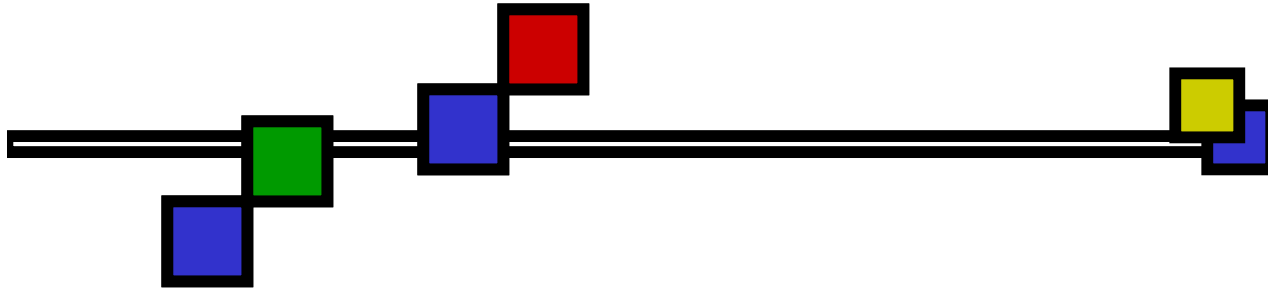


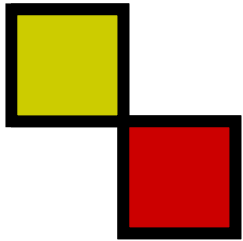
Post-2006 Slice Product Operational Issues



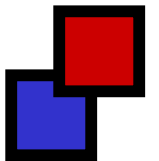
Technical Workshop,
January 15, 2003, 1:00-3:00
(BPA Rates Hearing Room)



How much Slice?



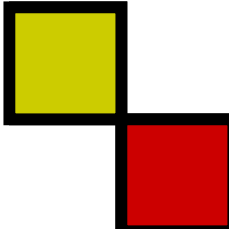
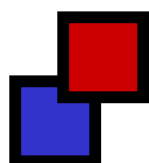
- If Slice below 35%, minor contract changes
- If Slice above 35%, potentially major contract changes
- Operational and financial concerns may dictate minimum and/or maximum Slice %

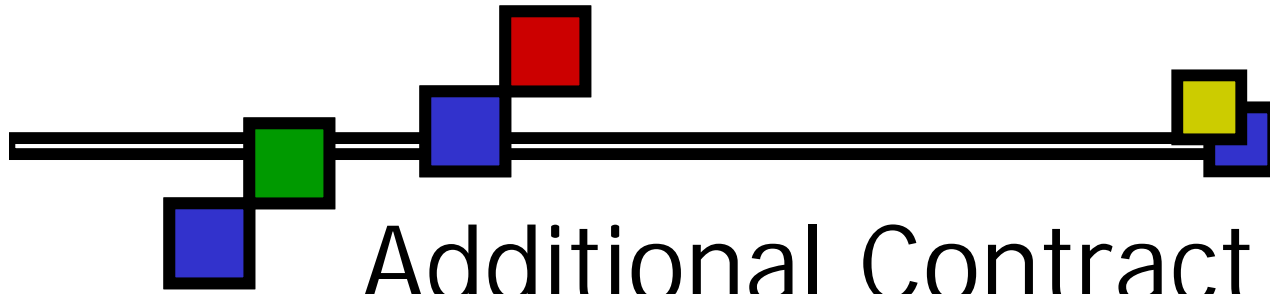




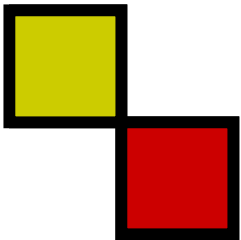
Possible Contract Changes: Slice = 35% or less

CONTRACT CHANGES WOULD LIKELY INCLUDE, BUT NOT NECESSARILY BE LIMITED TO THE FOLLOWING:

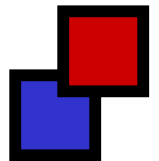
- 
- Require all Slice Customers to schedule electronically
 - Resolve GMS/dynamic scheduling issues
 - As Efficiency Projects suggest standards to allow better optimization, ask Slice Customers & PBL to meet standards, e.g. load forecasting
 - Current Slice Customers would be asked to sign new contract
 - Other changes as necessary, e.g. to accommodate RTO
- 



Additional Contract Changes would likely be needed when Slice % exceeds 35%

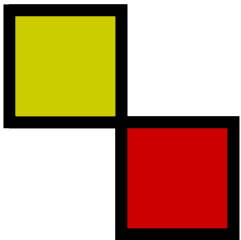


- As Slice % increases, harder for PBL's share of FCRPS operations to accommodate model error, e.g. forecasted runoff $>$ or $<$ actual runoff without cost shift
- Without dynamic scheduling, intra-hour load balancing harder to achieve without cost shift

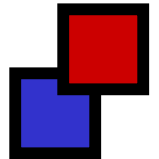




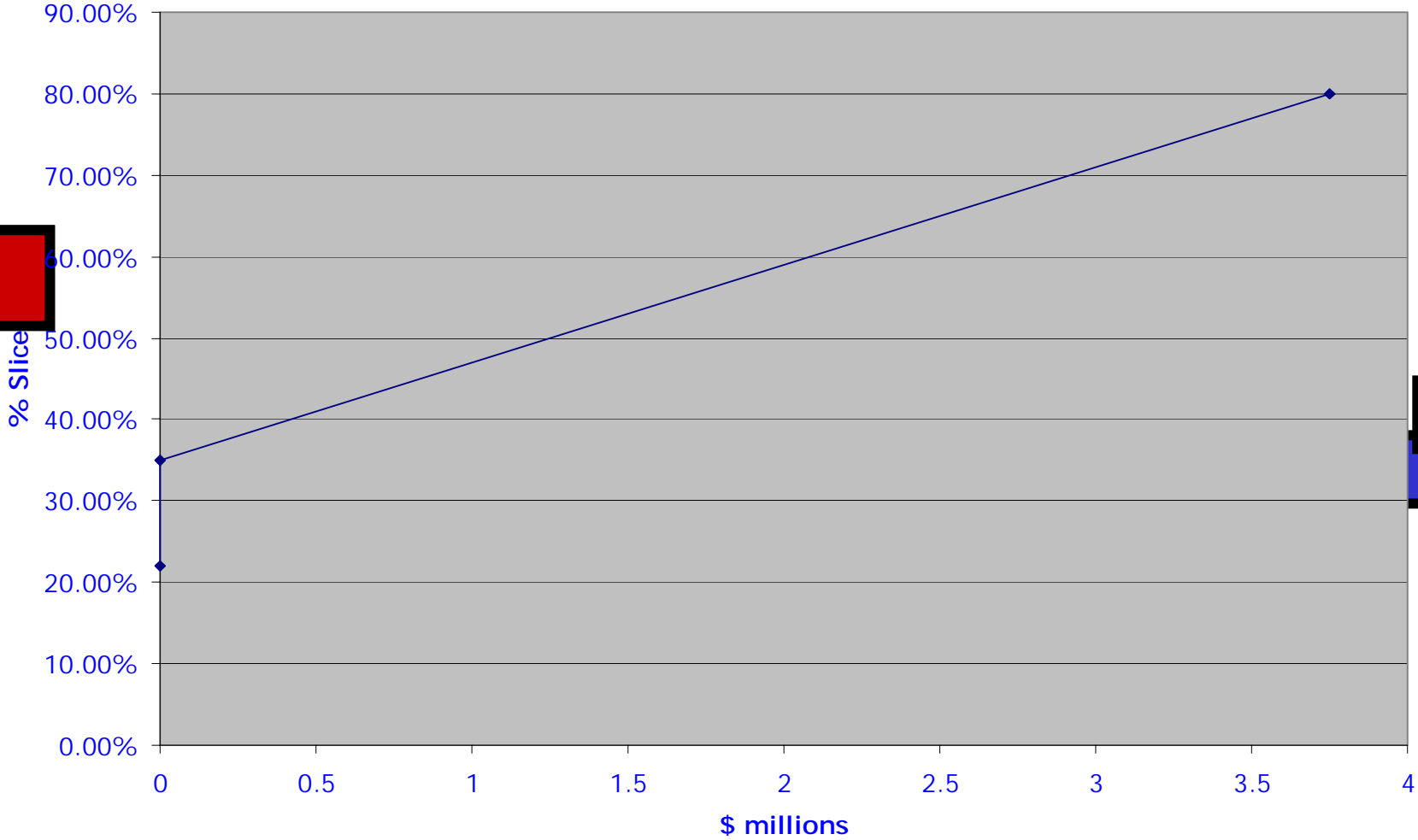
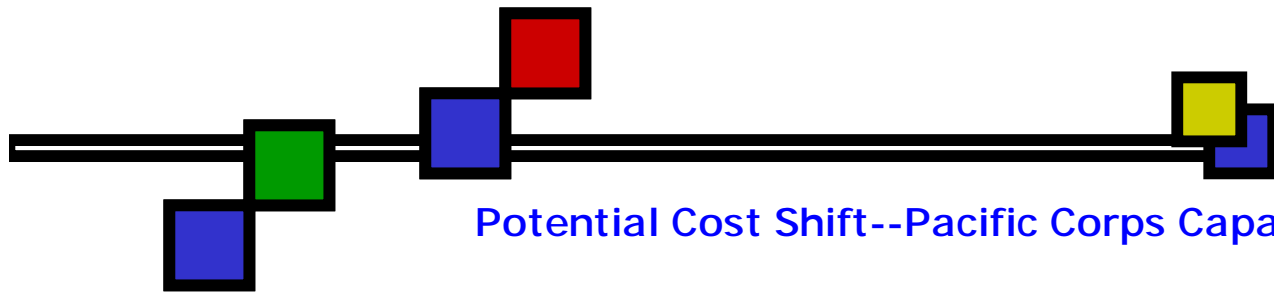
Additional Potential Cost-Shift above 35% Slice

