

Bruce A. Measure
Chair
Montana

Rhonda Whiting
Montana

W. Bill Booth
Idaho

James A. Yost
Idaho



Dick Wallace
Vice-Chair
Washington

Tom Karier
Washington

Bill Bradbury
Oregon

Joan M. Dukes
Oregon

May 5, 2011

MEMORANDUM

TO: Power Committee Members

FROM: John Fazio, Senior Power Systems Analyst
Ken Dragoon, Senior Resource Analyst

SUBJECT: Verification of Council Thermal Resource Assumptions

This presentation is, in part, a response to member Yost's request for information on thermal resource assumptions and how Council analytical models simulate their operation. Staff will present sources of data, describe what information is collected, explain how the information is validated, illustrate some of the validation methods used, and lay out considerations for data processing improvements.

A critical step in the Council's process to validate its thermal resource assumptions involves a comparison of our database to others in the region (in particular, the PNUCC Northwest Regional Forecast or NRF, which is a tabulation of utility assumptions). This comparison is generally made once a year. In cases where assumptions do not match, the difference in plant availability is calculated and labeled as due to; 1) different sources or different times of inquiry, 2) errors or omissions or 3) differences in purpose of use for the data. For example, a peaking resource may be shown as having a 5% availability in the NRF whereas, for adequacy purposes, it may be shown to have a 92% availability (counting maintenance and forced outage rates). The difference highlights the two differing uses for the data. For the NRF, information is used primarily for resource planning, while for adequacy assessments, it is used to determine the likelihood of curtailment to service (cost notwithstanding).

The Council uses thermal resource data in all of its analytical models (AURORA^{xmp}®, GENESYS and the Regional Portfolio Model). Generally, unless a resource is on maintenance or on forced outage, it should be available for dispatch to serve firm demand. It may also be dispatched for out-of-region market sales (depending on market price and resource operating cost). In the Council's analyses, if peaking resources or other non-base-loaded resources are being dispatched too often, it is likely an indication that the system, while adequate, may not be the most economical.

Overall, the aggregate simulated dispatch of thermal resources in the GENESYS model is consistent with observed results. There remain a few minor refinements that should be made to make the simulation better. One is to add a ramp-up and ramp-down limit on thermal resources

(primarily coal) and the second is to investigate if load pockets exist within the region that have transmission limitations that impede their access to market resources.

