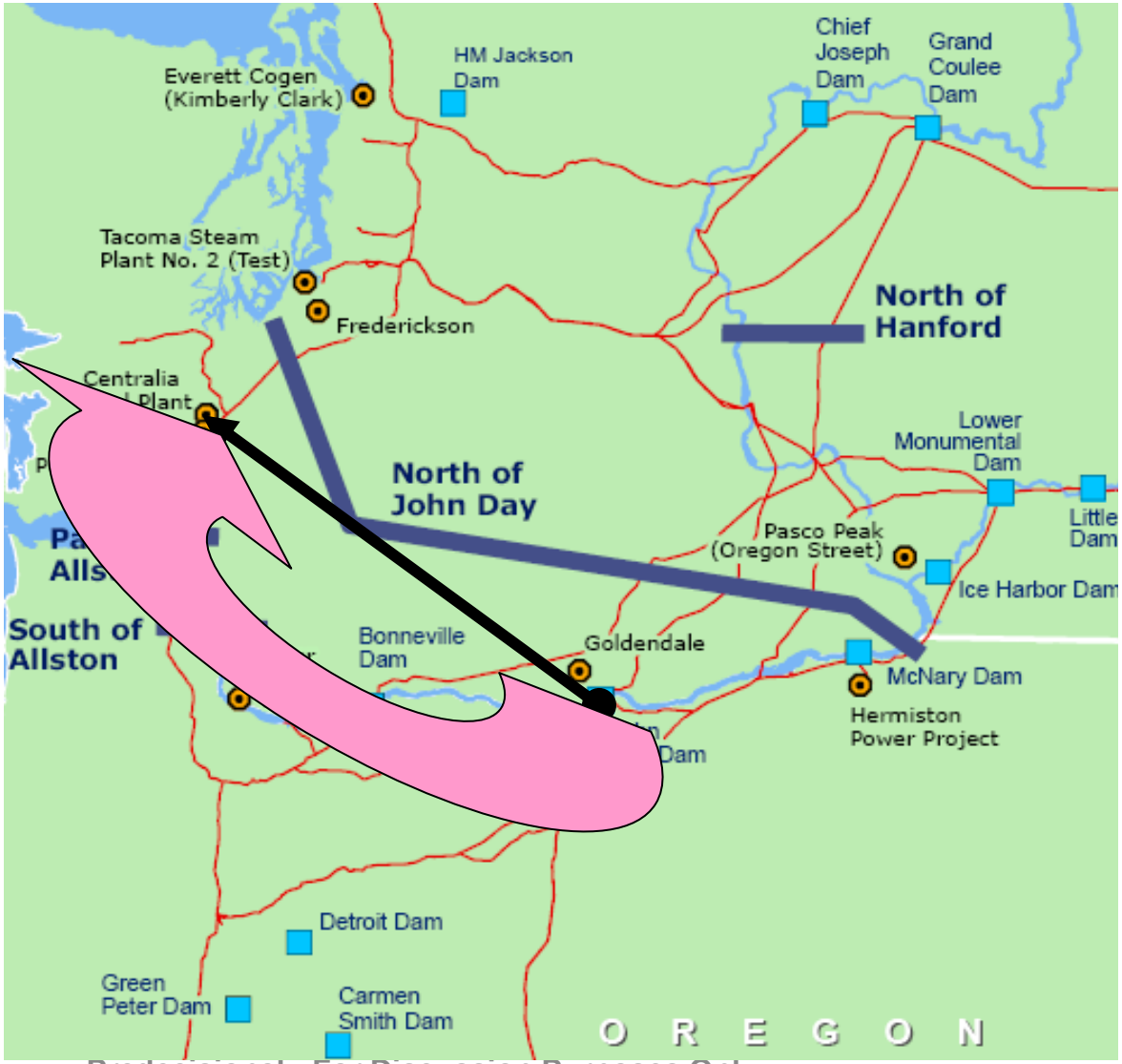
Paul to Allston

JDA INC + CNT DEC:
-0.156 + (-0.352)
= -0.508



Paul to Allston, cont.

