Operating Reserves Rules

RMWG

November 16, 2005

Revised

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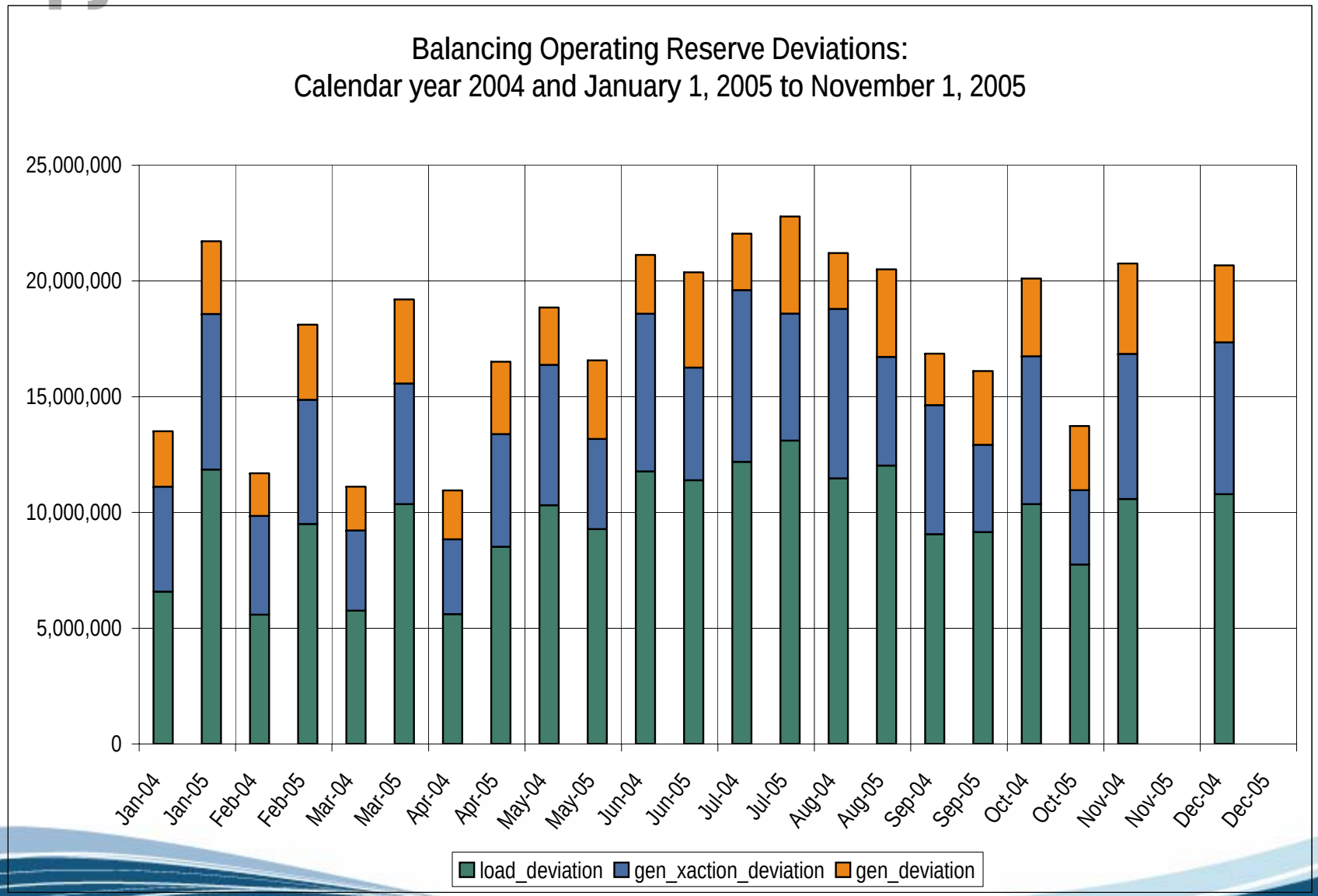
Market Monitoring Unit

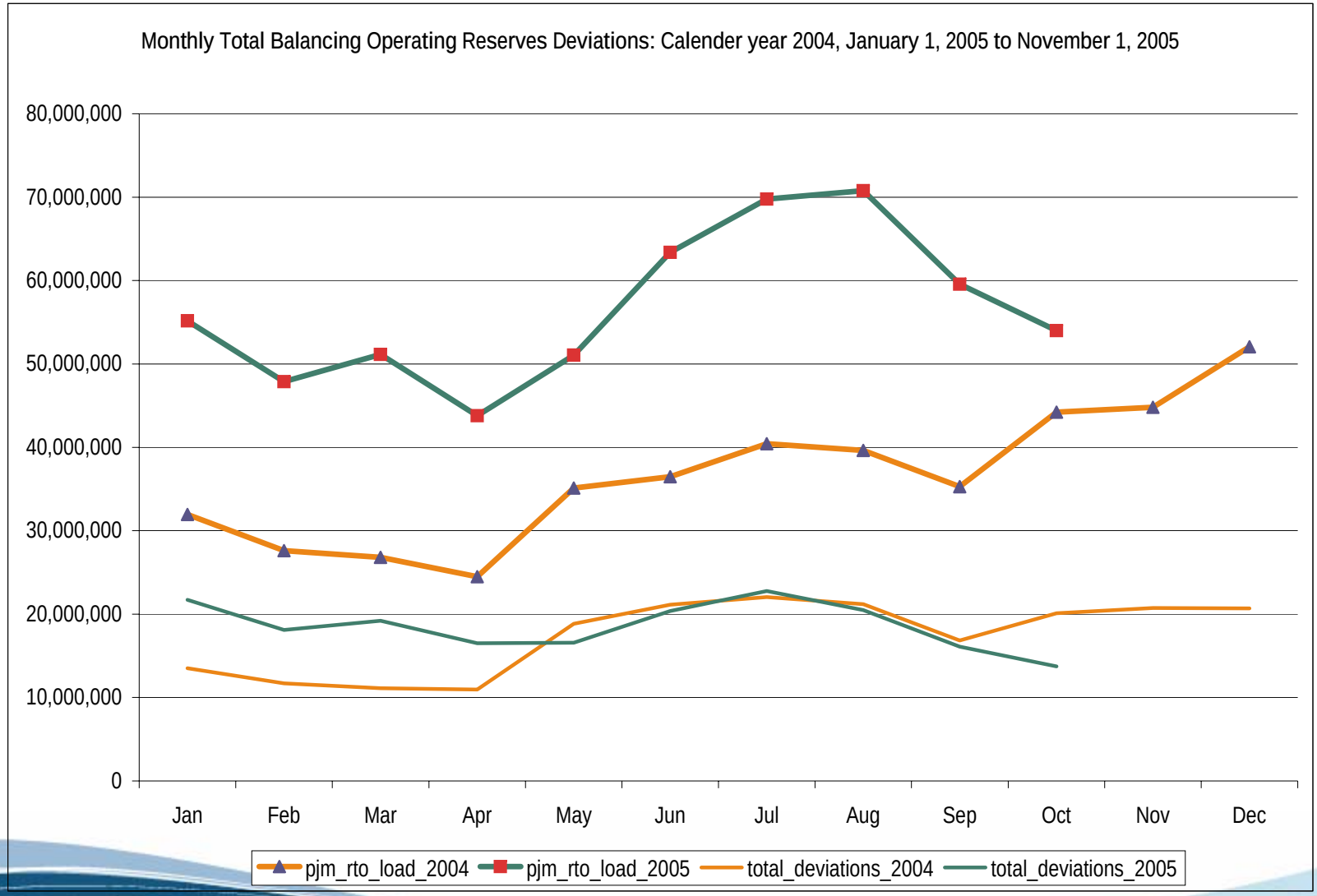
Operating Reserves Payments and Monthly Average Balancing Operating Reserves Rates

Month	Operating Reserve Payments ($)	Operating Reserve Payment as a percent of Total PJM Billings	Average Monthly Balancing Operating Reserves Rates
Jan-04	52,614,260.35	**6.57%**	2.97
Feb-04	18,606,774.01	**3.35%**	1.01
Mar-04	10,900,284.08	**2.03%**	0.46
Apr-04	15,384,926.93	**2.96%**	0.96
May-04	35,060,648.55	**4.90%**	1.41
Jun-04	44,365,902.56	**6.13%**	1.40
Jul-04	39,212,547.83	**4.36%**	1.11
Aug-04	37,548,758.69	**4.45%**	1.09
Sep-04	25,549,623.45	**3.68%**	0.89
Oct-04	31,332,037.76	**4.55%**	0.57
Nov-04	35,350,526.10	**4.56%**	0.75
Dec-04	68,978,719.92	**6.95%**	2.21
Jan-05	54,710,092.89	**4.64%**	1.72
Feb-05	26,818,691.15	**3.09%**	1.04
Mar-05	20,898,195.79	**2.01%**	0.81
Apr-05	16,365,871.44	**1.91%**	0.73
May-05	23,631,406.86	**1.96%**	0.90
Jun-05	64,192,257.80	**3.11%**	2.80
Jul-05	104,948,671.39	**3.79%**	4.32
Aug-05	87,785,171.96	**2.75%**	3.82
Sep-05	83,563,440.07	**3.24%**	4.78
Oct-05	103,833,680.75	**4.60%**	6.70