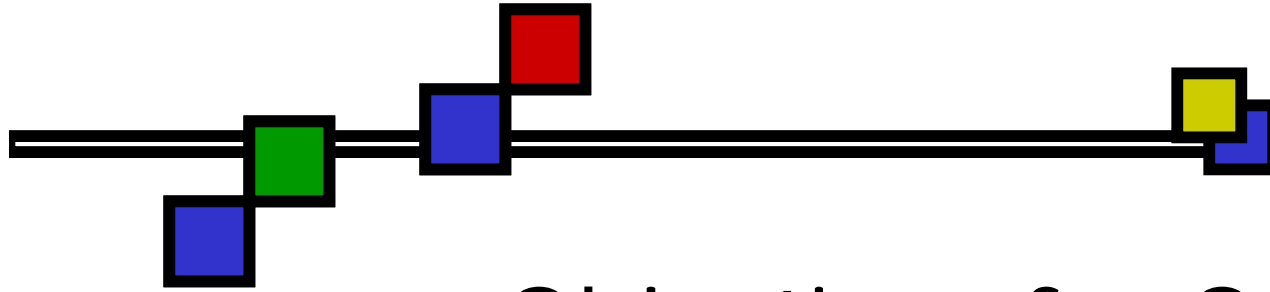


- Pacific-Corps Capacity Contract = Contract that pre-dates Slice
- 2005-2012, peak capacity under contract = 575 MW
- As Slice % increases, PBL will likely need to purchase more HLH hours and sell more LLH to accommodate contract
- If \$5/mwh differential in market price assumed, following graph shows potential cost shift



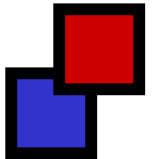
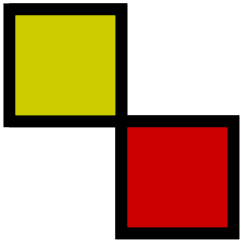
Potential Cost Shift--Pacific Corps Capacity Contract

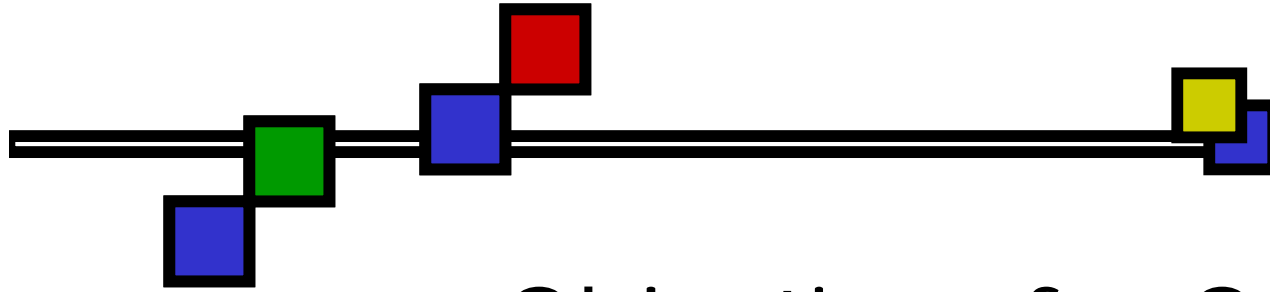




Objectives for Optimal Operation of Federal System

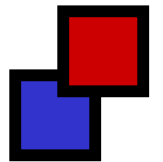
- Operate to best meet multipurpose objectives of flood control, irrigation, navigation, recreation, fish and power
- Operate to ensure regional and transmission system reliability
 - Sufficient ancillary services need to be available to meet WECC, NERC requirements
 - Access to generation to assist NW and neighbors in emergency situations **as well as for day to day operations**
 - Access to generation for re-dispatch





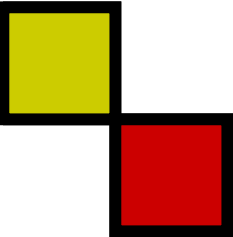
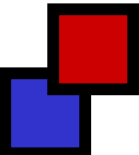
Objectives for Optimal Operation of Federal System

- Operate to honor existing treaties, agreements and contracts
- Operate to maximize generation to meet customer load and to maximize the value of surplus generation for PBL's Slice of the FCRPS
 - Efficiency Projects underway to help achieve optimal operation of Federal System