JDA-CNT: -0.508



Redispatch

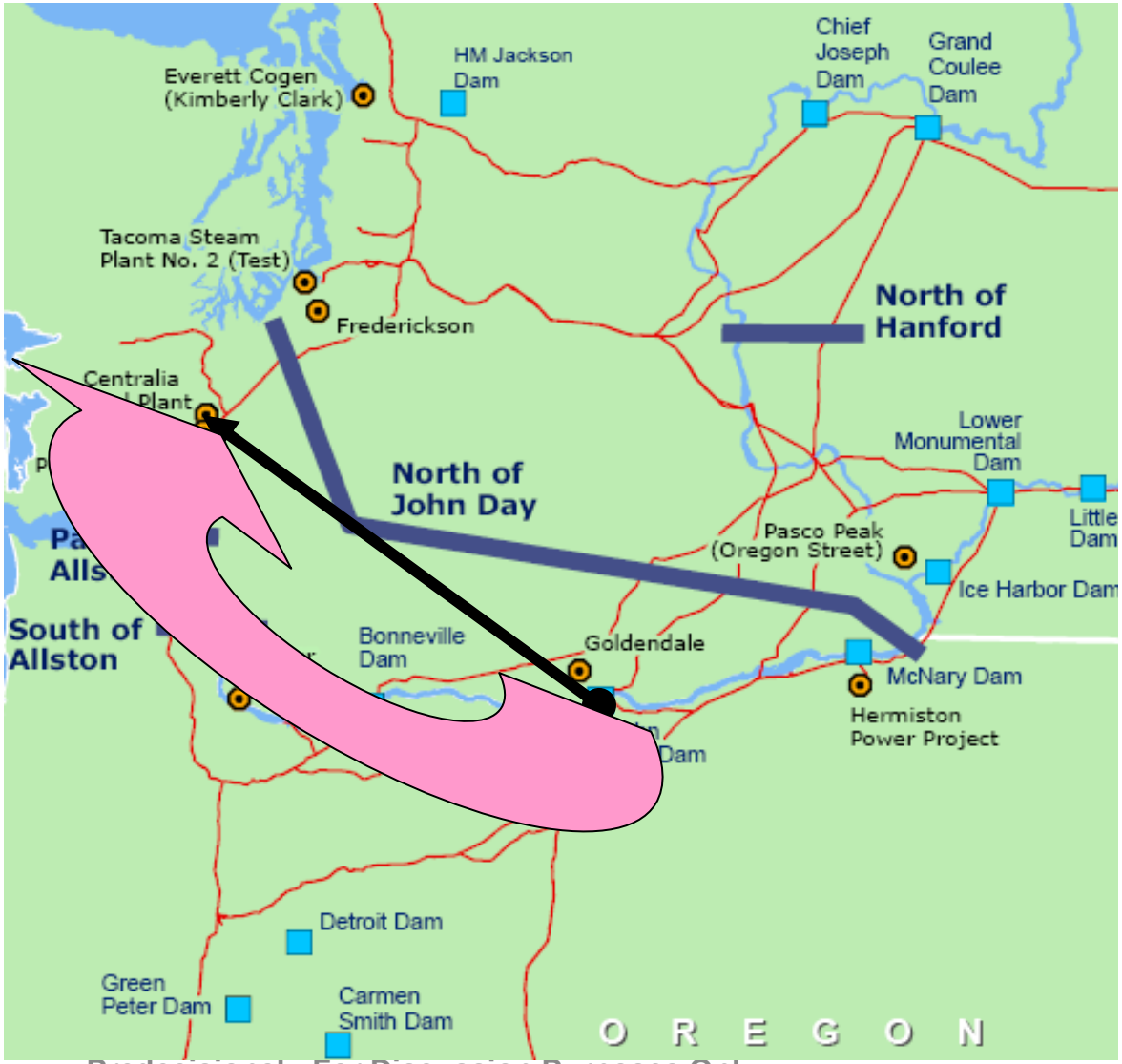
- To relieve the loading on the path, we find the pairs of generators that will provide relief.
- We look for combinations of INC generator and DEC generators with a PTDF that is negative.
- The PTDF is the INC TLR – DEC TLR.
- Numbers closer to -1.0 are more effective.

	DEC	CNT	CHP	CHJ	GCL
INC	**P-A**	0.352	0.389	0.012	0.000
CAR	-0.204	-0.556	-0.593	-0.216	-0.204
GCL	0.000	-0.352	-0.389	-0.012	0.000
JDA	-0.156	-0.508	-0.545	-0.168	-0.156
TDA	-0.169	-0.521	-0.558	-0.181	-0.169

+ -

Single Redispatch Pair

JDA-CNT



Redispatch: 35 MW

Impact: 35*-0.508= -17.8 MW

Redispatch Solution

- To get more relief, redispatch more pairs of generators.
- Since a single generator could be involved in multiple pairs, the amounts are summed and each generator is called once.