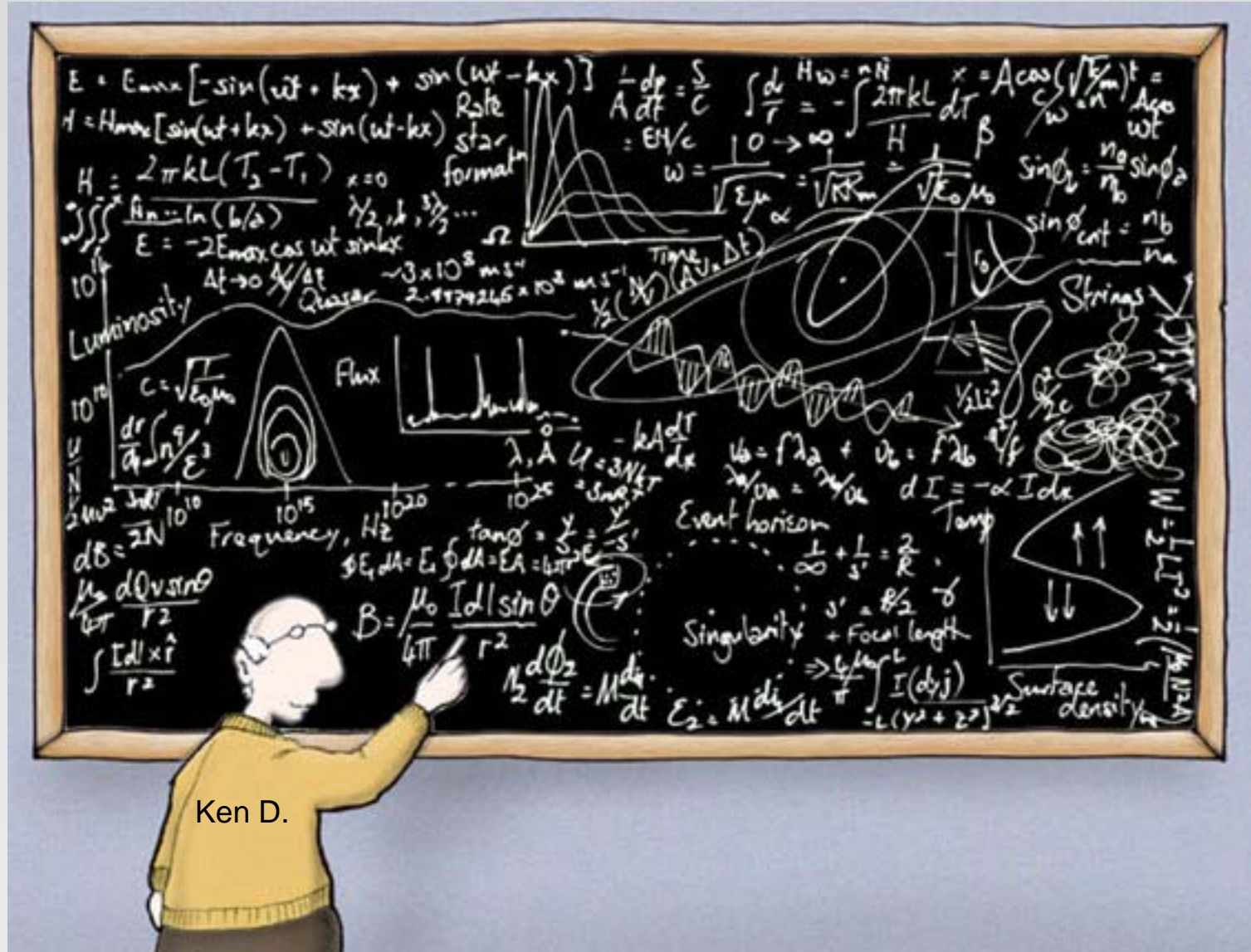
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Verification of Council Thermal Resource Assumptions



Power Committee Go-To-Meeting
May 5, 2011

Thermal Data Verification Process – Simple Version



Ken D.

Outline

- What is Resource Data?
- Data sources
- Validating Data
- Challenges
- Data Management Improvements
- Modeling Thermal Resources
- Actual vs. Simulated Hourly Dispatch
- Suggested GENESYS Improvements

What is Resource Data?

- Resource data is a collection of information relating to the operational and economic aspects of power plants.
- The Council maintains a database of more than 700 regional power plants.
- That data is added to information on more than 4,000 power plants in the WECC region that is supplied to us by EPIS for the AURORA^{xmp}® Model.

Existing Projects Database

<http://www.nwcouncil.org/energy/powersupply/projects/ExistingProjects.xlsx>

Northwest Power and Conservation Council									
POWER PLANTS IN THE PACIFIC NORTHWEST & SYSTEM PLANNING ASSUMPTIONS									
March 28, 2011									
Notes (dropdown) >>		2009 historical energy from 2009 EIA Monthly Time Series File (Updated Jul 2010)							
PROJECT DATA									
Name	NWPPC Unit ID	EIA (ORIS) Plant Code/Unit ID	FERC Project ID	Technology	Primary Fuel	Alternate Fuel	Resource Type	Installed Capacity (MW)	White Book Jan 1-hr Cap (MW)
<i>Names</i>	<i>NWPPCID</i>	<i>EIAGC</i>	<i>PID</i>	<i>TECH</i>	<i>PriFuel</i>	<i>AltFuel</i>	<i>RES</i>	<i>NCap</i>	<i>BPAJanMW</i>
18th Street (Springfield ICs, Springfield Gen Farm)	1000			IC	NG		Natural gas	9.5	0.0
1910 Meyers Falls	1001	3868/UN1-UN2	12094	Diversion	WAT		Hydro	1.2	
Afton Generating Co. 1	1002			STCG	WW		Biomass	7.5	
Albeni Falls 1-3	1003	851/1-3	FCRPS	Storage	WAT		Hydro	42.0	
Alden Bailey (Wauna Peaking/Loki)	1004	56223/LOKI		GT	NG		Natural gas	10.9	11.0
Alder 1 & 2	1005	3913/11-12	1862B	Storage w/Div	WAT		Hydro	50.0	
Amalgamated Sugar (TASCO) (Nampa) 1 - 3	1006	54690/2250,500,6500		STCG	COL	NG	Coal	8.7	0.2
Amalgamated Sugar (TASCO) (Nyassa) 1 - 3	1007	54612/1-3		STCG	COL		Coal	14.0	
Amalgamated Sugar (TASCO) (Paul)	1008			STCG	COL	NG	Coal	5.1	

and lots more:

Operating status (planned, idled, retired, operating), heat rates, owner, power purchaser, load, historical generation, balancing area, availability (reliability), summer peak capability, winter peak capability, retirement date, location, data source documentation, last update date...

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Data Sources

Data comes to the Council from a wide range of sources:

- Utility press releases
- Journal articles
- Popular media reports
- Permitting agency actions
- Utility Integrated Resource Plans
- Reports to government bodies (PUCs, FERC, EIA, and EPA)
- Participation in regional planning venues (e.g., PNUCC)



Validating Data

Keeping all the data up-to-date and accurate is an ongoing, never-ending process.

- Try to find two sources to corroborate data before entering it into the database.
- Document sources when data is changed or added.
- Compare data with after-the-fact generation figures from EIA.
- Compare and contrast with utility filings to PNUCC.

PNUCC/Council Validation Process

- Create a side-by-side listing of PNUCC and Council thermal resources
- Highlight resources that are listed in one database but not the other (and investigate why)
- For matching resources, calculate difference in availability

Validating Data (cont'd)

- When matching resources have different availability, determine if difference is due
 - To different data sources
 - To errors (or omissions)
 - To differences in resource use
- For adequacy assessments, full capability is assumed
- For needs assessments, expected operation is used
- **Example from 2008 validation on next slide**

Resource	PNUCC	Council	Difference	Different Source	Errors and Omissions	Different Concepts
Beaver	416	423	7	7		
Bennett Mountain	3	146	143			143
Coyote Springs 2	248	221	(27)	27		
Danskin 1	3	140	137			137
Encogen	-	136	136			136
Frederickson Generation Station	140	229	89			89
Fredonia 1 & 2	-	206	206			206
Fredrickson 1 & 2	-	148	148			148
Goldendale	120	208	89	89		
Lancaster Power Project	260	233	(27)	27		
Port Westward	374	363	(11)	11		
Rathdrum 1 & 2	123	144	21	21		
River Road Generating Project	198	211	13	13		
Sumas Energy	119	105	(14)	14		
Whitehorn 2 & 3	-	148	148			148

Challenges

Data differences are sometimes omissions or errors, but can also be due to legitimate differences:

- Multiple and varying definitions of “capacity”.
- Projects that are included in one regional study, but not in another.
- Differences in timing of updates.
- Different project labeling and grouping.

Data Management Improvements

Methods can be improved in several ways:

- Timetable for routinely updating and validating data.
- Reducing number of times data must be duplicated.
- Automating data retrieval and validation.
- Allocating staff time to data process improvements.

Modeling Thermal Resources

- Thermal resource data is used in:
 - AURORA^{xmp}®
 - GENESYS
 - Regional Portfolio Model
- Simulation of thermal operation (in GENESYS)
 - Based on operating cost
 - Unless on maintenance or on forced outage, resource is assumed to be available for dispatch up to its full capability

Modeling Thermal Resources

- Simulation of thermal operation (cont'd)
 - Thermal resources outside the NW but owned by NW utilities are modeled explicitly (i.e. not as contracts)
 - IPP resources in the NW are modeled explicitly but are dispatched at market price (not operating cost)
 - IPP availability in summer is reduced (based on competition for their output)
- For adequacy assessments, all available resources, including expected market resources should be counted