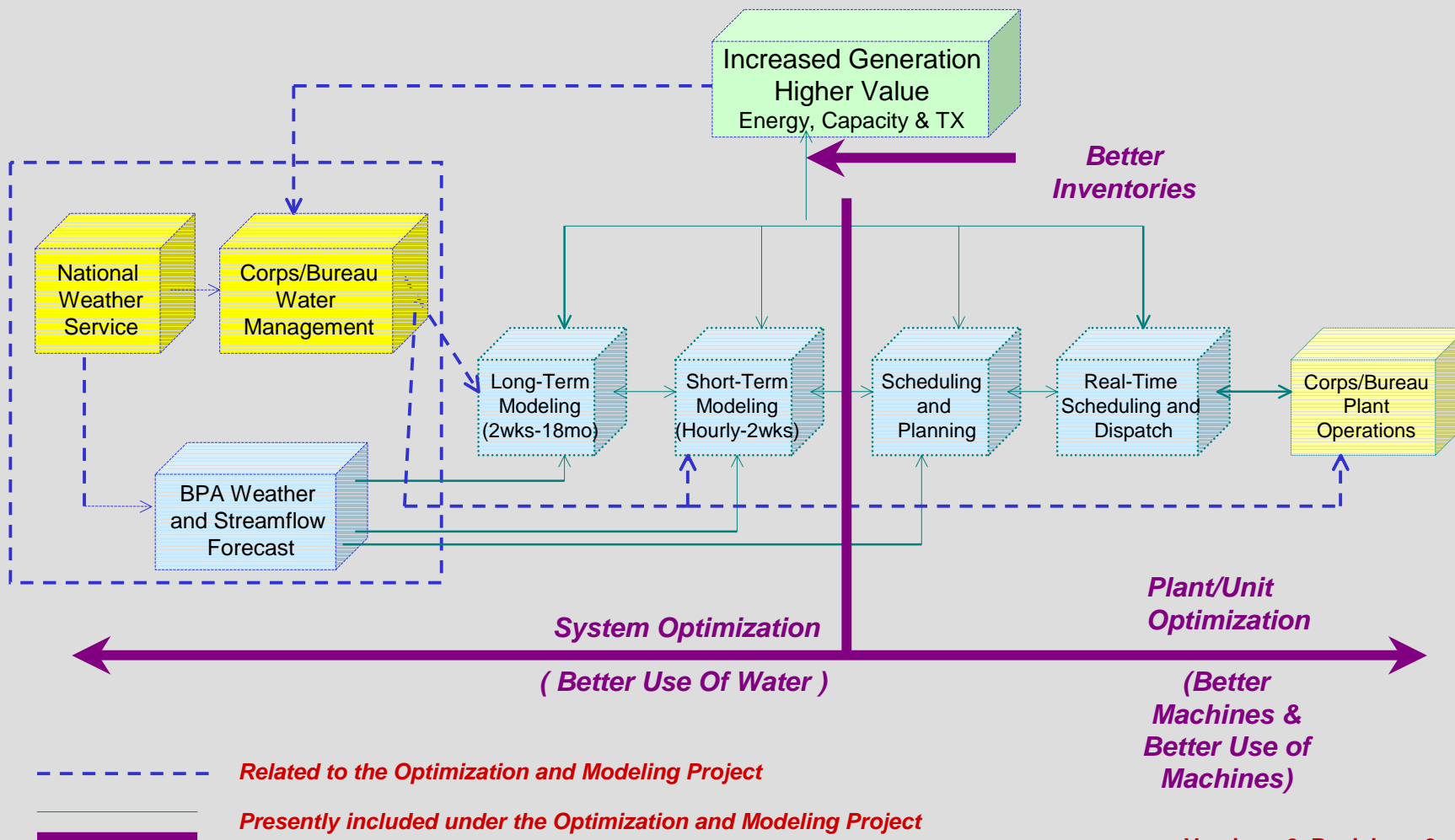




Concerns regarding Optimal Operations, Cost Shifts & Slice

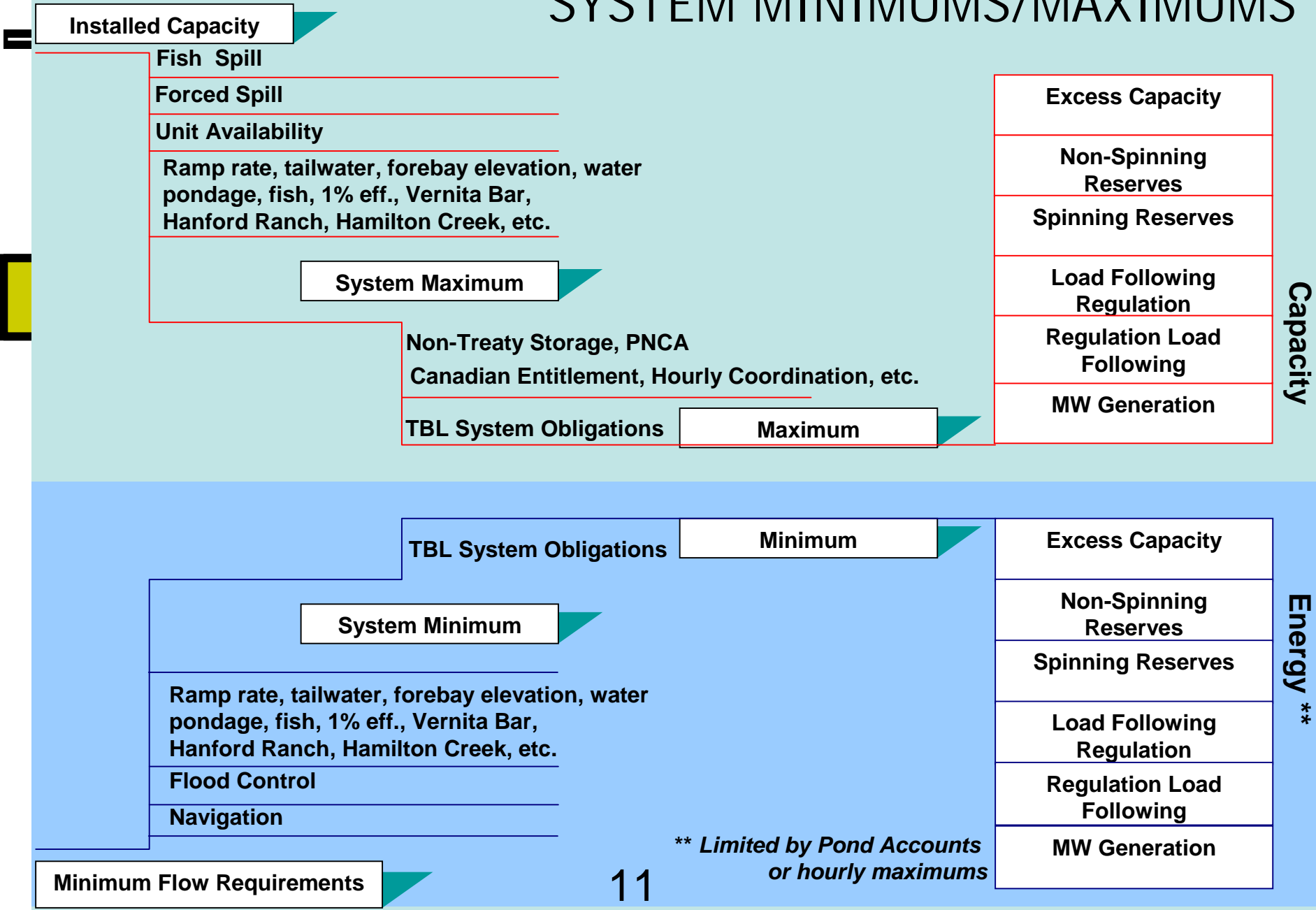
- 
- TBL needs access to generation to meet Ancillary Service and Re-Dispatch Requirements to ensure reliable, efficient transmission service
 - Model Error, i.e. difference in forecast and actual runoff, will cause PBL to have to change their planned operation to meet hard non-power constraints
 - As Slice % increases, potential cost-shift increases
 - PBL wants to maximize benefits from Efficiency Projects to improve Federal System Operation
 - Uncertainty of Slice Operation may impede benefits
- 

FCRPS OPTIMIZATION AND EFFICIENCY IMPROVEMENT PROJECT

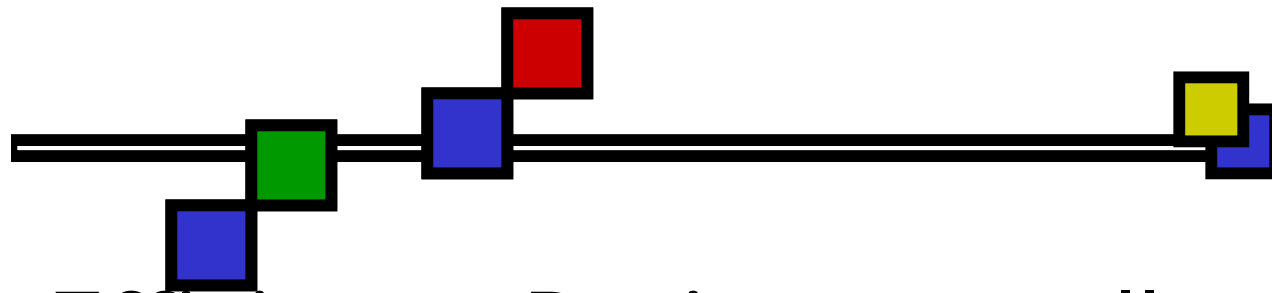


Version: 2 Revision: 0

SYSTEM MINIMUMS/MAXIMUMS



** Limited by Pond Accounts or hourly maximums



Efficiency Projects to allow for FCRPS

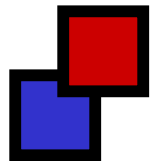
Optimization--Better Use of Water

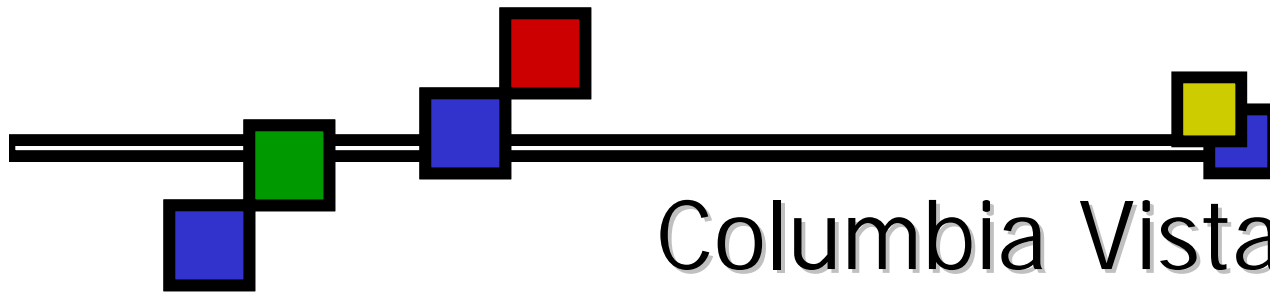
- System Optimization through Columbia Vista (HSP)

- Model Consolidation & Faster Study Turn-around
- Optimization of Basin Operations
- Increased Generation
- Shifts of Generation to Higher Value Periods

- Plant/Unit Optimization through Near-Real Term Optimizer (NRTO)

- Better Use of Machines (Plant Optimization)
- Better Machines (Unit Optimization)
- Increased Generation