Attachment M

- Attachment M to BPA's Tariff provides for redispatch of the FCRPS.
- It was crafted and agreed to as part of a rate case settlement and has been in existence since 2001 in one form or another.
- Three types of redispatch:
  - ***Discretionary****:* requested prior to curtailment of any firm or non-firm PTP schedules or secondary NT schedules to avoid or ameliorate curtailments.
  - ***NT Firm****:* requested for purpose of maintaining Firm NT transmission schedules, after curtailing non-firm PTP and secondary NT schedules consistent with NERC curtailment priority. Redispatch is provided from the FCRPS to the extent it can be done without violating non-power constraints.
  - ***Emergency****:* requested upon declaration of a "system emergency" as defined by NERC.
- Up until 2011, NT Firm Redispatch was not implemented and therefore not provided under Attachment M.

Attachment M - Implementation

- Attachment M Discretionary Redispatch (to the amount of relief needed or amount available, whichever is lesser).
- Integrated Curtailment and Redispatch System (iCRS) Curtailment Advisor curtailment of non-firm schedules.
- iCRS Curtailment Advisor curtailment of firm schedules including NT Redispatch (BPAP gets credit for any Discretionary Redispatch).
- Emergency Redispatch.

Discretionary Redispatch

- From FY 2009 through FY 2012 to date, BPA provided 9604 MWh of discretionary redispatch over the course of 106 hours.
- BPA does not maintain data in an easily accessible form to allow analysis of the benefits of Discretionary Redispatch, i.e., how many curtailments were avoided due to Discretionary Redispatch.

NT Redispatch

- BPA has only had the capability to implement NT Redispatch since January 2011.
- Prior to that time, BPA could not distinguish PTP from NT flows on a flowgate.
- Since January 2011, NT Redispatch has been provided one time: July 24, 2011 on the Raver-Paul Flowgate.
  - BPA curtailed 1-NS e-tags, 7-F e-tags, and requested Power to provide NT Redispatch.
  - NT Redispatch was provided one hour but due to internal confusion was not provided the second hour.
- In 2012, BPA has had 3 events where NT Redispatch was requested but was not able to be provided.
- Because BPA does not have a long history of being able to request NT Redispatch, it is not clear whether the need for NT Redispatch is increasing.

Redispatch and FCRPS Flexibility

- Redispatch capability is assessed in real-time and is based on an instantaneous assessment of system conditions and operational objectives.
- Redispatch is provided from the FCRPS to the extent it is operationally feasible.
- Redispatch pricing is based on the opportunity cost of moving water and the expected future operations.
- Redispatch flexibility is limited or unavailable when one of the following occur in real-time, or subsequent hours:
  - High Priority operational objectives cannot be met.
    - Project limits (minimum/maximum flow, elevation, etc.).
    - Biological Opinion (fish passage spill, 1% limits, etc.).
    - Spill within acceptable Total Dissolved Gas (TDG) standards.
    - Flood control objectives.
    - Project and Human Safety.
    - These limitations on balancing reserves may result from hitting these constraints “now” or within the next few hours, or days.
  - System reliability is jeopardized.
    - Contingency and Balancing Reserves must be maintained.

Redispatch and Operational Objectives

- Some examples of operational constraints which limit flexibility:
  - Grand Coulee.
    - Draft limits can constrain the ability to carry reserves –1.5 ft draft limit protects the forebay from sloughing.
    - Tailwater ramp limitation restricts the rate of reduction in discharge to protect banks below the project from sloughing.
  - Redispatch may cause a “forebay bounce” when project discharge is changed rapidly.
    - At John Day, this can cause the forebay to change by as much as a foot which results in a wave that repeats every few hours and can take as long as a day to dissipate.
  - Redispatch at projects providing spill for fish passage can result in missing the spill amount specified in the BiOp and creates risk of operating outside of the specified 1% efficiency range.
    - Variances from these spill amounts are reported monthly during fish passage season to the US District Court
    - Hydro schedulers are instructed to avoid these conditions.

System Flexibility and Sources of Uncertainty

- **In order to manage the FCRPS to meet operational objectives and load obligations, consideration is given to a number of different sources of uncertainty.**
  - Streamflows.
    - Huge variation in the annual runoff volume and shape.
    - Short-term streamflows can rise and drop unexpectedly.
  - Project Operations.
    - High priority operational objectives can change very quickly.
    - Nonfederal hydro projects interconnected to the FCRPS can change operations unexpectedly.
  - Loads/Obligations.
    - Driven by temperatures which can deviate from forecasts.
    - Products offered by BPA (such as Slice) allow for schedule changes up to the hour of delivery.
  - Unpredictable Balancing Reserve Deployment.
    - Deployment of balancing reserves may cause FCRPS projects to inadvertently run into hard project limits.
  - Resource Performance.
    - Unit outages.
    - Intermittent generation.

Next Steps

- BPA is requesting customer comments on:
  - Rate design.

- Comments due by August 29, 2012:
  - techforum@bpa.gov
  - Please include in subject line: “BP14 Transmission Rate Case – Redispatch, Rate Design”.