Balancing Operating Reserve Deviations



Balancing Operating Reserve Deviations



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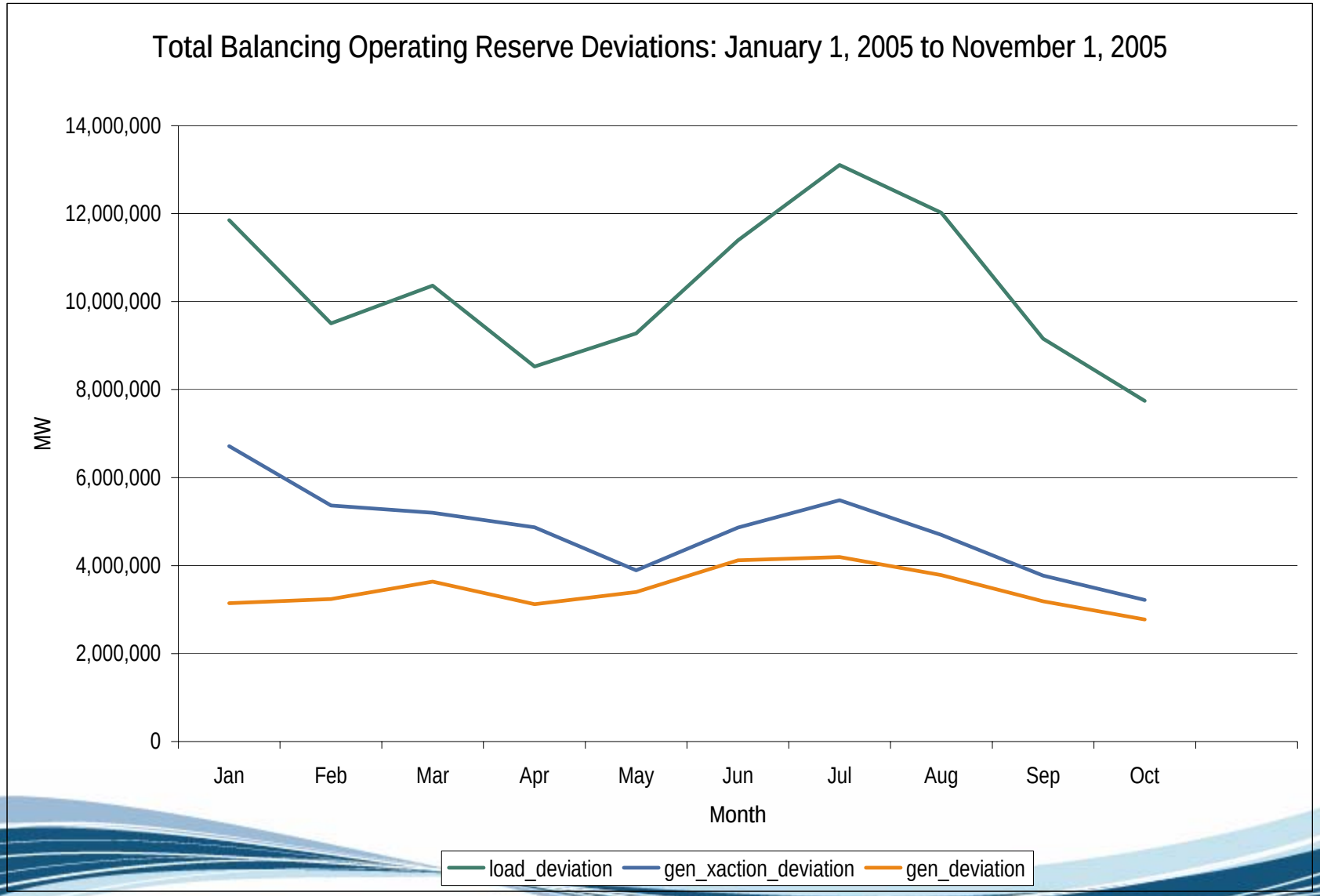
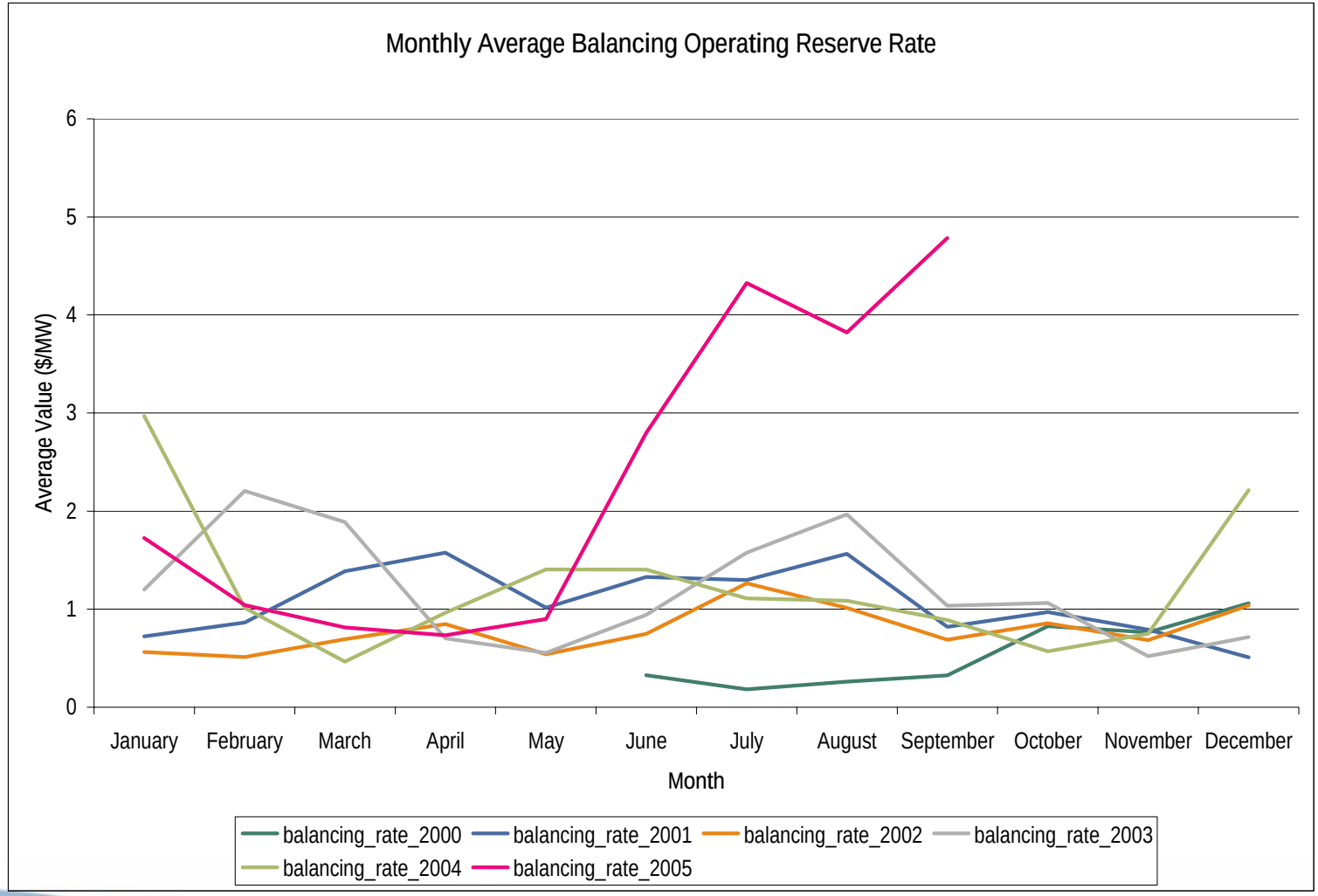
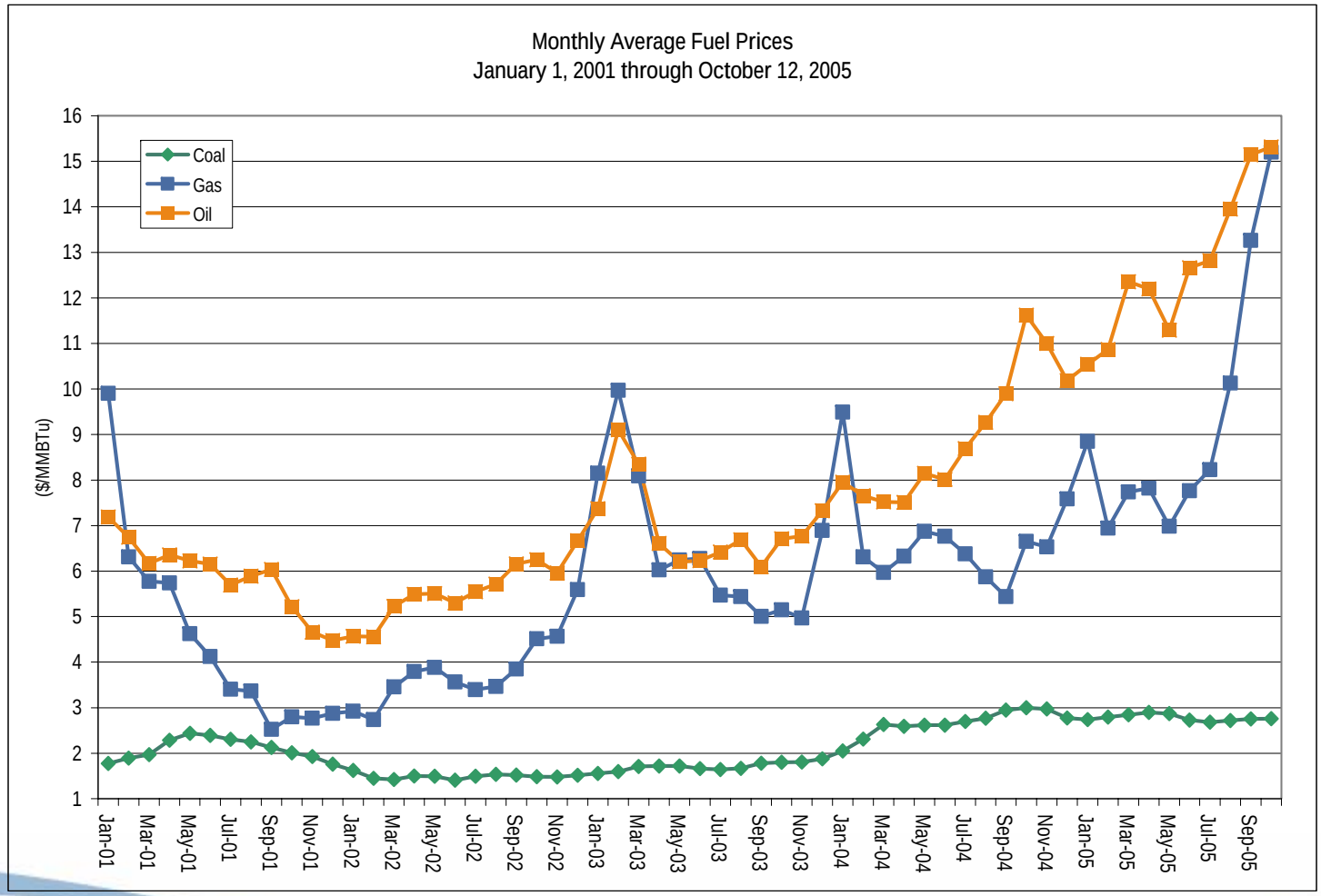