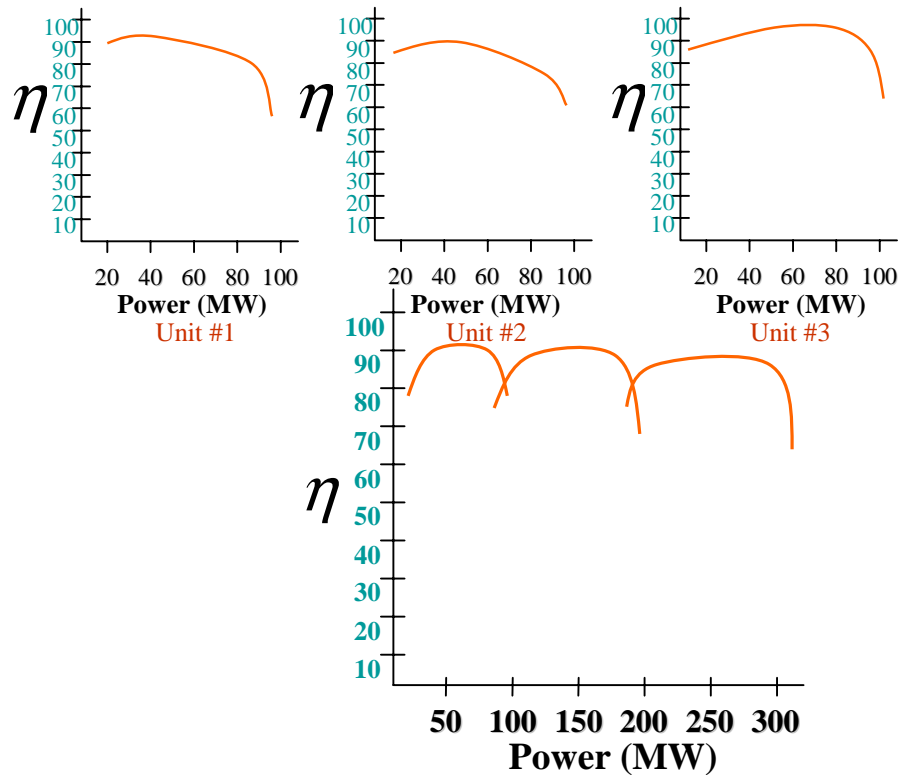




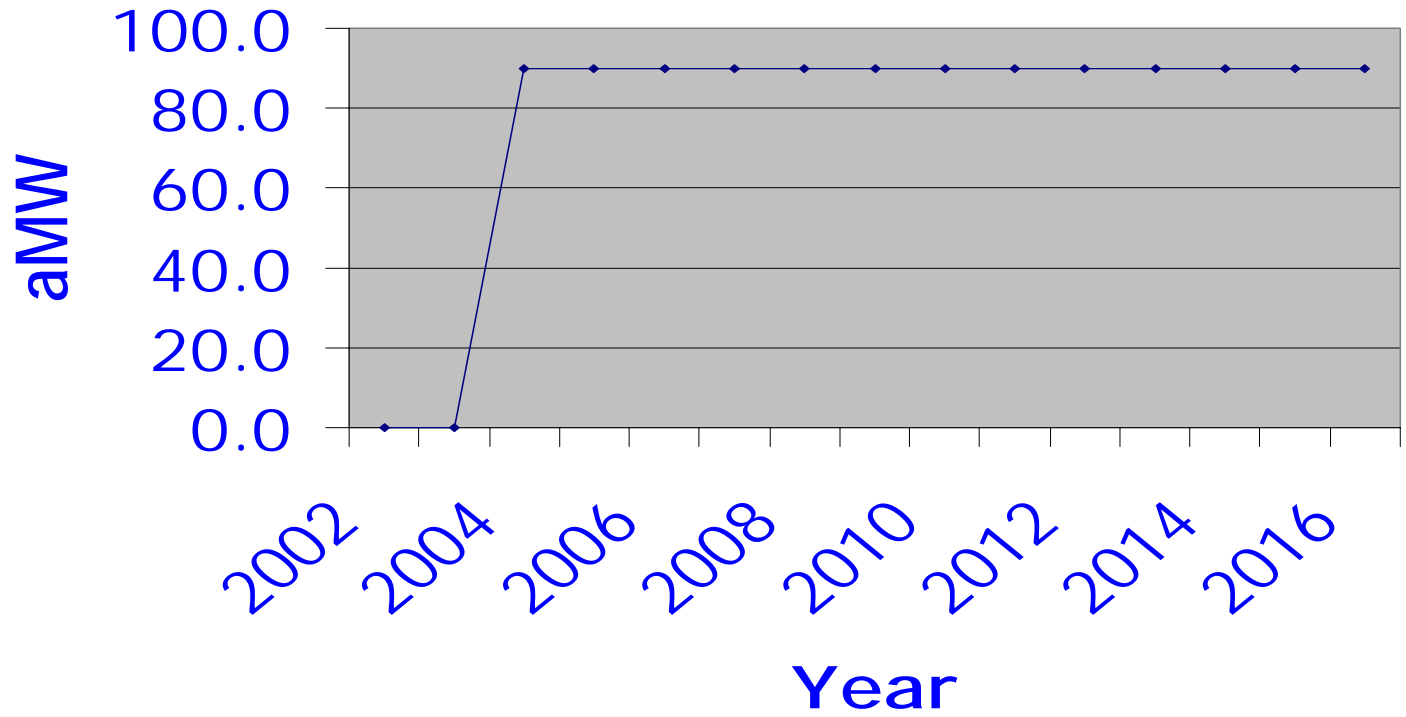
Columbia Vista

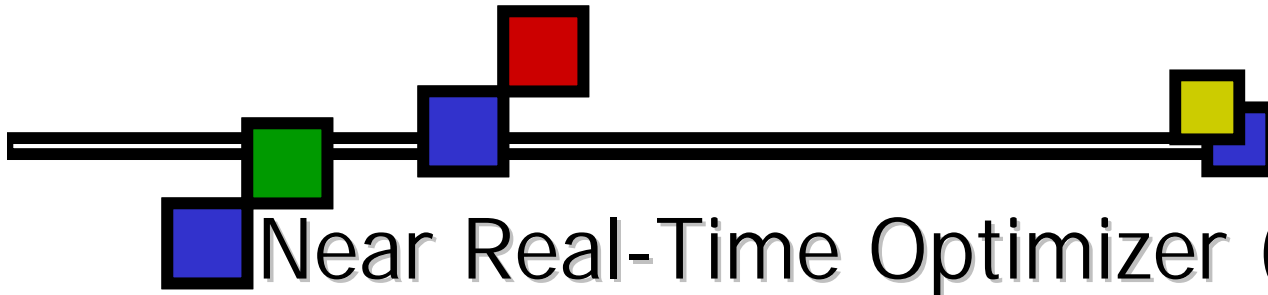
(Primarily used by Modellers and Short-Term Planners)

- Use of H₂O (Basin or Type III Optimization).
- Use of Machines (Plant or Type II Optimization embedded in program).



