Technical Conference
Avoided Cost Modeling
January 6, 2015

PacifiCorp

Pacific Power | Rocky Mountain Power

What is GRID

- GRID is an hourly production cost dispatch model that dispatches PacifiCorp resources to serve load obligation through the most economic means possible given the constraints of the Company's system

- For Avoided Cost Purposes …

- GRID is configured to calculate the change in costs between two production cost dispatch model runs.

Key GRID Model Inputs

Calculated outside of GRID

- Hourly Data
  - Load Forecast
  - Market Prices
  - Short-Term standard product Purchases and Sales
- Non-Hourly Data
  - Contract Energy Price
  - Derate
  - Fuel Cost
  - Heat Rate Coefficient
  - Hydro Weekly Energy
  - Planned Outage

Attributes entered into GRID

- Thermal
  - Resource Characteristics
- Hydro
  - Resource Characteristics
- Non Standard Product, Intermediate-Term, and Long-Term Contracts
  - Contract Term
  - Take Limitations
  - Fixed Costs
- Transmission Capability
  - Firm Transfer Rights
  - Wheeling Charge

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This data list is representative of the data series and attribute data utilized by GRID. It is not intended to be exhaustive.

Description of Data Series

- Delivery Point
  - Location of resources
- Demand
  - Defines the demand size of resources configured as contracts
  - Denominated in MW per hour, MWh per month or MWh per year (typically denominated in MW per hour)
- Demand Charge
  - Defines the contract demand charge which is tied to monthly maximum utilization
  - Denominated in dollars per kW month ($/kW-month)
- EOR (Effective Outage Rate)
  - Used to define the reduction in availability of contracts and thermal resource due to forced outages
  - In addition it is used to shape wind, solar and other resources
  - Denominated in factor from 0 to 1 with 0 fully available and 1 not available