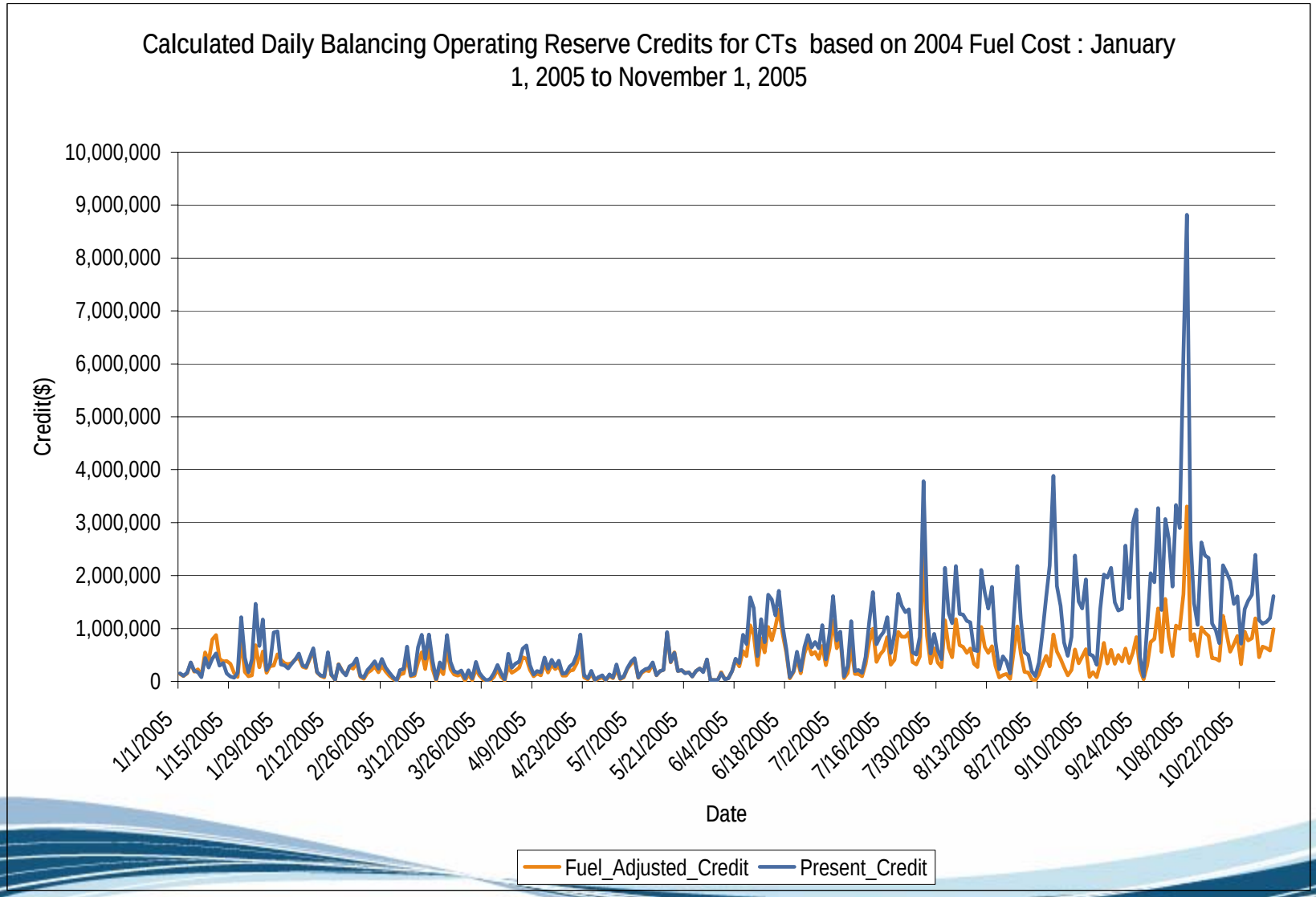
Monthly Average Balancing Operating Reserve Rate



Fuel Price Increases



Estimated Fuel Cost Impact on CT's Balancing Operating Reserve Credits in 2005



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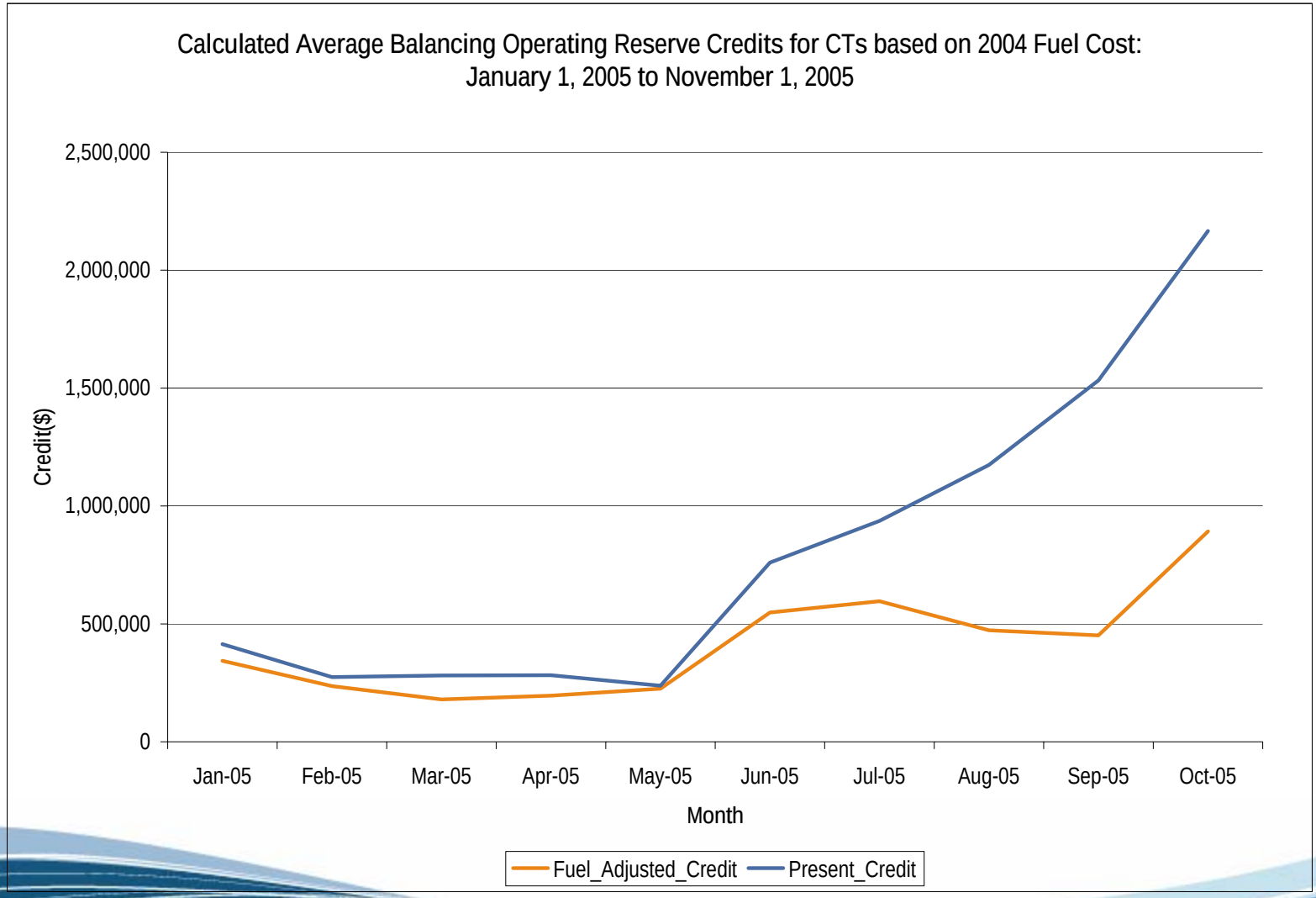