Expected Columbia Vista Efficiency Gains with load forecasting standard

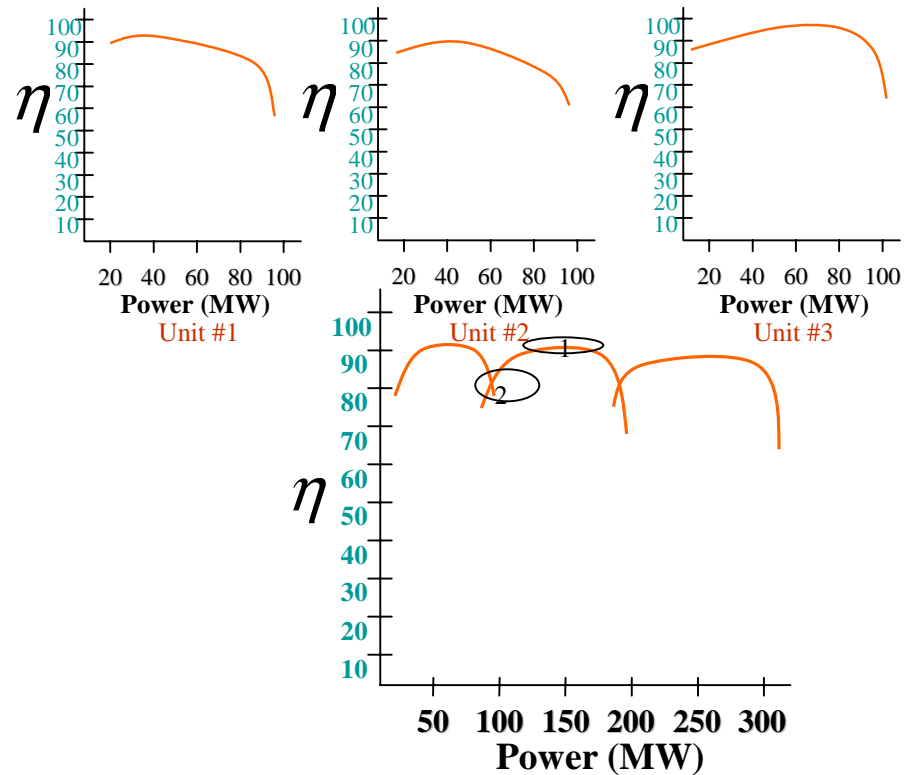


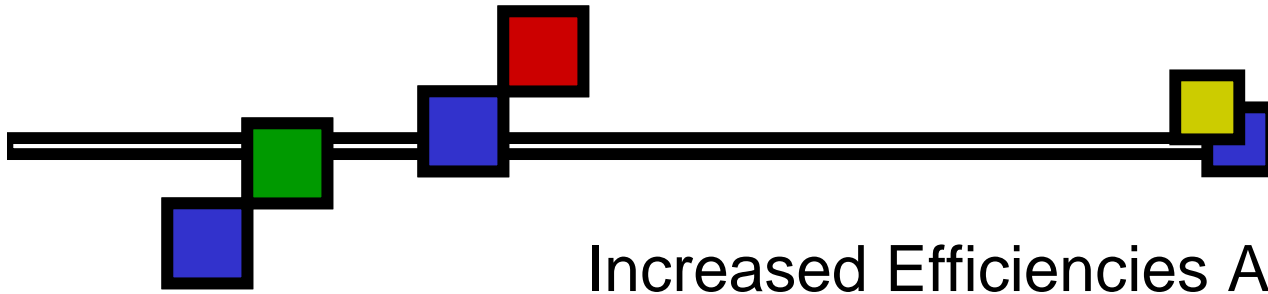


Near Real-Time Optimizer (NRTTO) at BPA

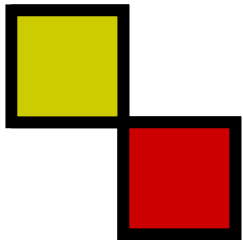
(Primarily used by Duty Schedulers and Real-Time Marketing)

- Use of H₂O (Limited Basin or Type III Optimization).
- Use of Machines (Plant or Type II)

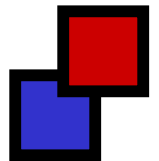


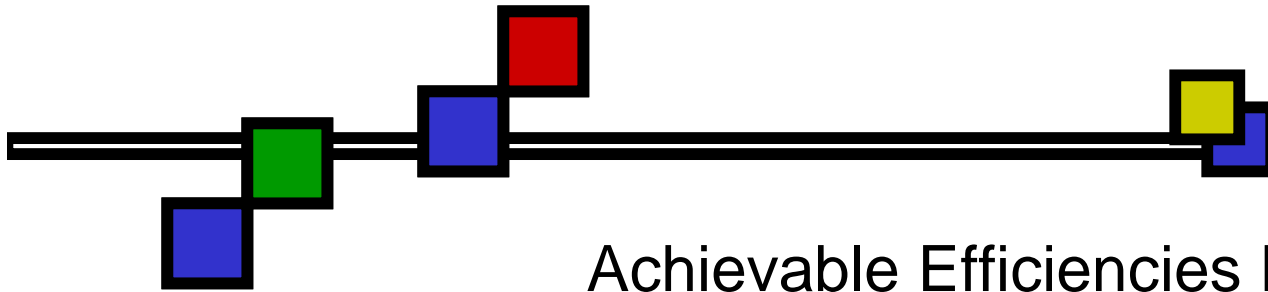


Increased Efficiencies Achievable
With Load Forecast Standard

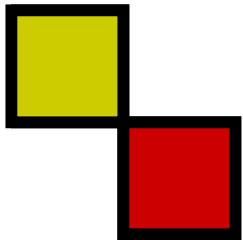


Graph deleted to keep file smaller.

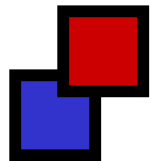


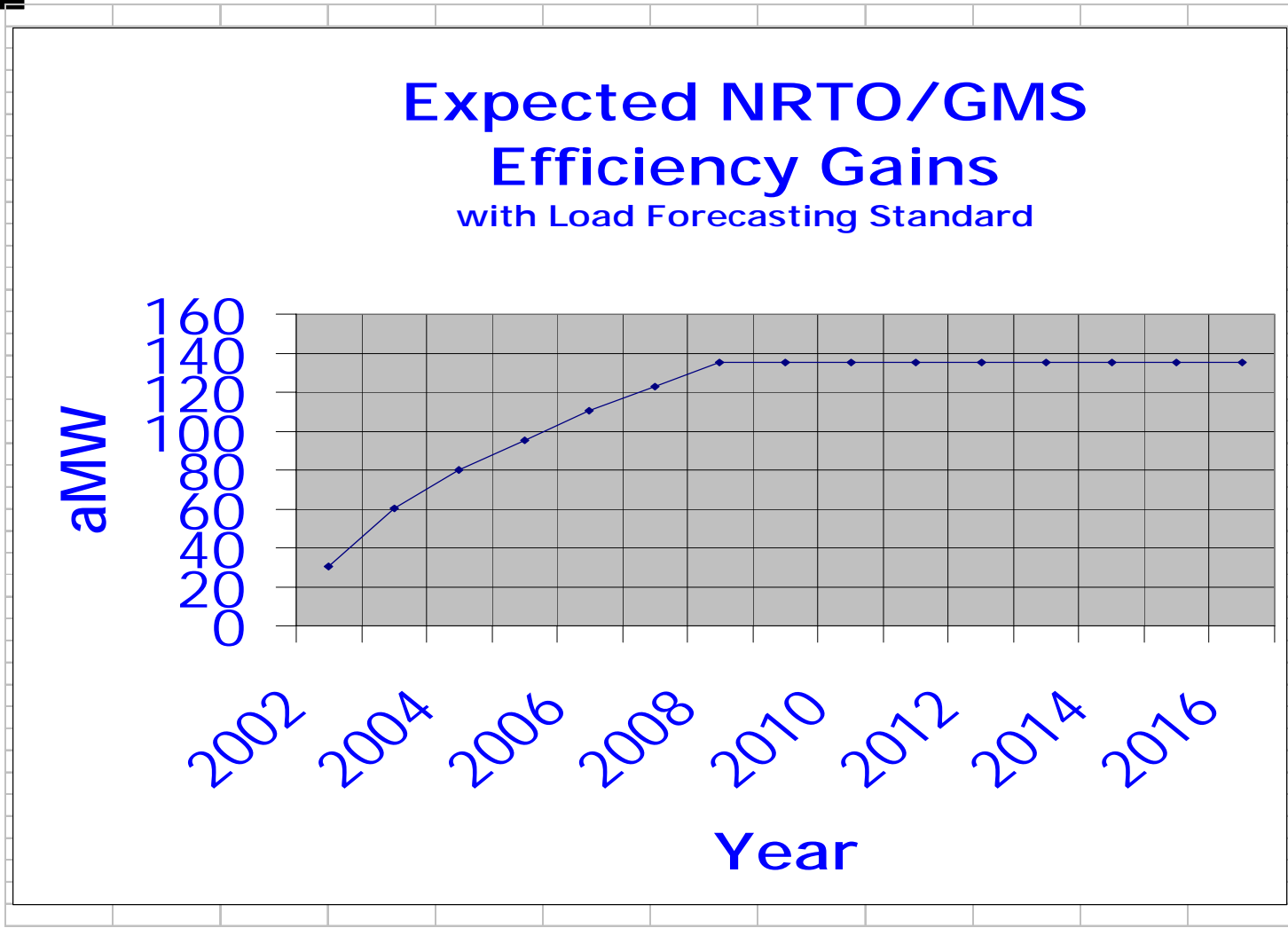
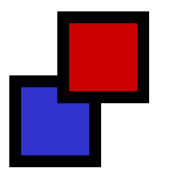
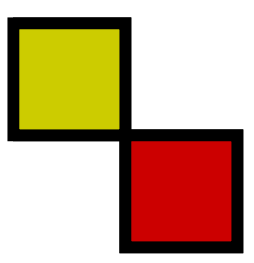
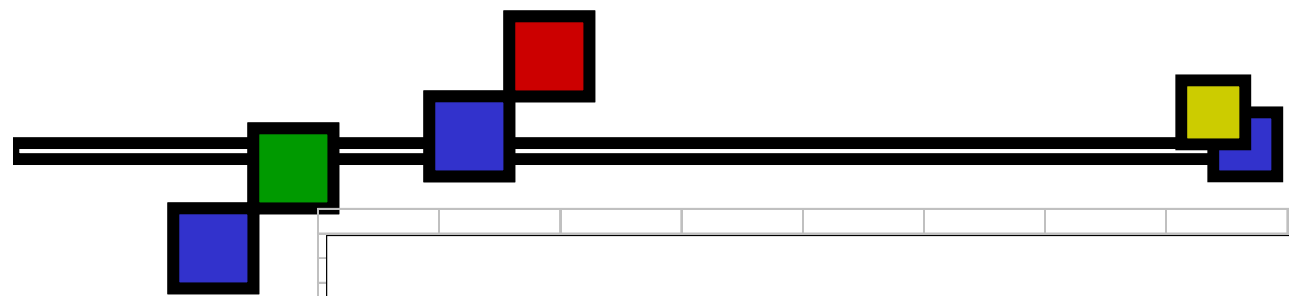