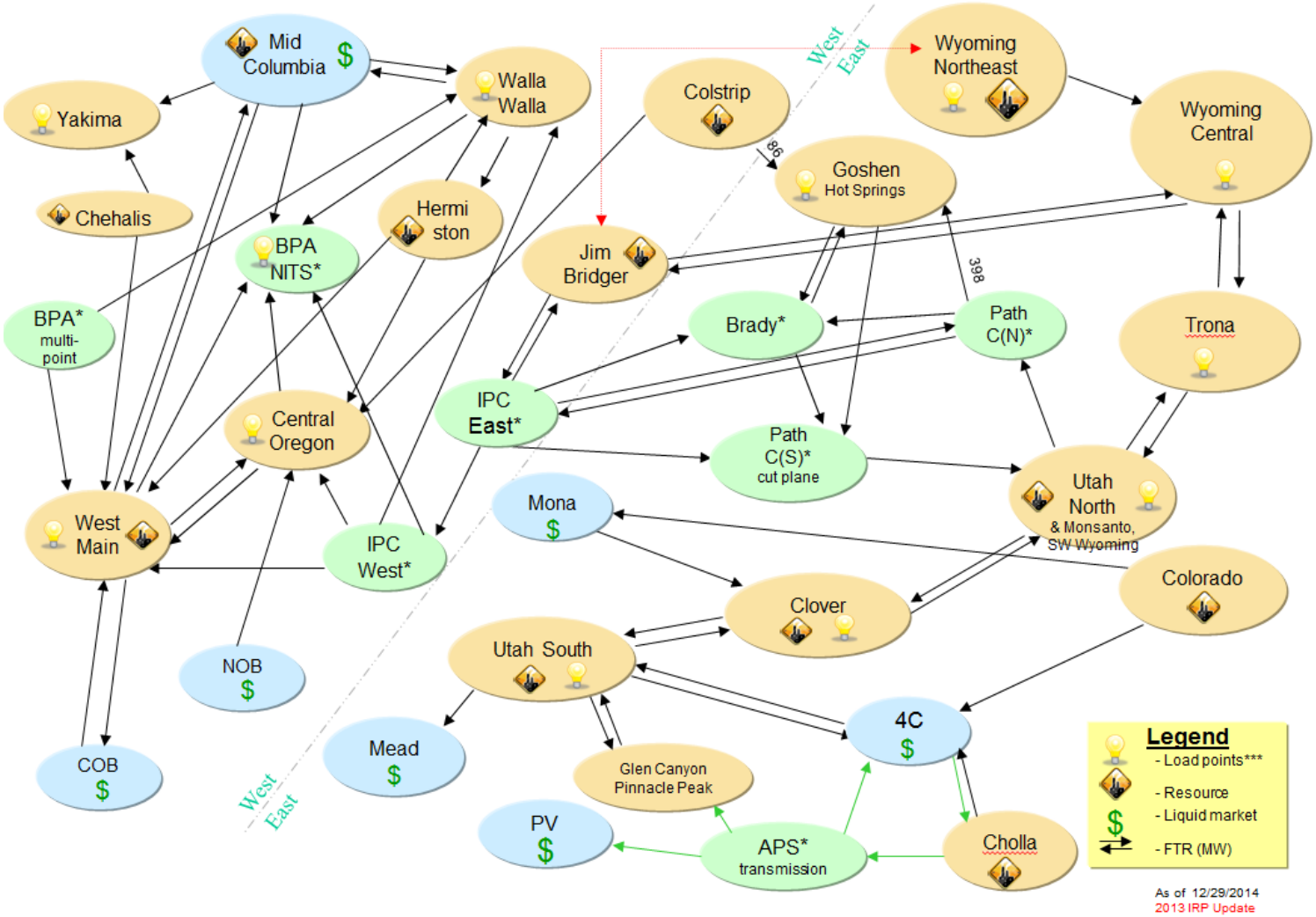
Description of Data Series

- Energy Price
  - Defines the prices for contracts
  - Denominated in $/MWh
- Fuel Price
  - Defines the prices for thermal resources
  - Denominated in $/MMBtu
- Heat Rate Coefficient
  - Defines the efficiency of converting fuel (MMBtu) to power (MWh)
- Hydro Weekly Energy
  - Defines the weekly MWh and capacity available by hydro resource
  - Denominated in MWh and MW
- Market Capacity
  - Defines the market depth
- Other Costs
  - Defines the fixed costs of contracts
  - Denominated in $/Month

Description of Data Series

- Planned Outage
  - Used to define the planned outages of thermal and some contract resources
  - In addition it is used to limit (screen) the operation of thermal and contract resources
  - Denominated in hours, days, weeks or months during which a resource is not available
- Price Forecast
  - Defines the market price available at market transmission bubbles
  - Denominated in $/MWh
- Retail Load
  - Lists hourly retail load requirement
  - Denominated in MWh
- Retail Load Transmission Area Map
  - Splits retail load into retail load transmission bubbles
- Short Term Firm
  - Consolidates executed short term firm transactions by transmission bubble
  - Denominated in hourly Dollars and MWh

GRID Transmission Topology



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How are Data Series Used

- Defining a QF Resource
  - Delivery Point Data Series – to define the location of the QF
  - Demand Data Series – to define the hourly generation profile
- Wind and Solar Hourly Generation Profile
  - Demand Data Series – to define the hourly generation profile
    - Used to define potential QF resources
- Carbon Pricing
  - Fuel Data Series – prices adjusted to include implied carbon costs
  - Price Forecast – prices adjusted to include implied carbon costs

Updating for Official Forward Price Curve

- For Net Power Costs
  - Energy Data Series – to update contracts prices that are contractually tied to market prices
    - Market indexed contract prices
  - Fuel Data Series – to update gas prices
  - Other Cost Data Series – to update monthly costs tied to market prices
    - Includes electric and gas swaps tied to market
    - Mid-Columbia contracts – some costs estimated by market prices
    - Gas storage contracts tied to gas prices

- For Avoided Cost Purposes
  - Energy Data Series
    - Update market indexed Front Office Trades prices only
  - Fuel Data Series

Typical Avoided Cost Study

- Base Case
  - Starting point is similar to general rate case net power cost study
  - Includes IRP resources
  - Includes signed and potential QF resources

- Avoided Cost Case
  - Revise Demand Data Series
    - Add the potential QF hourly generation profile
    - Revise (partially displace) IRP Front Office Trades
  - Add the Potential QF Resource
  - Revise (partially displace) the next deferrable IRP CCCT

Note: Capital costs of the partially displaced IRP CCCT are calculated outside of GRID

What is included in Avoided Costs

Break Down of Avoided Costs by Dollars ($) and Energy (MWh)
Utah 2014.Q3 Compliance Filing

	2016	2021	2026	2031	2035
Dollars ($ x 1000)					
Market (System Balancing)	$ 7,716	$ 10,572	$ 11,107	$ 1,561	$ 2,742
Coal Burn Expense	$ 6,810	$ 7,517	$ 7,501	$ 5,346	$ 5,684
Gas Burn Expense	$ 5,571	$ 5,571	$ 11,739	$ 4,409	$ 4,489
Displaced CCCT (Energy Only)	$ -	$ -	$ -	$ 22,166	$ 23,924
Total Avoided Dollars	$ 20,097	$ 23,661	$ 30,347	$ 33,482	$ 36,839
Energy (MWh)					
Market (System Balancing)	235,822	248,320	210,761	38,956	53,705
Coal Burn Expense	336,299	358,141	302,357	183,353	176,320
Gas Burn Expense	174,520	138,139	231,482	139,023	131,486
Displaced CCCT	-	-	-	383,268	383,089
QF Generation	746,640	744,600	744,600	744,600	744,600
Avoided Costs $/MWH	$ 26.92	$ 31.78	$ 40.76	$ 44.97	$ 49.48
MWh (% of Total AC Resource)					
Market (System Balancing)	31.6%	33.3%	28.3%	5.2%	7.2%
Coal Burn Expense	45.0%	48.1%	40.6%	24.6%	23.7%
Gas Burn Expense	23.4%	18.6%	31.1%	18.7%	17.7%
Displaced CCCT	0.0%	0.0%	0.0%	51.5%	51.4%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