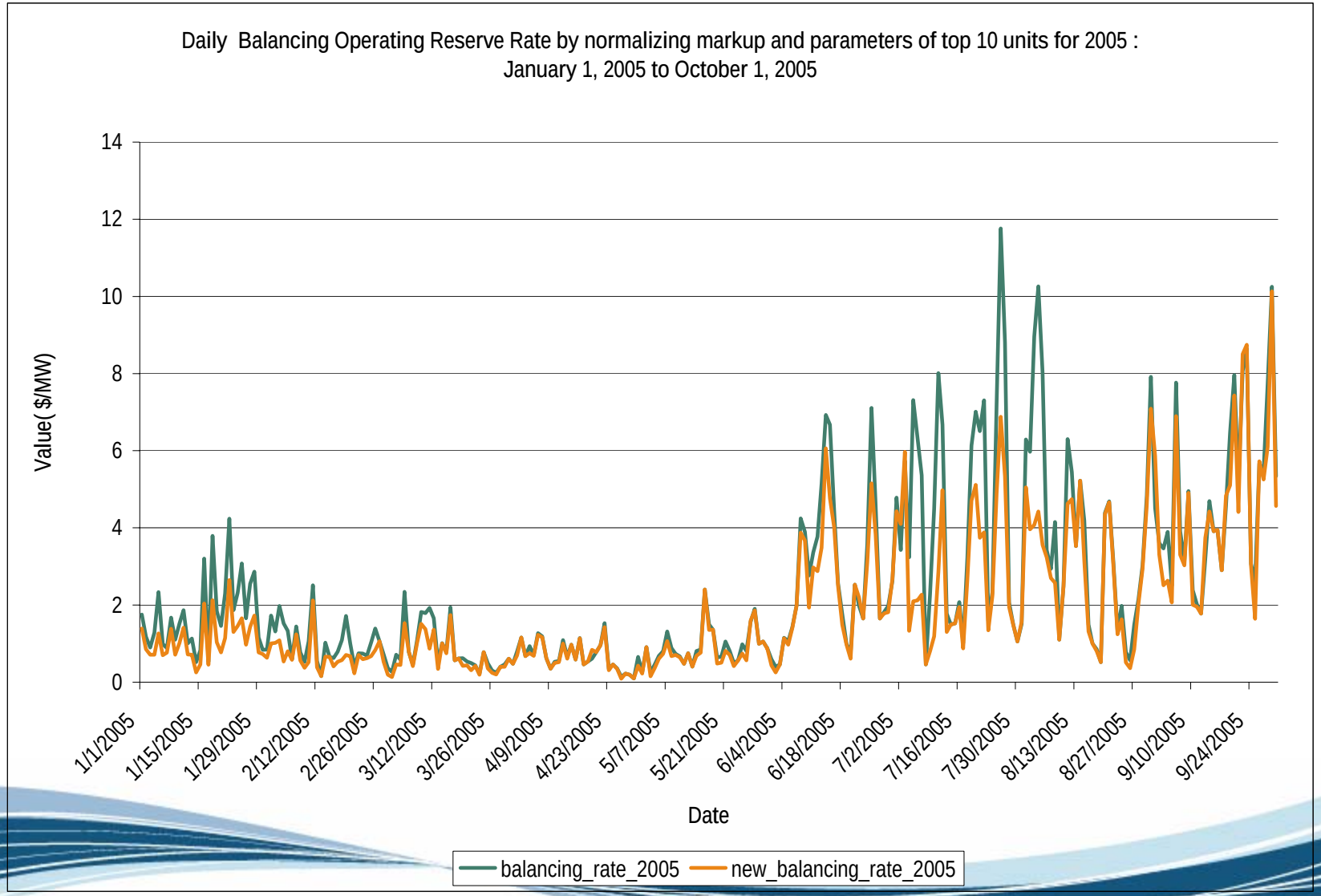
Monthly Average Rates Adjusted for CT Fuel Costs

Month	Present_Rate	Fuel_Adjusted_Rate
Jan-05	1.72	1.64
Feb-05	1.04	0.98
Mar-05	0.81	0.65
Apr-05	0.73	0.58
May-05	0.90	0.88
Jun-05	2.80	2.50
Jul-05	4.32	3.87
Aug-05	3.82	2.78
Sep-05	4.78	2.78
Oct-05	6.70	3.96

Monthly Credits Adjusted for CT Fuel Costs

Month	Fuel_Adjusted Credit	Fuel_Adjusted Cumulative Credit	Present_Balancing Credit	Present_Balancing Cumulative Credit
Jan-05	$35,697,829	$35,697,829	$37,895,417	$37,895,417
Feb-05	$17,927,146	$53,624,974	$18,965,471	$56,860,889
Mar-05	$12,209,993	$65,834,967	$15,360,115	$72,221,003
Apr-05	$9,507,413	$75,342,380	$12,110,506	$84,331,509
May-05	$14,278,329	$89,620,709	$14,646,225	$98,977,734
Jun-05	$51,717,278	$141,337,988	$58,066,578	$157,044,312
Jul-05	$89,054,383	$230,392,370	$99,637,963	$256,682,275
Aug-05	$59,310,260	$289,702,630	$81,020,541	$337,702,816
Sep-05	$43,715,856	$333,418,486	$76,143,552	$413,846,368
Oct-05	$56,880,659	$390,299,145	$96,352,636	$510,199,003

Balancing Operating Reserve Rate by normalizing markup and parameters of top 10 units for 2005