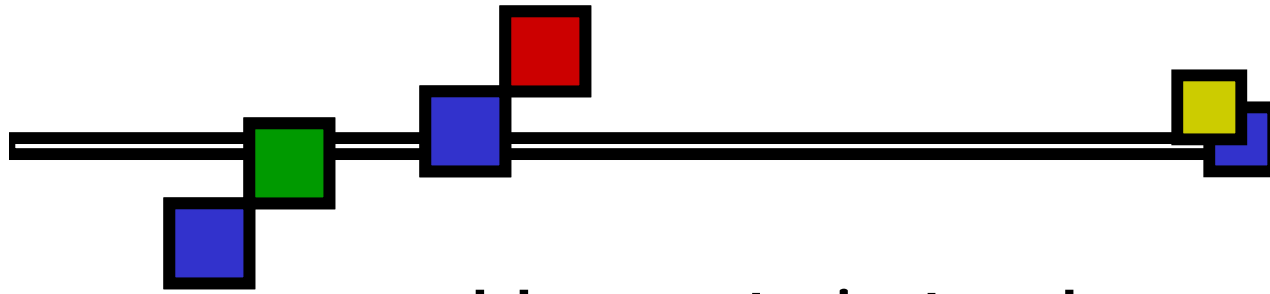
Achievable Efficiencies Decrease
Without Load Forecast Standard



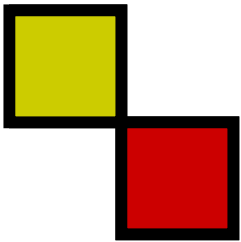
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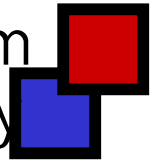


Uncertainty Jeopardizes Optimization Gains



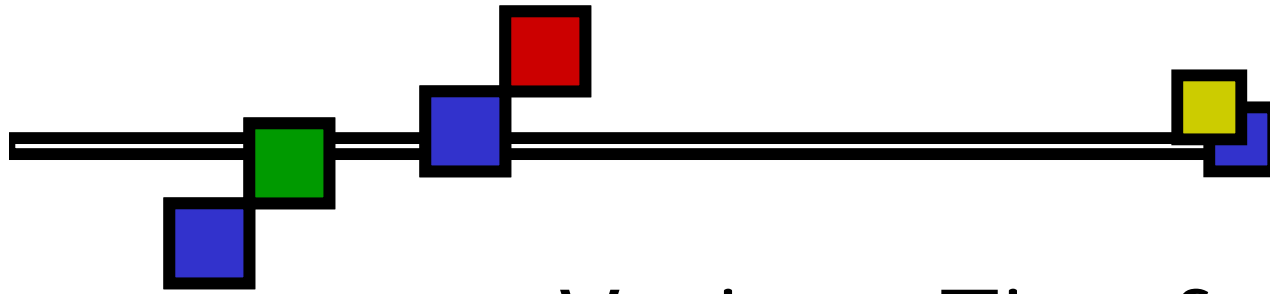
■ Runoff Uncertainty

- BPA uses state-of-the-art modeling that incorporates probabilistic methods and short-term weather prediction to decrease runoff uncertainty



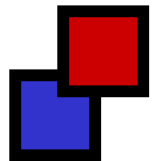
■ **Load Uncertainty**--most control over this uncertainty

- Load Forecasting Efficiency Project Underway to Improve BPA's Ability to Forecast Loads

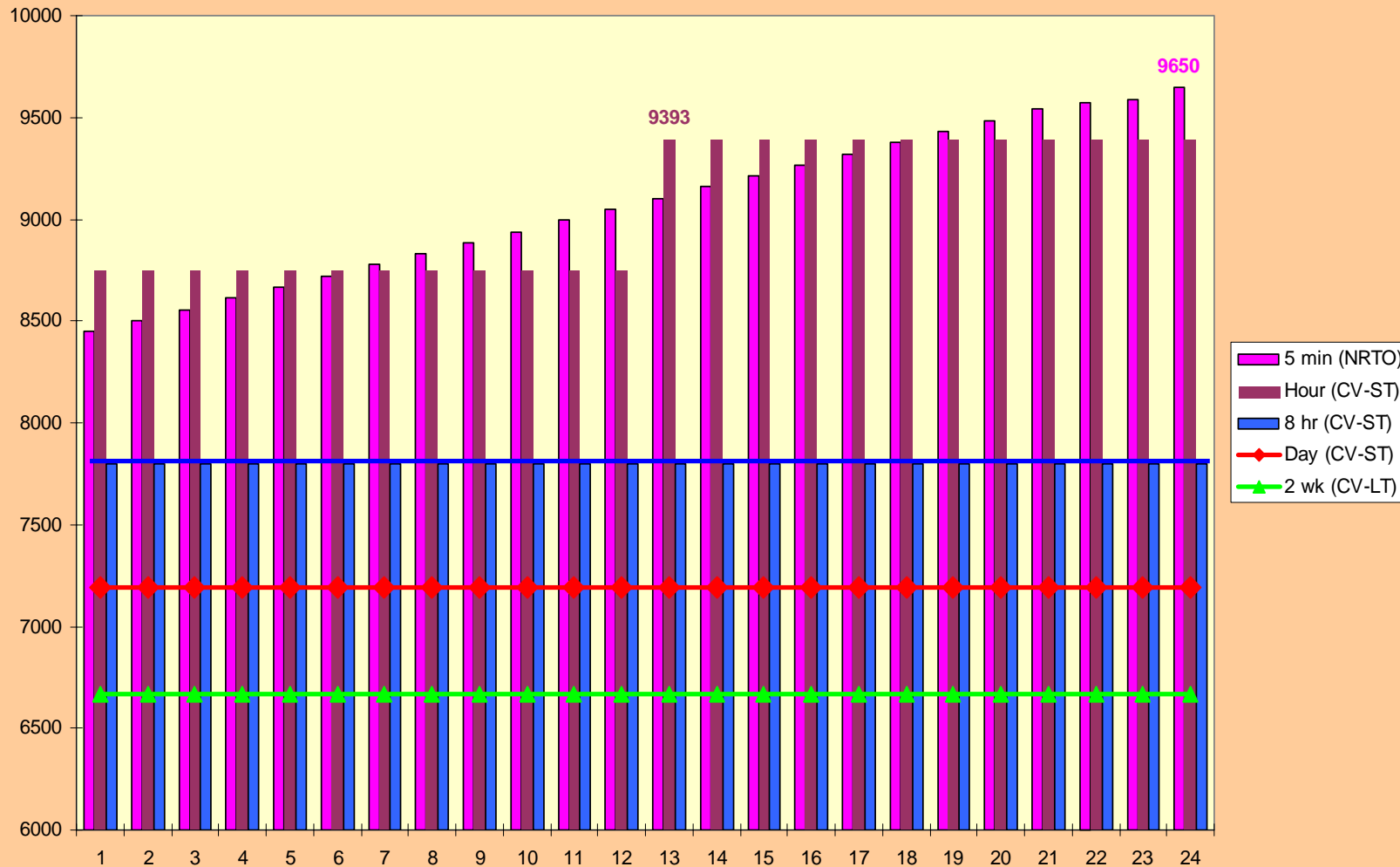


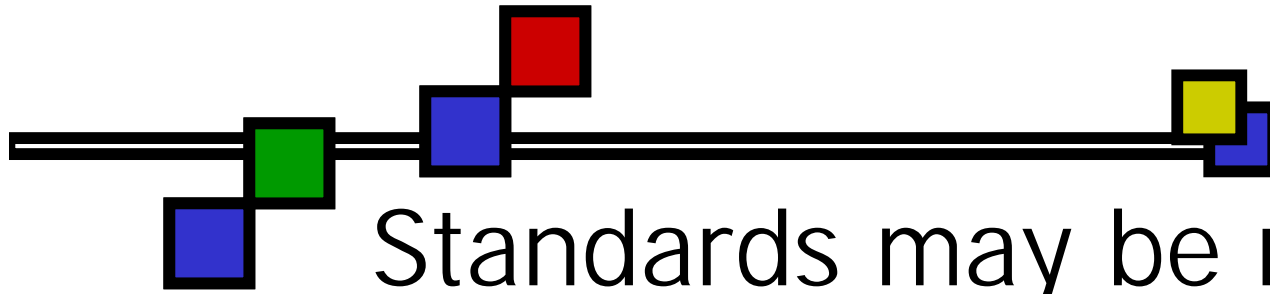
Various Timeframes for Load Forecasting

- 10-year horizon--White Book
- 6-year--Assured Operating Plan for Treaty Ops
- Long-term (18 months to 2 weeks)
- Short-term (2 weeks to day-ahead)
- Scheduling (Hour Ahead)
- **Expectation that ability to Load Forecast improves as timeframe becomes nearer term**



