Power Operations Planning and Scheduling

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Federal Columbia River Power System (FCRPS)

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January - July Runoff at The Dalles
1929-2012*

80-yr Avg (1929-2008) = 102 maf
30-yr Avg (1971-2000) = 107 maf
*2012 estimated from April 23rd Ensemble Forecast

January - July Runoff (maf)
Federal Columbia River Power System (FCRPS)

- The FCRPS includes 31 hydroelectric projects and one nuclear power plant.
  - Hydroelectric projects are owned and operated by the U.S. Army Corps of Engineers and the Bureau of Reclamation.
  - The Bonneville Power Administration (BPA) is responsible for managing and transmitting the power produced at federal facilities while operating within authorized purposes and special operations.
Federal Columbia River Power System (FCRPS)

- 22,458 MW of installed capacity.
- 30% of electrical power in the Pacific Northwest is from the FCRPS.
Federal Columbia River Power System (FCRPS)

- Hydroelectric projects are operated for multiple purposes.
  - Flood control
  - Navigation
  - Fish & Wildlife
  - Irrigation
  - Power
  - Recreation
Federal Columbia River Power System (FCRPS)

- Flood control planning is very important
  - The Columbia Basin is storage-limited, capable of storing less than half of the average annual runoff.
Federal Columbia River Power System (FCRPS)

- Biological Operations
  - Several species of fish are listed as threatened or endangered under the Endangered Species Act.
Federal Columbia River Power System (FCRPS)

Natural and Regulated Flow at The Dalles Dam
WY2013-14

Approximate Beginning of Damage in Portland/Vancouver
Federal Columbia River Power System (FCRPS)

- The objectives, requirements, and constraints of the FCRPS operation are fairly well understood.

- The mixture of power and non-power constraints and objectives is complex.

- Power production is a by-product of operating the system for other purposes.
Federal Action Agencies

- The dams are owned and operated by the U.S. Army Corps of Engineers and Bureau of Reclamation.

- The region’s only nuclear power plant is owned by Energy Northwest, but the output is owned by BPA.

- BPA is responsible for allocating and transmitting the power produced from the federal generating resources.
Federal Action Agencies

- The federal agencies jointly manage the hydraulic operation of the FCRPS resources and define the hydraulic objectives and constraints.

- Once hydraulic objectives are defined, BPA must manage releases such that generation equals load and that reliability criteria are satisfied (e.g. reserves).
  - If hydraulic objectives are expected to result in generation in excess of load, BPA must increase load (sell power) or reduce generation (e.g. move less water).
  - If hydraulic objectives are expected to result in generation in less than load, BPA must decrease load (buy power) or increase generation (e.g. move more water).
Determining Power Inventory

- Moving more or less water can only be done within the limited flexibility of the hydraulic objectives and constraints.

- If hydraulic flexibility is limited, market mechanisms can be used to adjust load.
  - Long-term (annual, seasonal, and monthly)
  - Balance-of-month (BOM)
  - Day-ahead
  - Hour-ahead

- Most power sales and purchases are done through bilateral agreements between parties.
Determining Power Inventory

- In the Long-term, BOM, and Day-ahead markets, power is sold in standard blocks.
  - Flat – Fixed amount over all hours in a day.
  - Heavy Load Hours (HLH) – Fixed amount between hour-ending (HE) 07:00 through HE 22:00 on a given day.
  - Light Load Hours (LLH) – Fixed amount for HE 01:00-06:00, and HE 23:00 and 24:00 on a given day.
  - Exceptions include CAISO bids and one-off individual bilateral agreements.

- Hour-ahead market is hourly or sub-hourly.
Power Scheduling

- Once trading deals are completed, all power transactions must be pre-scheduled and tagged the day prior to actual power flow.
  - Pre-scheduling involved checking with all counterparties to assure that sending and receiving parties agree on all schedules between each other.
  - This includes sales, purchases, and any other power service agreements.

- All power transactions must be tagged.
  - The tag memorializes the ownership chain from source to sink and the contractual transmission path.
Power Scheduling

- For transactions that allow adjustments to pre-schedule and for all hour-ahead transactions, the transactions must be scheduled and tagged 30 minutes prior to the hour the power flows.

- Once in the hour, load-resource balance is met primarily through balancing resources or within-hour markets.
  - Within some transaction provisions or near-last resort, schedules and associated tags can be cut to decrease load or some generation can be cut (not preferable).
Planning Summary

1. Define Hydraulic Objectives
2. Simulate/Optimize FCRPS Operation
3. Gen = Load?
4. Preferred, Minimum, Maximum Inventory
5. Sufficient Market Depth?
6. Acquire Transmission
7. Submit Schedules to PreSchedule
8. Generate Tags
9. Check-out with Counterparties and Transmission Providers
10. Buy/Sell in DA/BOM Market to meet Inventory Objectives
11. Hydraulic Objectives cannot be met.

Redefine Objectives

To Real-time
Real-time Summary

From PreSchedule

Scheduled Load

Non-scheduled Load Forecast

Define Hydraulic Objectives

Simulate/Optimize FCRPS Operation

Alt Hydraulic Operations?

Gen = Load?

Sufficient Market Depth?

Preferred, Minimum, Maximum Inventory

Buy/Sell in HA Market to meet Inventory Objectives

Hydraulic Objectives cannot be met.

Redefine Objectives

Acquire Transmission

Generate Tags

Check-out with Counterparties and Transmission Providers

Implement
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