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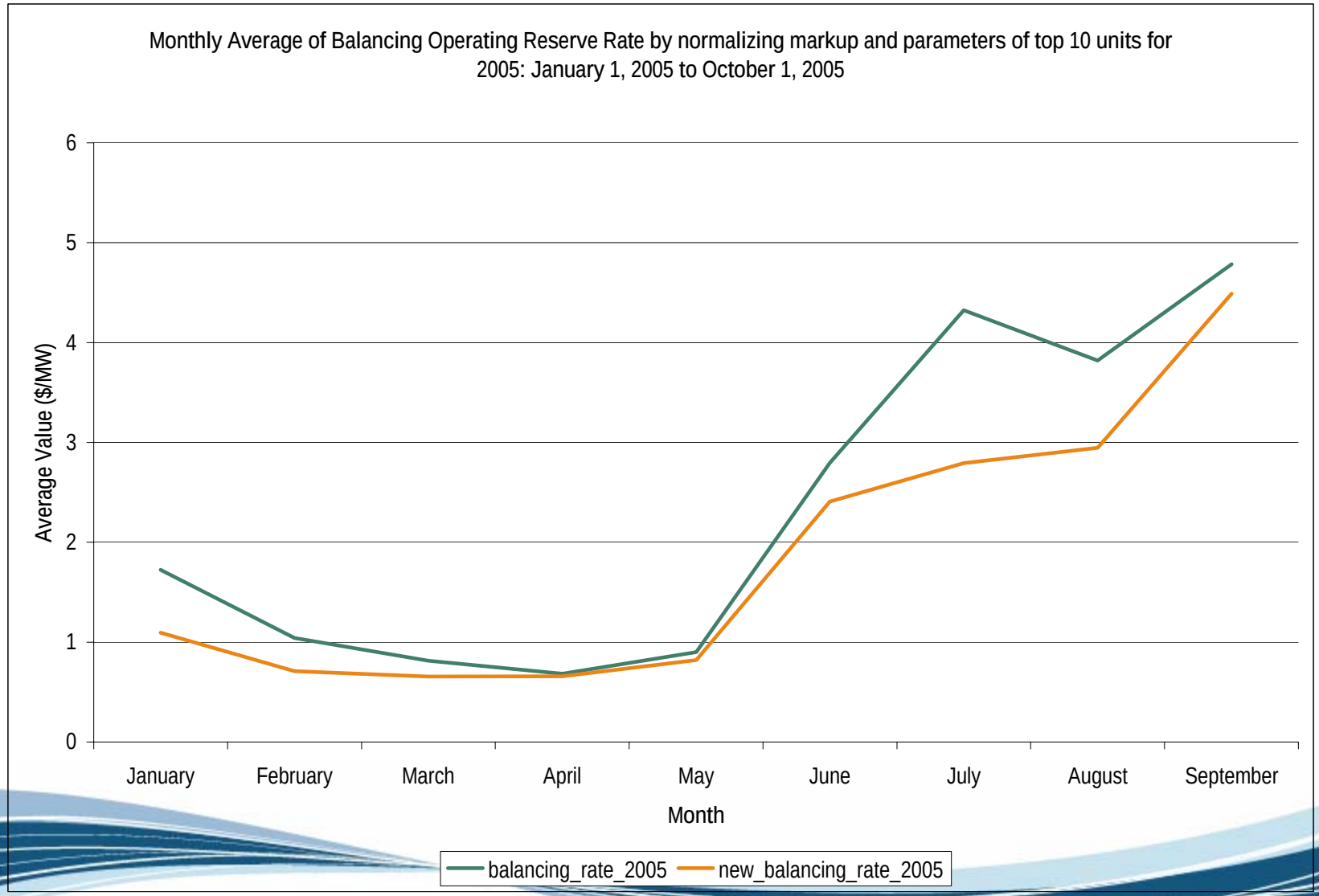


- Current:
  - No rules that address the operating parameters of units selected for operating reserves
- Proposed:
  - Maintain unit parameters at levels based on physical characteristics – defined by actual PJM market offers
  - PJM calculations based on actual market data, excluding outliers
  - Notification of PJM in instances of parameter changes
  - PJM defines a set of unit parameter levels with an acceptable range
  - Operating Reserves Credits limited to units with defined parameters
  - Exceptions on a case by case basis

Definitions of Operating Parameters

•Minimum Down Time — The minimum number of hours between starts, calculated as the difference between when the unit shuts-down and the next time the unit is put online, as measured by telemetry available to PJM.

•Minimum Run Time — The minimum number of hours a unit must run, from the time the unit is put online to the time the unit is shut down (as measured by PJM's state estimator).

•Maximum Daily Starts — The maximum number of times that a unit can be started in a day under normal operating conditions.

•Hot to Cold Time — The amount of time, in hours, after shutdown that a hot temperature state unit takes to cool down to cold temperature state.

•Hot to Warm Time — The amount of time, in hours, after shutdown that a hot temperature state unit takes to cool down to warm temperature state.

•Warm Start Time — The time interval, measured in hours, from the actual unit start sequence to the unit breaker closing for a generating unit in its warm temperature state.

Definitions of Operating Parameters

•Cold Start Time — The time interval, measured in hours, from the actual unit start sequence to the unit breaker closing for a generating unit in its cold temperature state.

•Hot Start Time — The time interval, measured in hours, from the actual unit start sequence to the unit breaker closing for a generating unit in its hot temperature state.

•Warm Notification Time — The time interval between PJM notification and the start sequence of a generating unit that is currently in its warm temperature state.

•Cold Notification Time — The time interval between PJM notification and the start sequence of a generating unit that is currently in its cold temperature state.

•Hot Notification Time — The time interval between PJM notification and the start sequence of a generating unit that is currently in its hot temperature state.

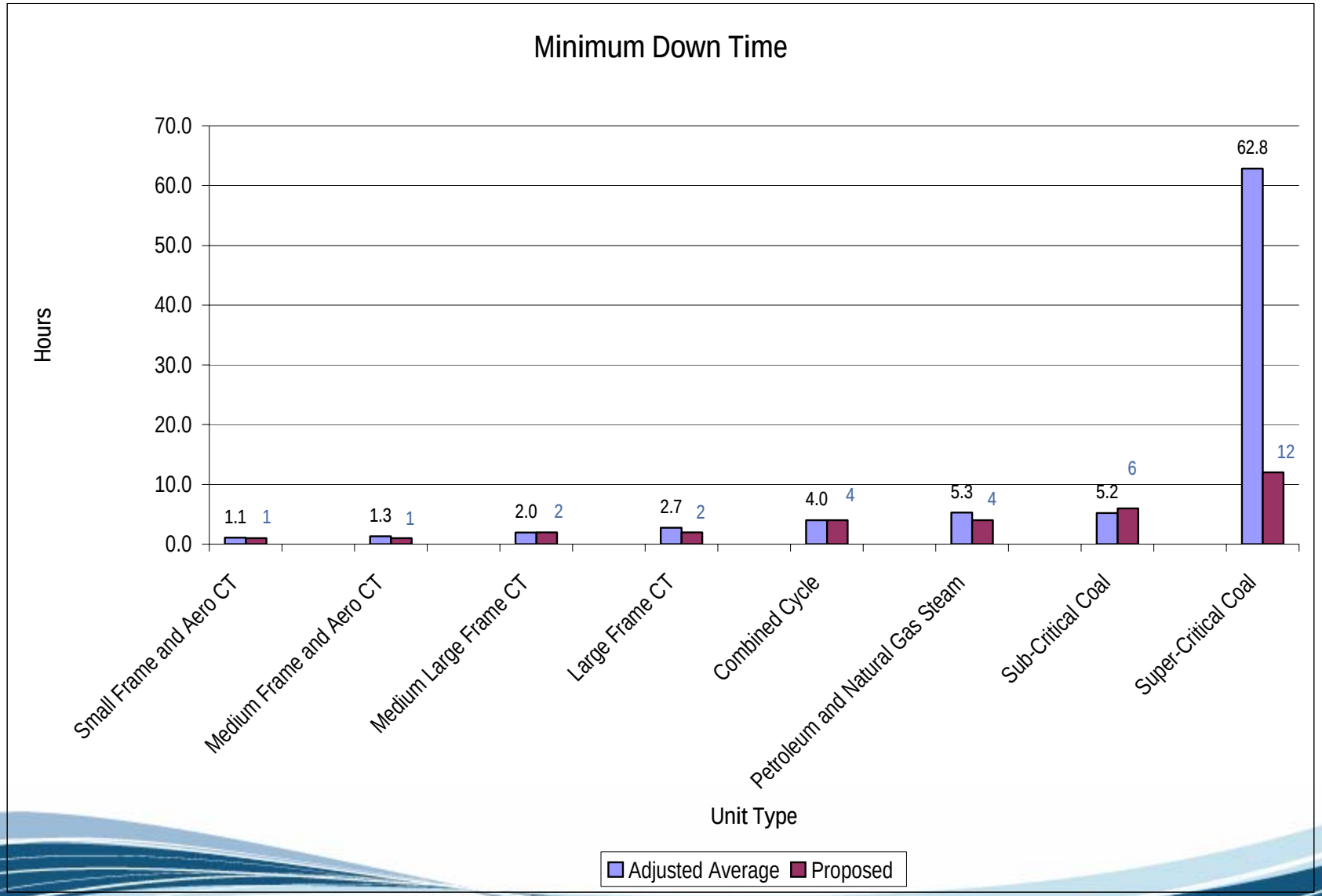
•Ramp Time — Change in MW per minute as a percent of ICAP capability in a generators output level.