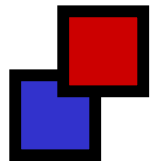
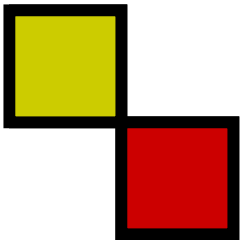
Load Granularity 2 hours in Time 5 Different Views

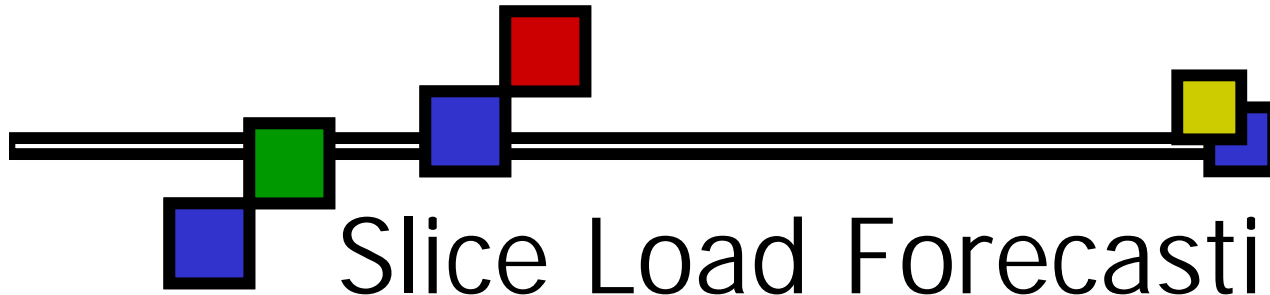




Standards may be needed to Achieve Efficiency Project Gains

- Load Forecasting improvements go hand-in-hand with Columbia Vista and Near-Real Time Optimizer Projects
- Although **no** Load Forecasting Standards set yet, current goal for short-term is + or - 2.5%
- RTO and/or SMD Initiatives may set Standard for day-ahead and hour-ahead timeframes
 - South Idaho Std: +/- 2 MW or 1.5% in hour ahead
- **Parity Expectation: PBL and Slice**
Customers would forecast loads using same standard.

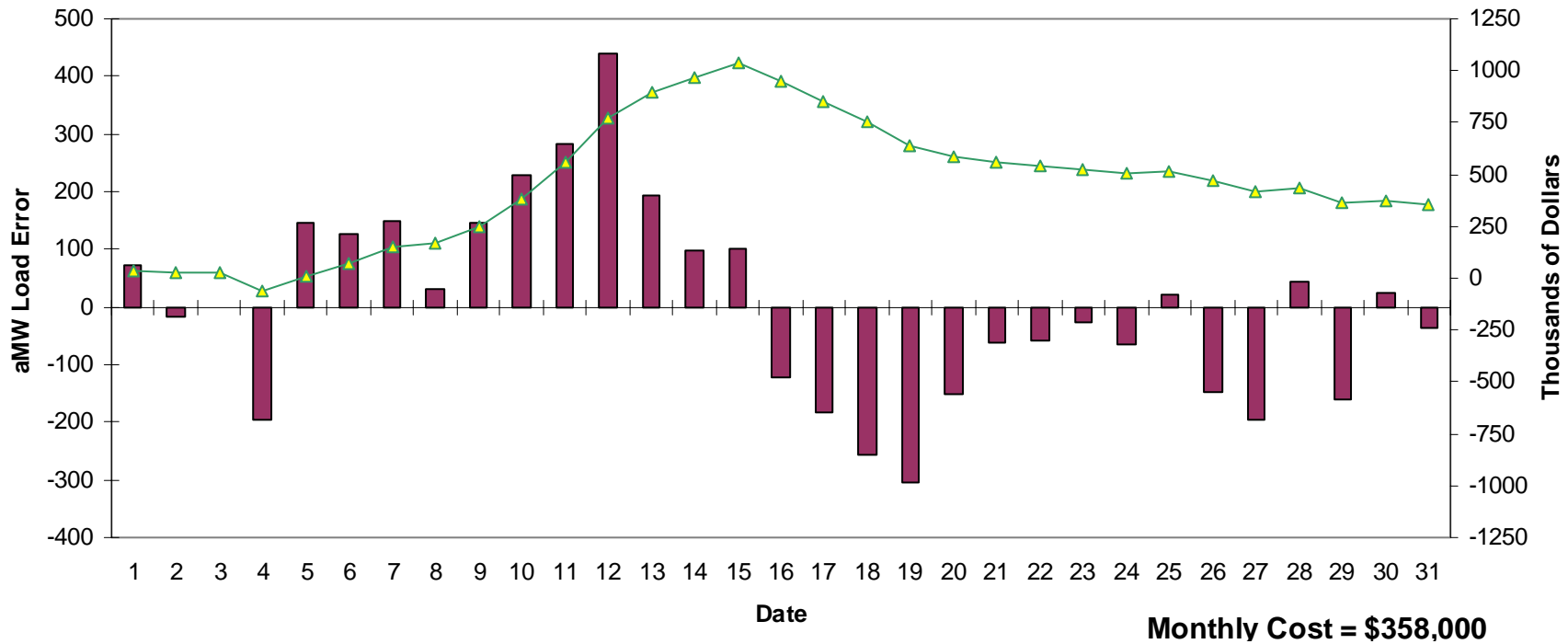




Slice Load Forecasting Issues to date

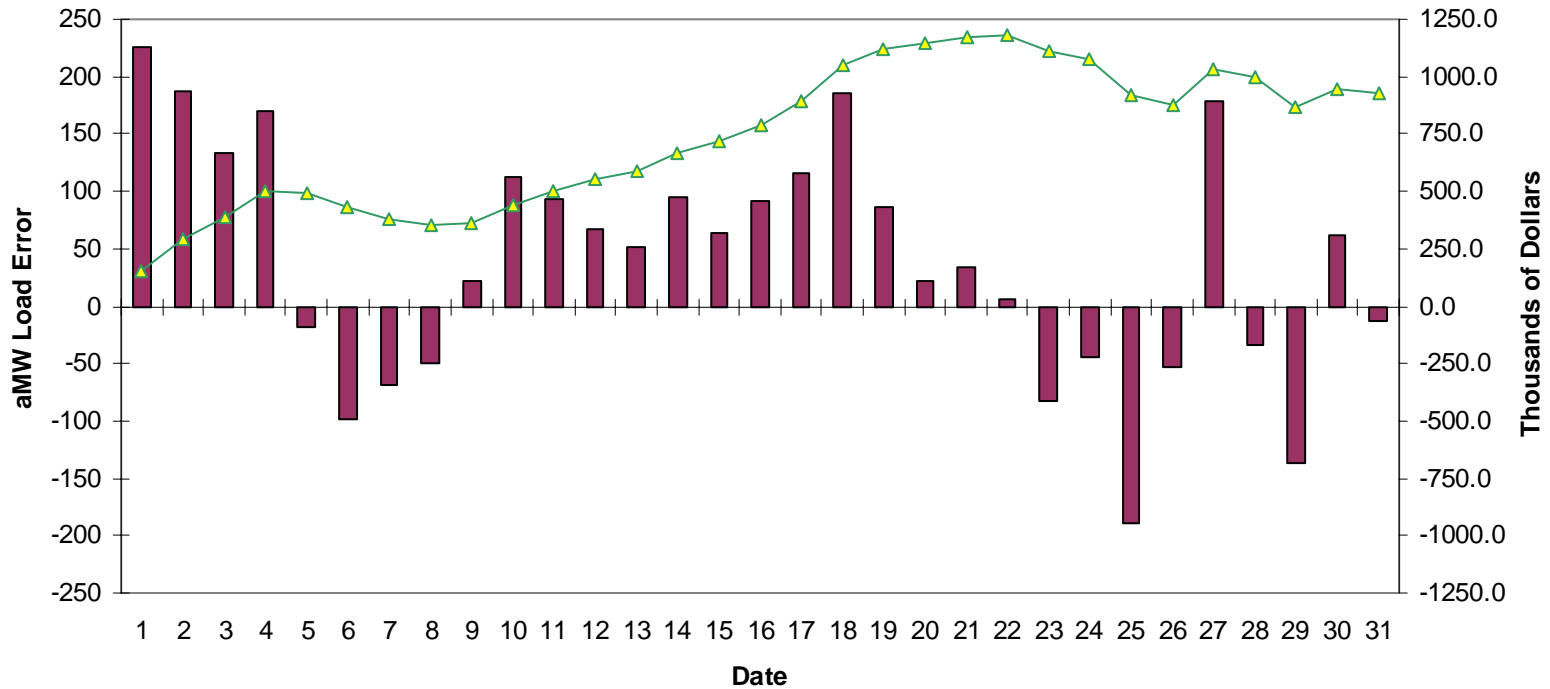
- Currently, the amount and quality of 7-Day Ahead Forecast Data from Slice Customers is insufficient to develop Week Ahead Forecast of Slice Load so a constant 22.6% is assumed
- Daily Fluctuations to this Assumption can be Significant
- At 22.6% Slice, the remaining FCRPS can absorb most of Variations, but as Slice % goes up, Cost goes up
- This type of uncertainty may impair Efficiency Gains from Columbia Vista