Modeling Thermal Resources

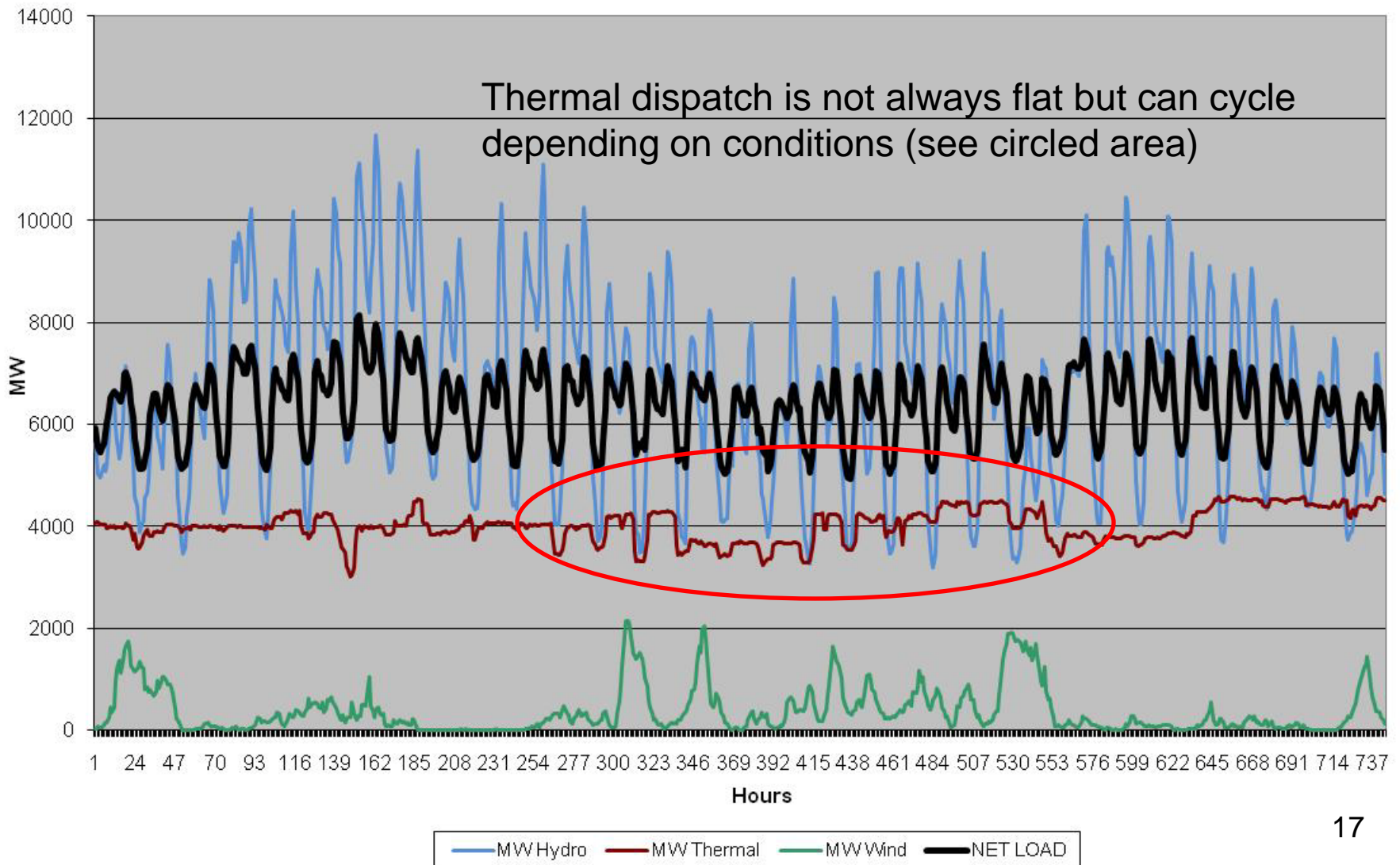
- For a resource-needs assessment, policy makers decide how much market resource to assume
 - First draft studies usually assume zero market availability
 - Also, the availability of peaking resources or resources that a utility would rather not operate much are reduced
- In an adequacy assessment, if market or peaking resources are dispatched too often, it implies that the supply is not economical