eMKT User Guide - http://www.pjm.com/etools/downloads/emkt/ts-userguide.pdf

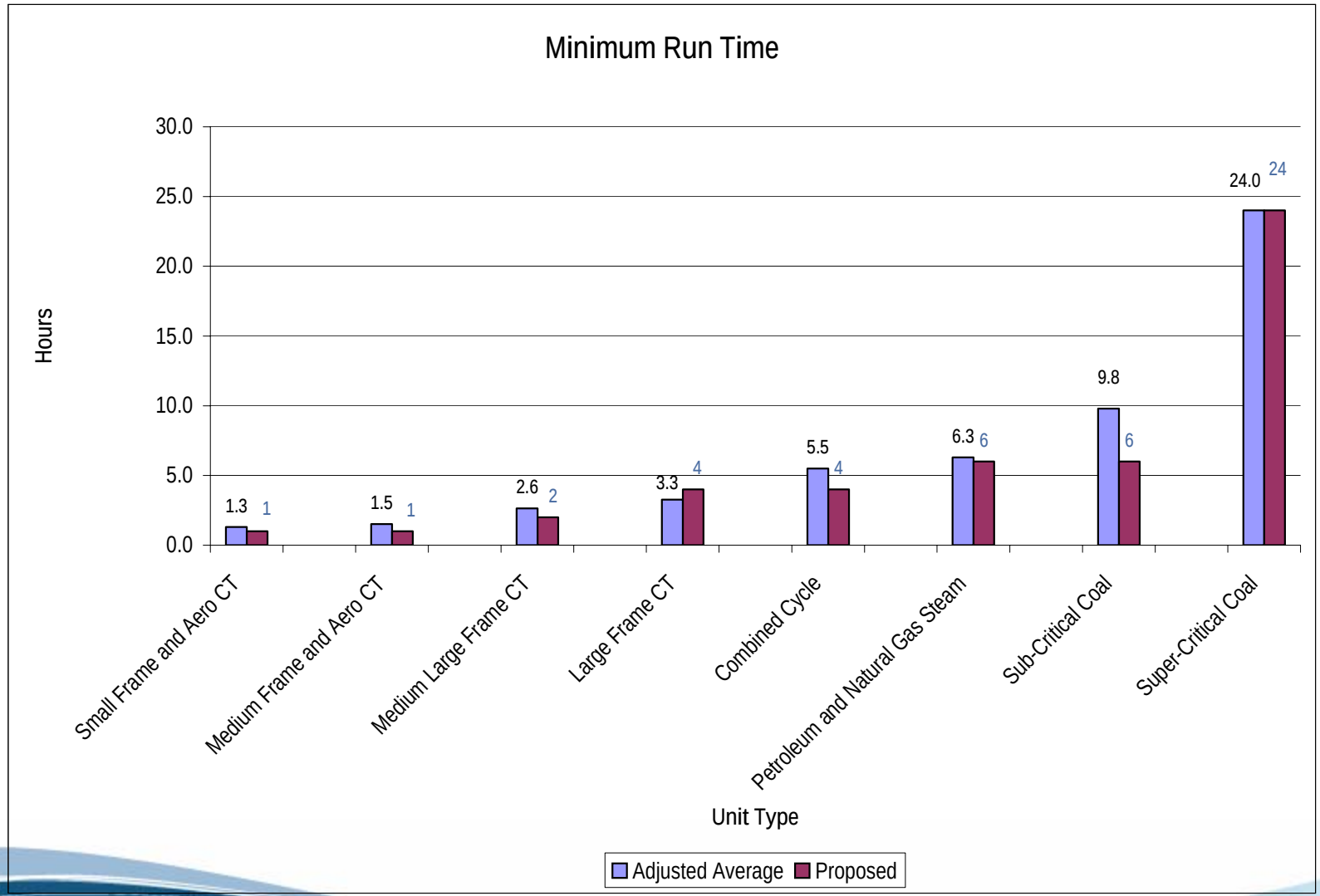
Number of Units Analyzed for Proposed Changes

PJM Units Surveyed	No. of Units	MW
Small Frame and Aero CT Units Up to 29 MW	133	2,462
Medium Frame and Aero CT Units 30 MW to 65 MW	154	7,190
Medium Large Frame CT Units 65 MW to 125 MW	99	8,907
Large Frame CT Units 135 MW to 180 MW	66	10,346
Combined Cycle Plants	45	19,922
Petroleum and Natural Gas Steam Plants	91	12,835
Sub-Critical Coal Plants	194	44,647
Super-Critical Coal Plants	38	24,601
Total Surveyed	820	130,910
Units Not Surveyed		
Hydro	157	
Nuclear	31	
Diesel	58	
Outside PJM	40	
Wind	6	
On Outage or No Offer	40	
Retired	47	
Total Units Not Surveyed	379	
Total Units	1,199	