**WITHOUT LOAD FORECAST STANDARD:
May '02 Actual Slice Load vs Estimate, and Maximum Cost to PBL**



Actual Slice Load - 22.6% Net Gen
 Cumulative Cost in Thousands of Dollars

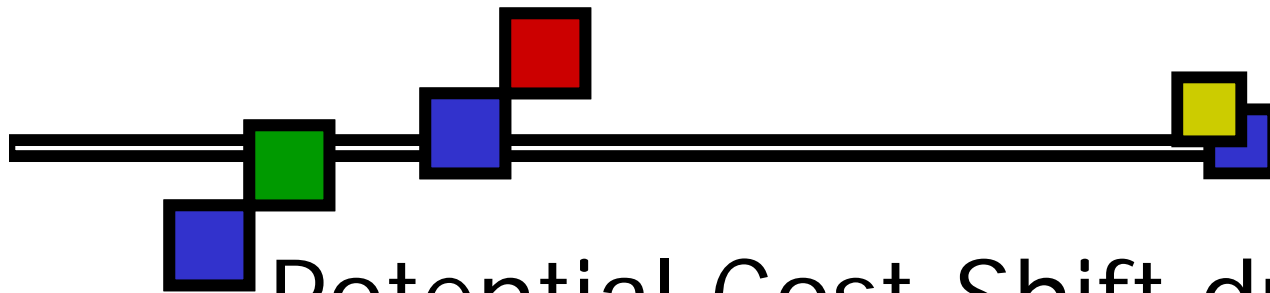
**WITHOUT LOAD FORECAST STANDARD:
October '02 Slice Load vs Estimate, and Maximum Cost to PBL**



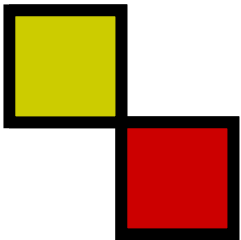
Total Cost = \$927,000

Actual Slice Load - 22.6% Net Gen

Cumulative Cost in Thousands of Dollars

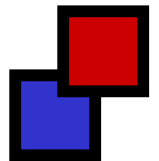
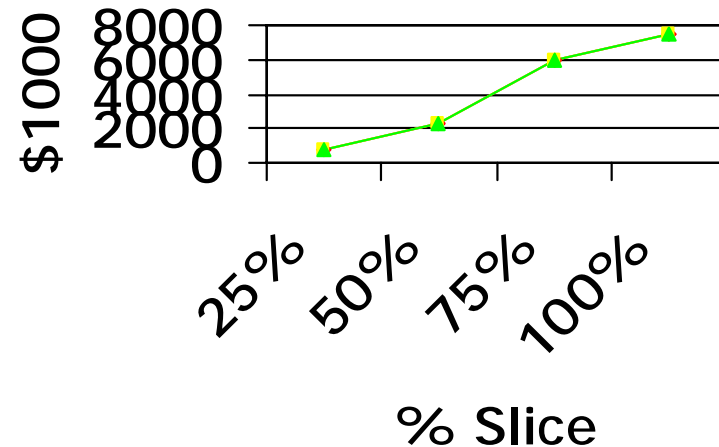


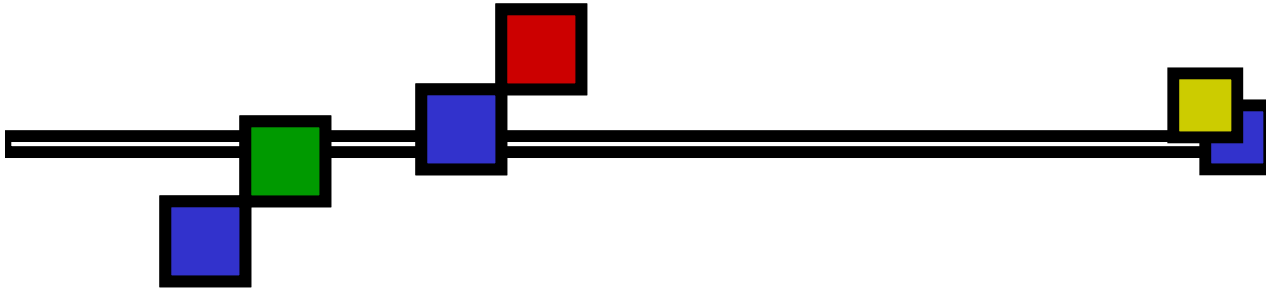
Potential Cost-Shift due to Week Ahead Load Forecast Error



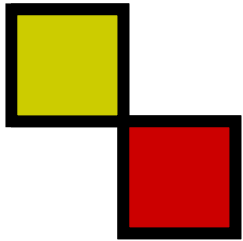
- Cursory Evaluation based on Anecdotal Information
- Does not include Potential Cost of Decreased Efficiency Gains from Columbia Vista

Without Standard Potential Cost of LF Error

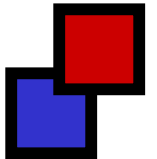




Scheduled vs. Actual Slice Load

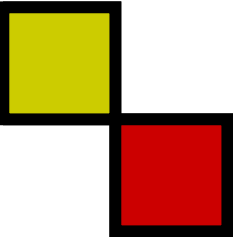


- Accurate Load Forecasting Important
 - To avoid Cost-Shift due to within Hour Energy Imbalance
 - To ensure benefits of Near-Real Time Optimizer

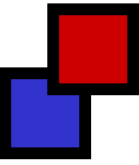


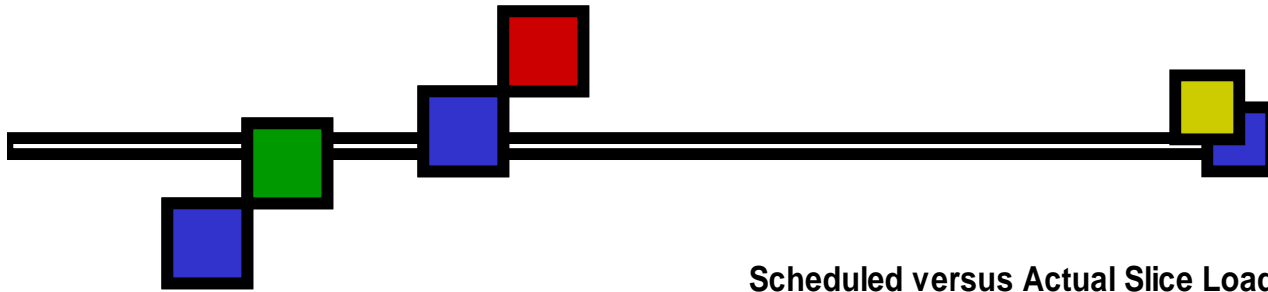


Comparison of Actual versus Scheduled Slice Load



January, 2002	Number of Hours	Percent of Hours	Average Deviation Outside Range	Maximum Deviation Outside Range
Above +/- 25% Range	21	2.8%	18.3MW	58.7MW (3.3% over range)
Within +/- 25% Range	575	77.3%	NA	NA
Below +/- 25% Range	148	19.9%	-29.5MW	-129.2MW (10.9% under range)





Scheduled versus Actual Slice Load --80% Sample