Actual vs. Simulated Hourly Dispatch

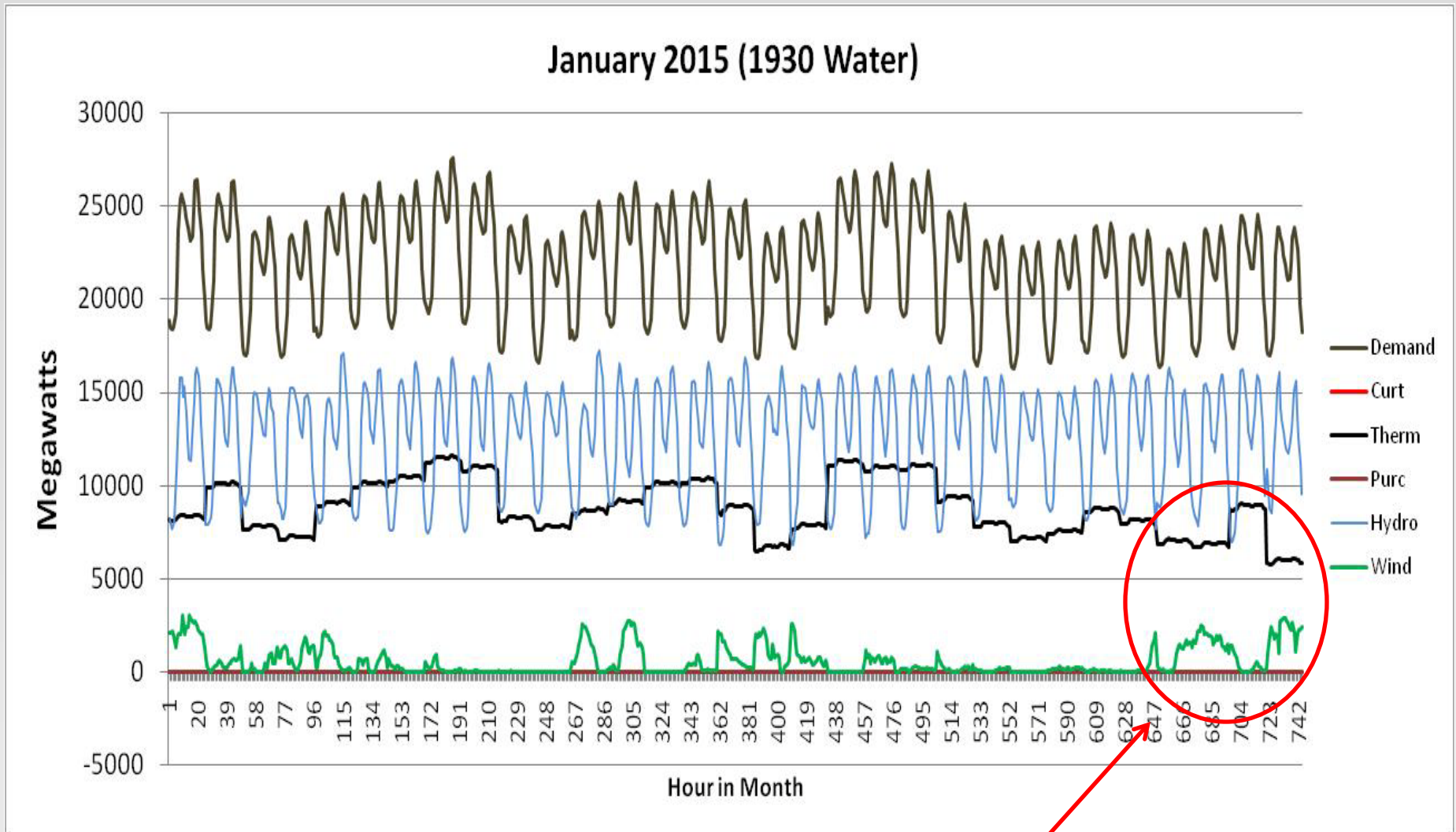
1. The following slides (17 through 20) show examples of hourly loads and resource dispatch.
2. Slides 17 and 19 show actual observed loads and dispatch for the Bonneville Power Administration balancing area.
3. Slides 18 and 20 show load forecasts and simulated resource dispatch for the Northwest region.
4. GENESYS cannot simulate recent years because we do not have water records for those years. So, we are not trying to do a “back-cast” analysis.
5. However, we can gain some confidence in the simulated results by observing how thermal resources (in aggregate) react to load changes and wind generation.
 - In both actual and simulated output, thermal is displaced by wind generation, whenever possible.
 - Also in both, thermal resources “cycle” on a daily basis.