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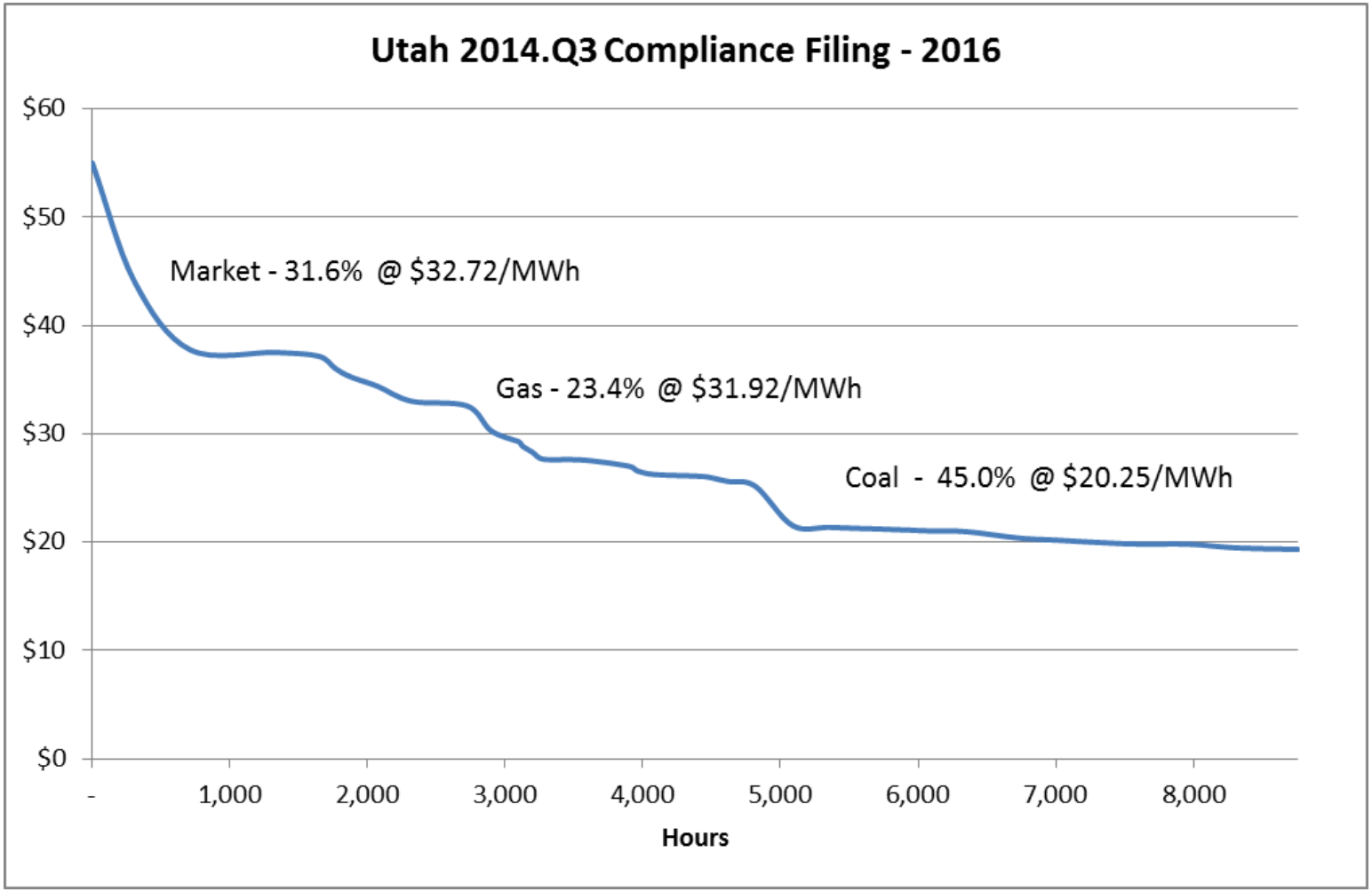
Major Avoided Cost Drivers

- QF Potential Resource
  - Resource type – solar vs wind
  - Resource location
  - Resource generation profile
- Official Forward Price Curve
  - Gas prices
  - Market prices
  - Spark spread
- Retail Load
- Resource Stack
  - Avoidable resources
  - QF queue – signed and potential QFs

Resource Stack



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