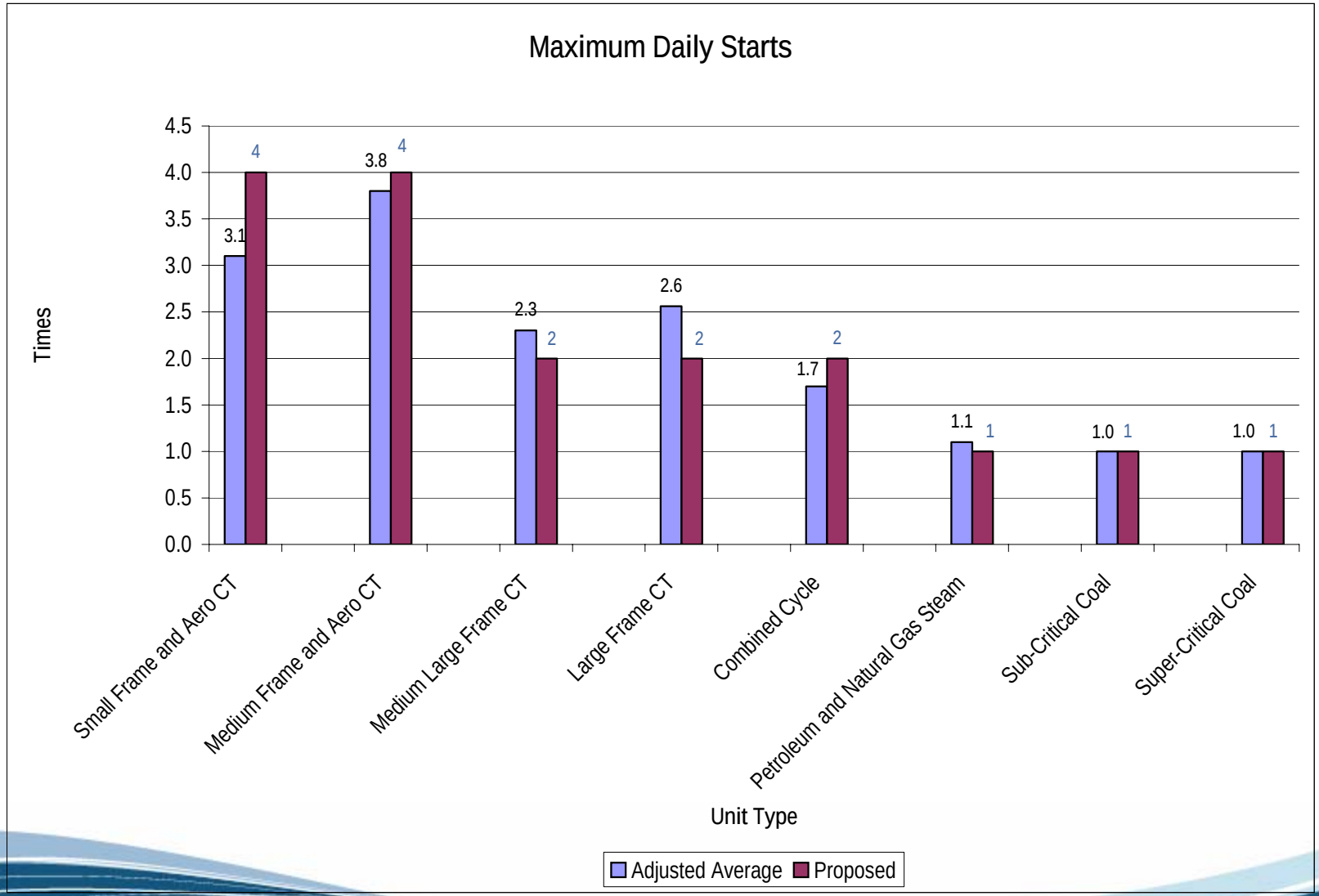
Minimum Down Time



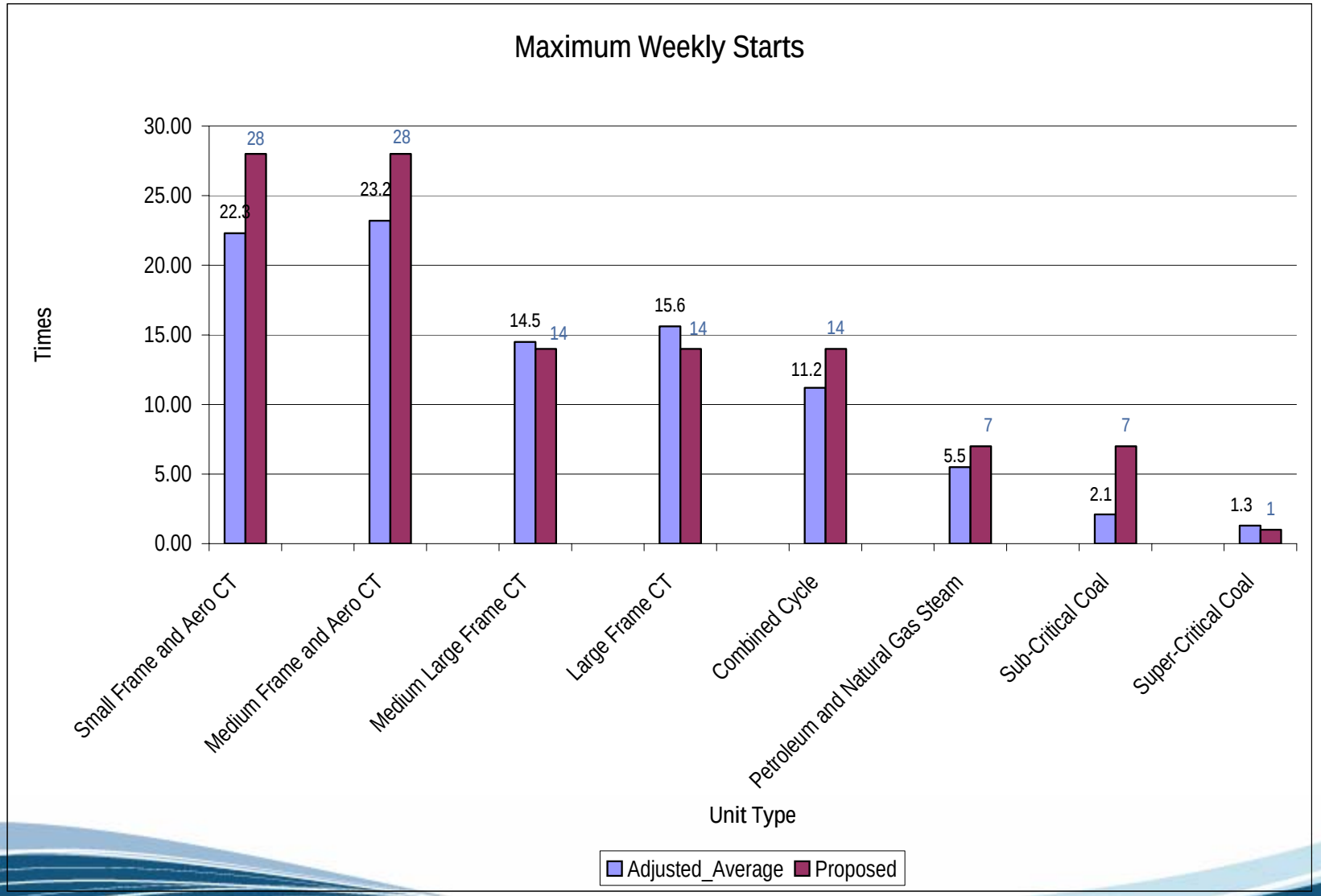
Minimum Run Time



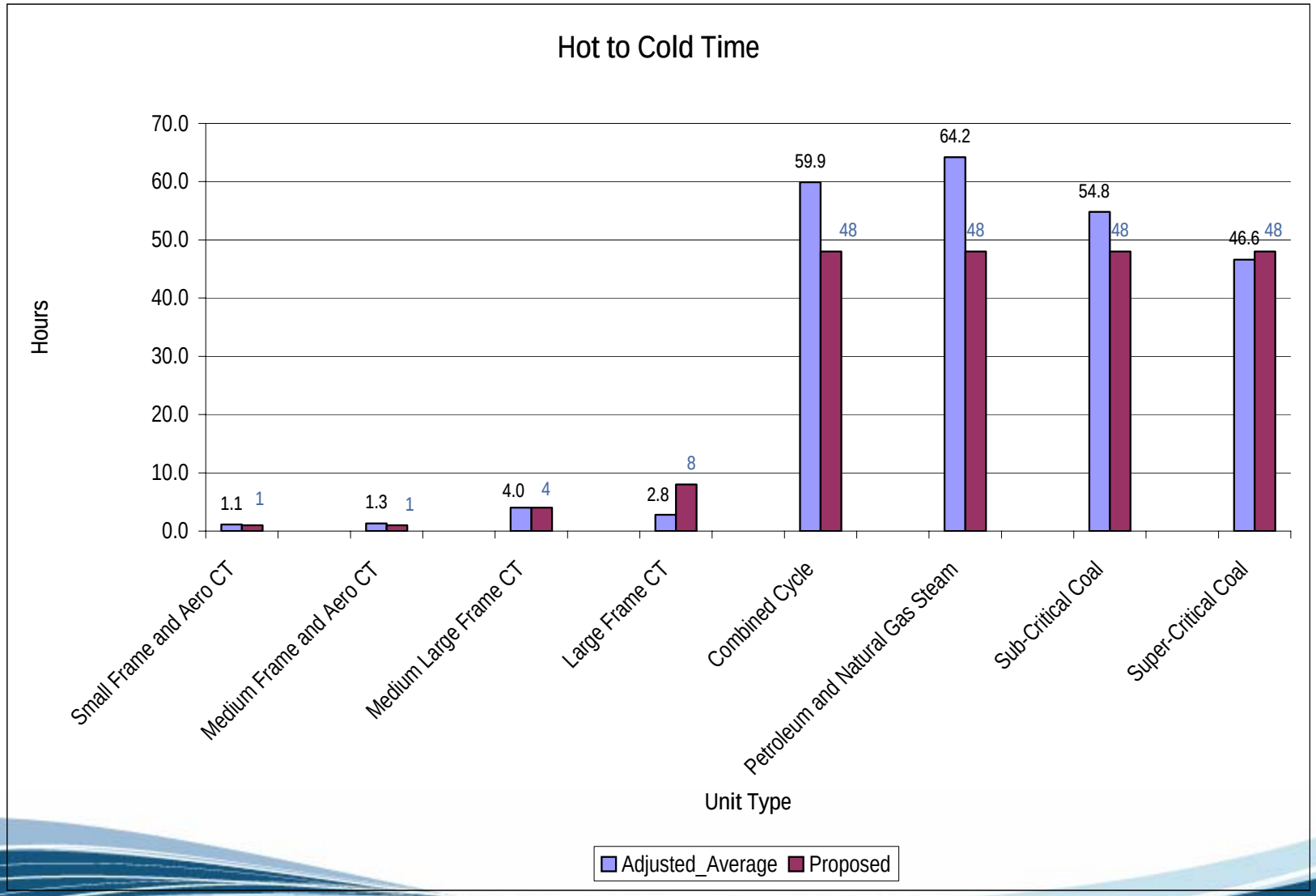
Maximum Daily Starts