Historic Resource Dispatch (BPA Balancing Area)

January 2010



Simulated Regional Resource Dispatch

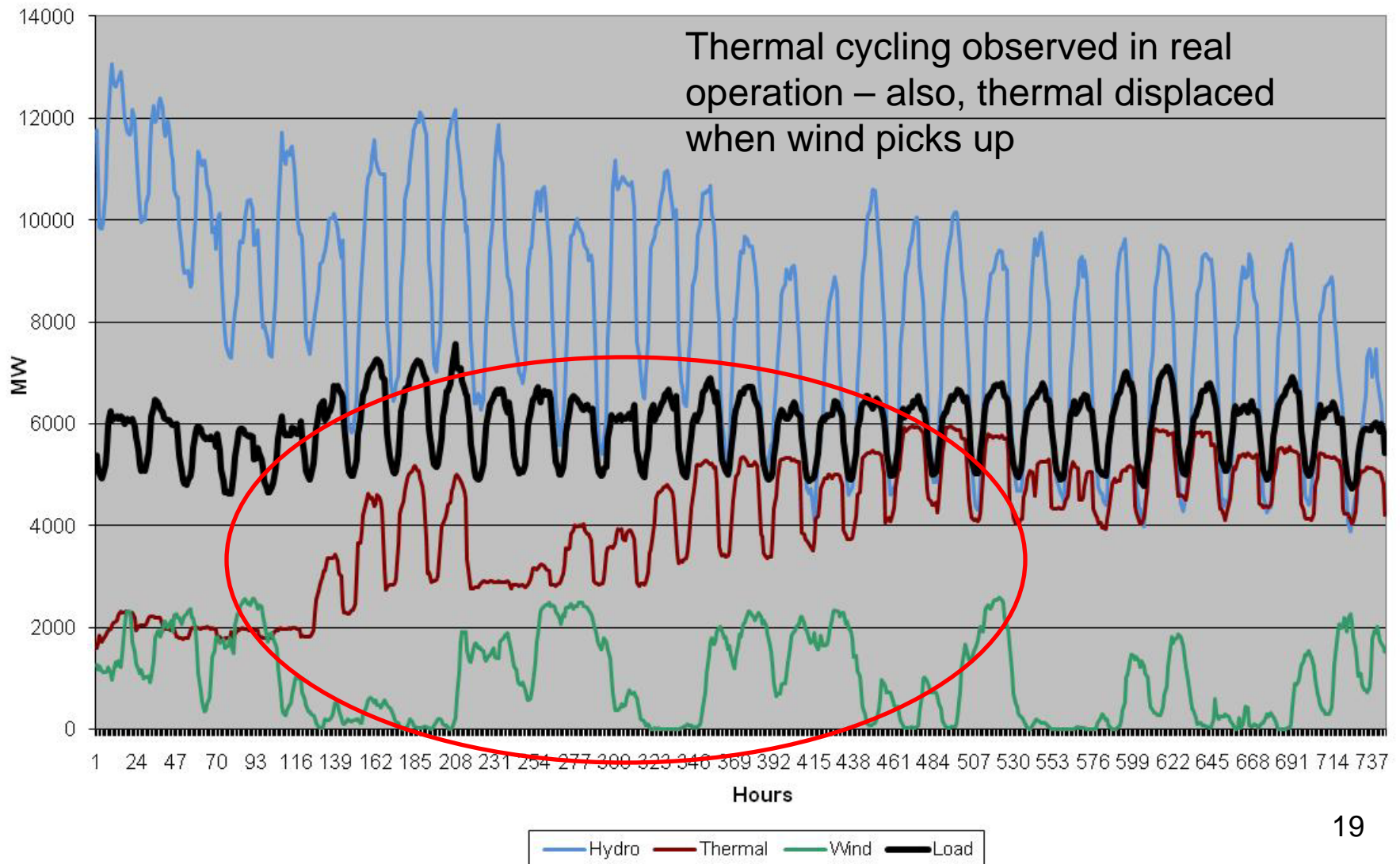


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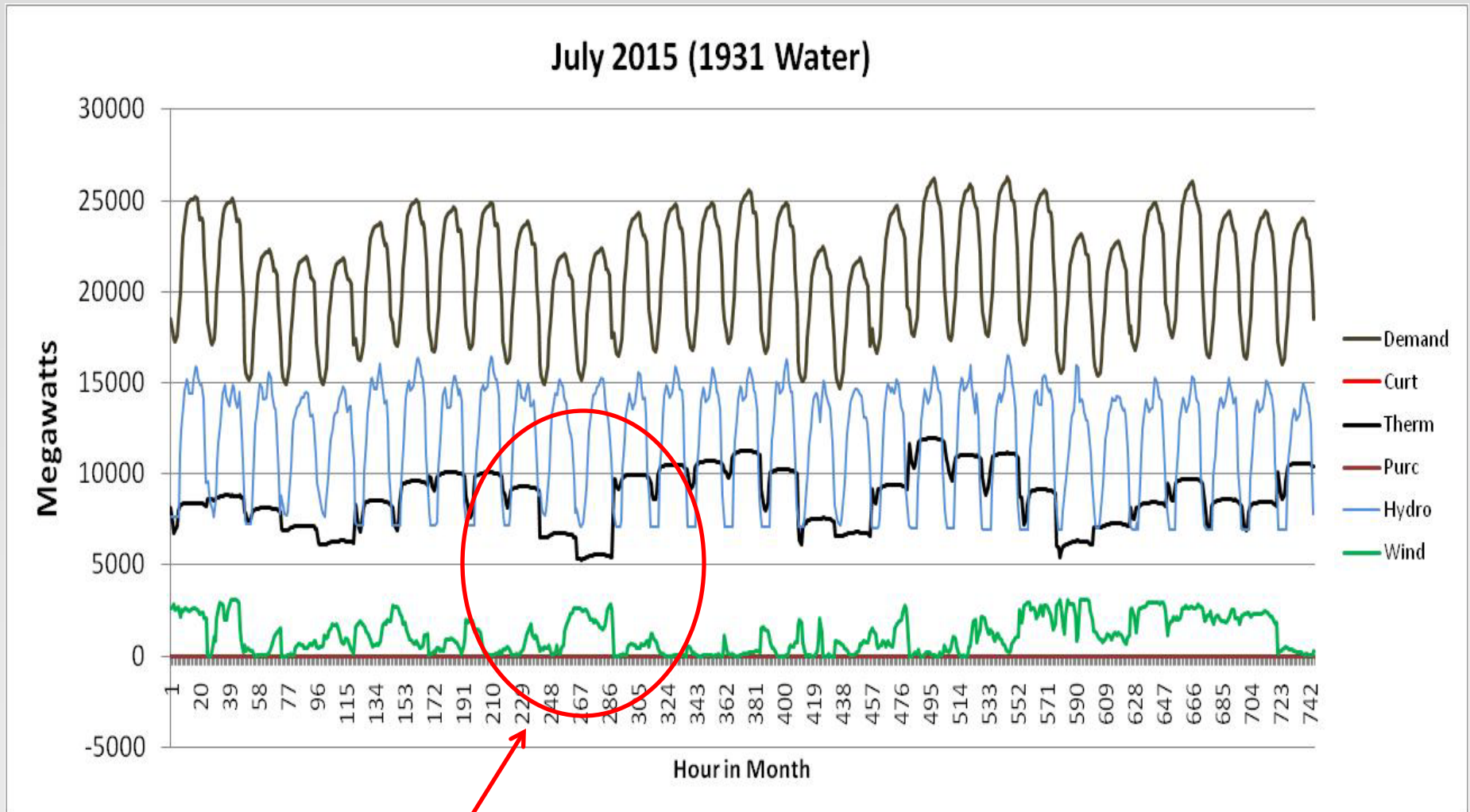
Thermal displaced when wind picks up – it's more costly than hydro

Historic Resource Dispatch (BPA Balancing Area)

July 2010



Simulated Regional Resource Dispatch



May 5, 2011

Simulated dispatch shows thermal cycling and displacement due to wind

Observations

- In aggregate, simulated thermal hourly dispatch appears to be consistent with observed dispatch
- Have observed some within day “cycling” for coal (which is not realistic but only affects overgeneration assessment, is OK for adequacy)
- Have added an output file that shows aggregate thermal hourly dispatch by fuel type
- Also have the capability of displaying simulated hourly dispatch for individual thermal resources

Suggested GENESYS Improvements

- Short-term: Fix coal cycling problem by making it must run for the entire day (if it's needed)
- Long-term: Add ramping logic for thermal dispatch
- Investigate transmission limitations to market resources and potential impacts to adequacy assessments