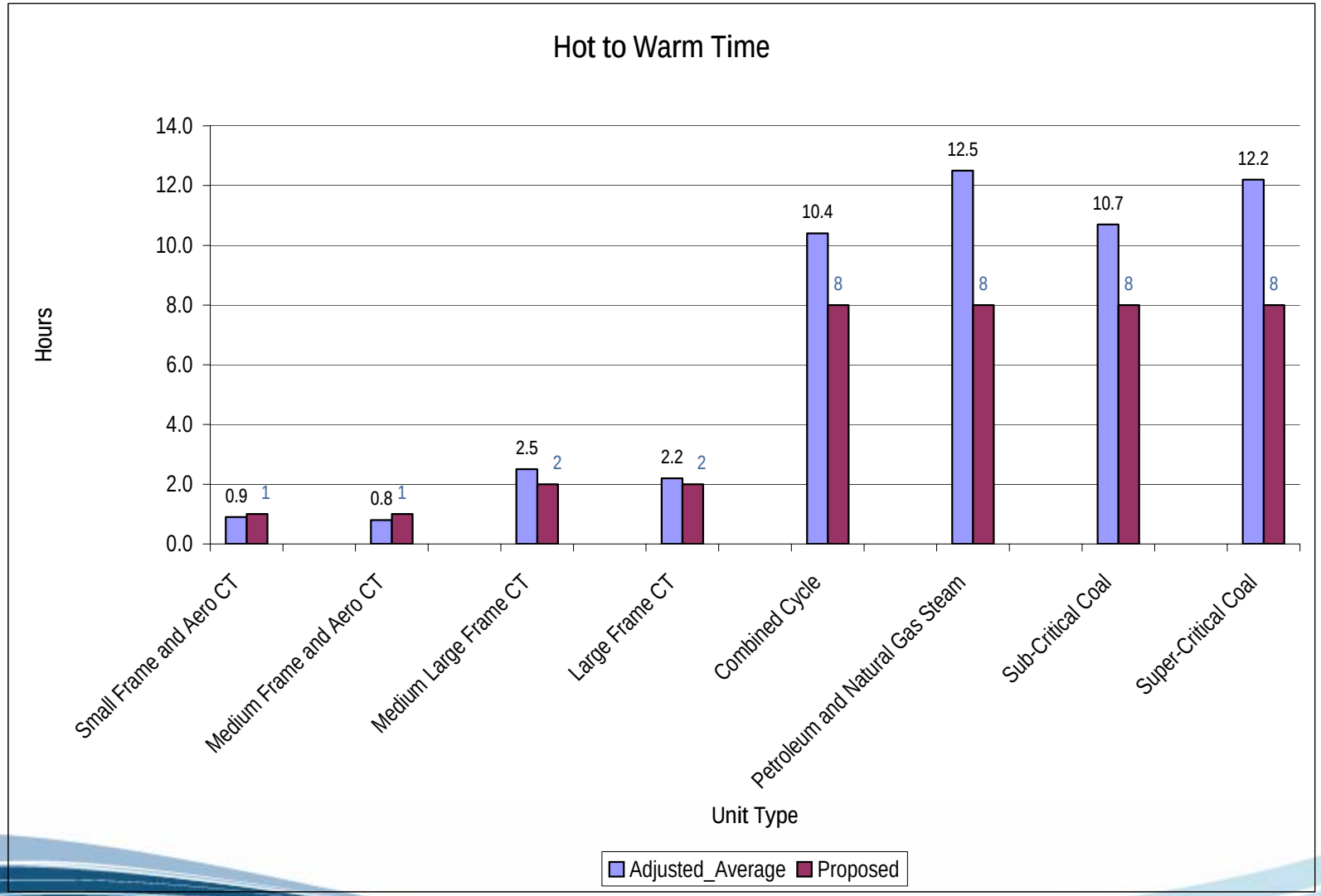
Maximum Weekly Starts



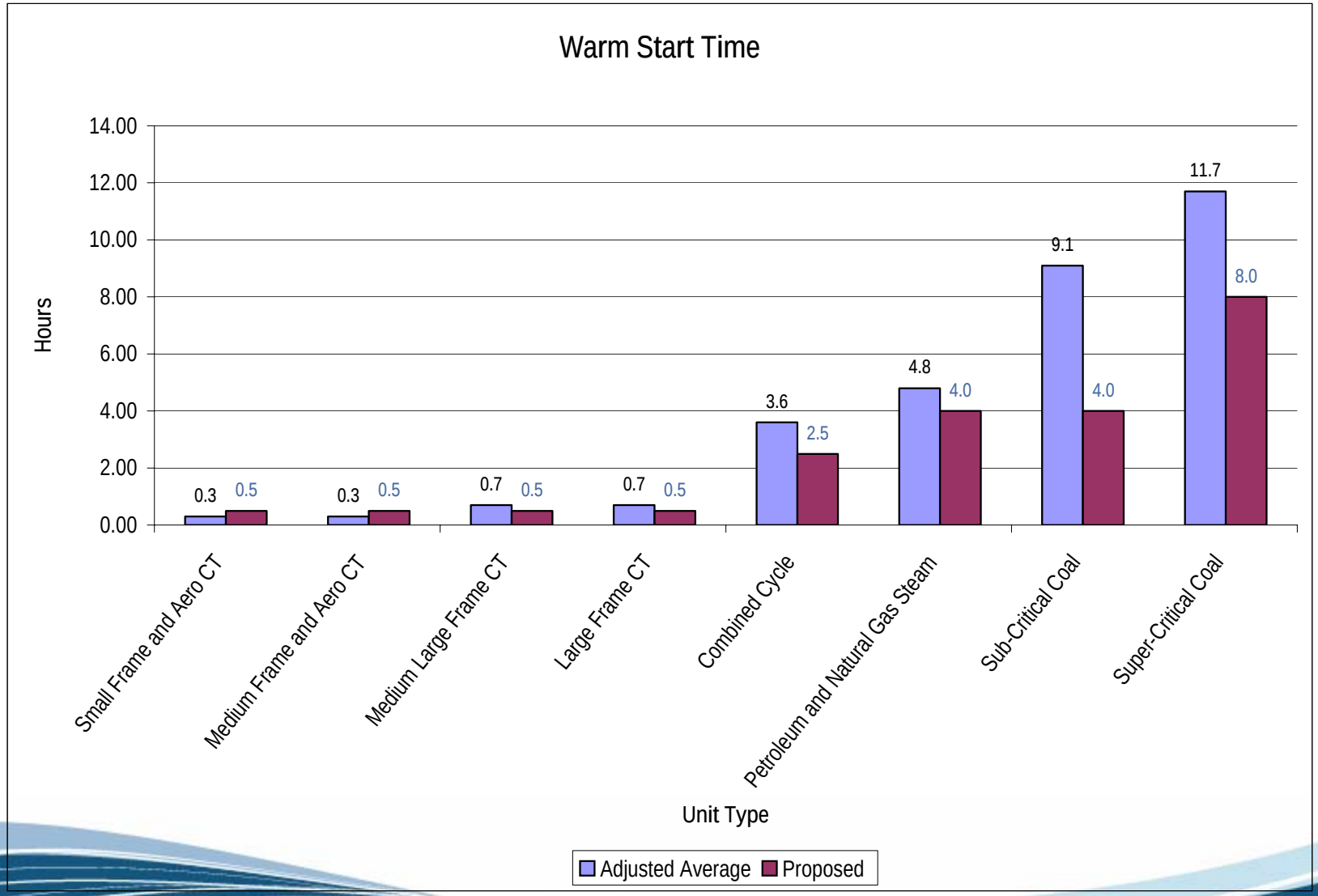
Hot to Cold Time



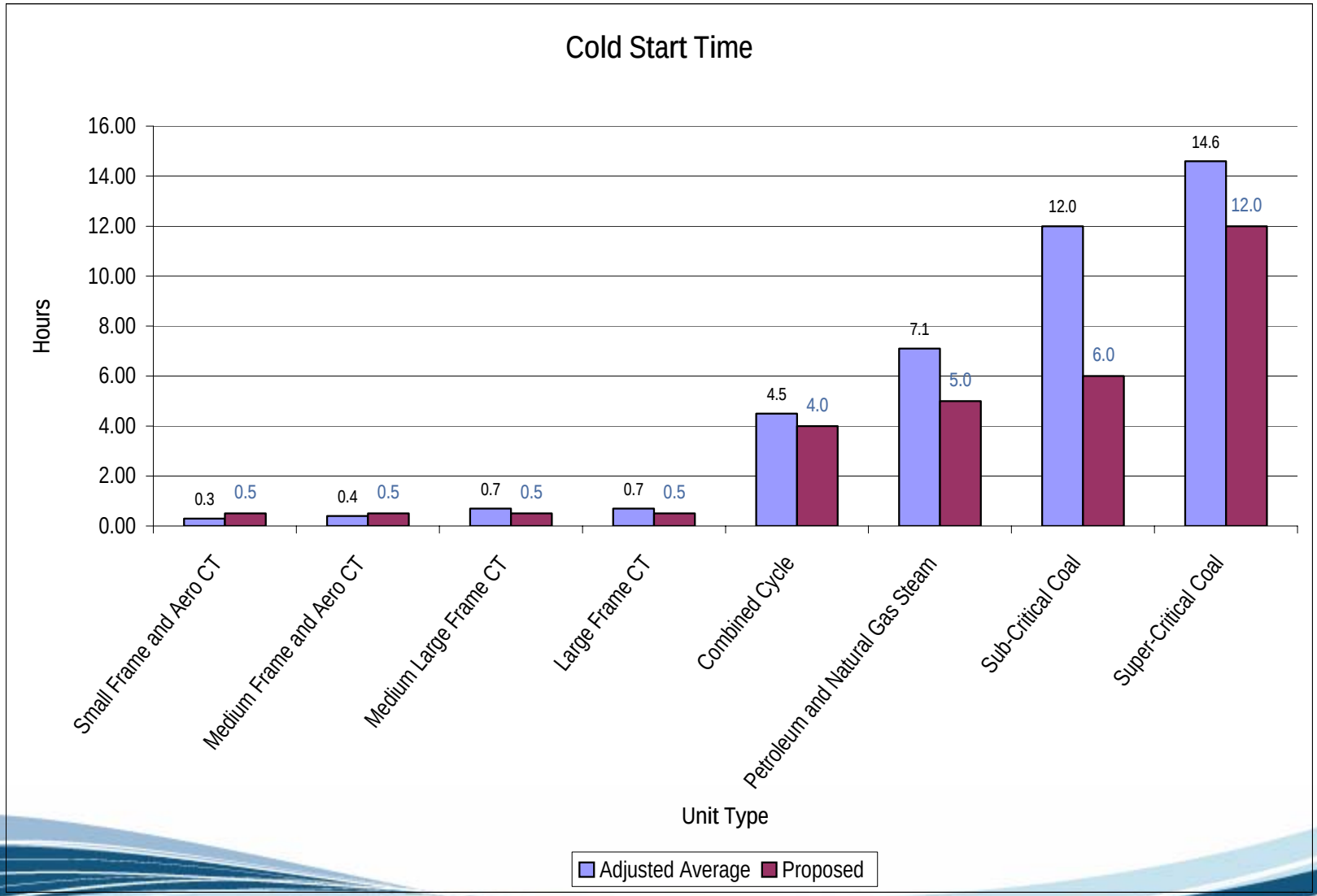
Hot to Warm Time



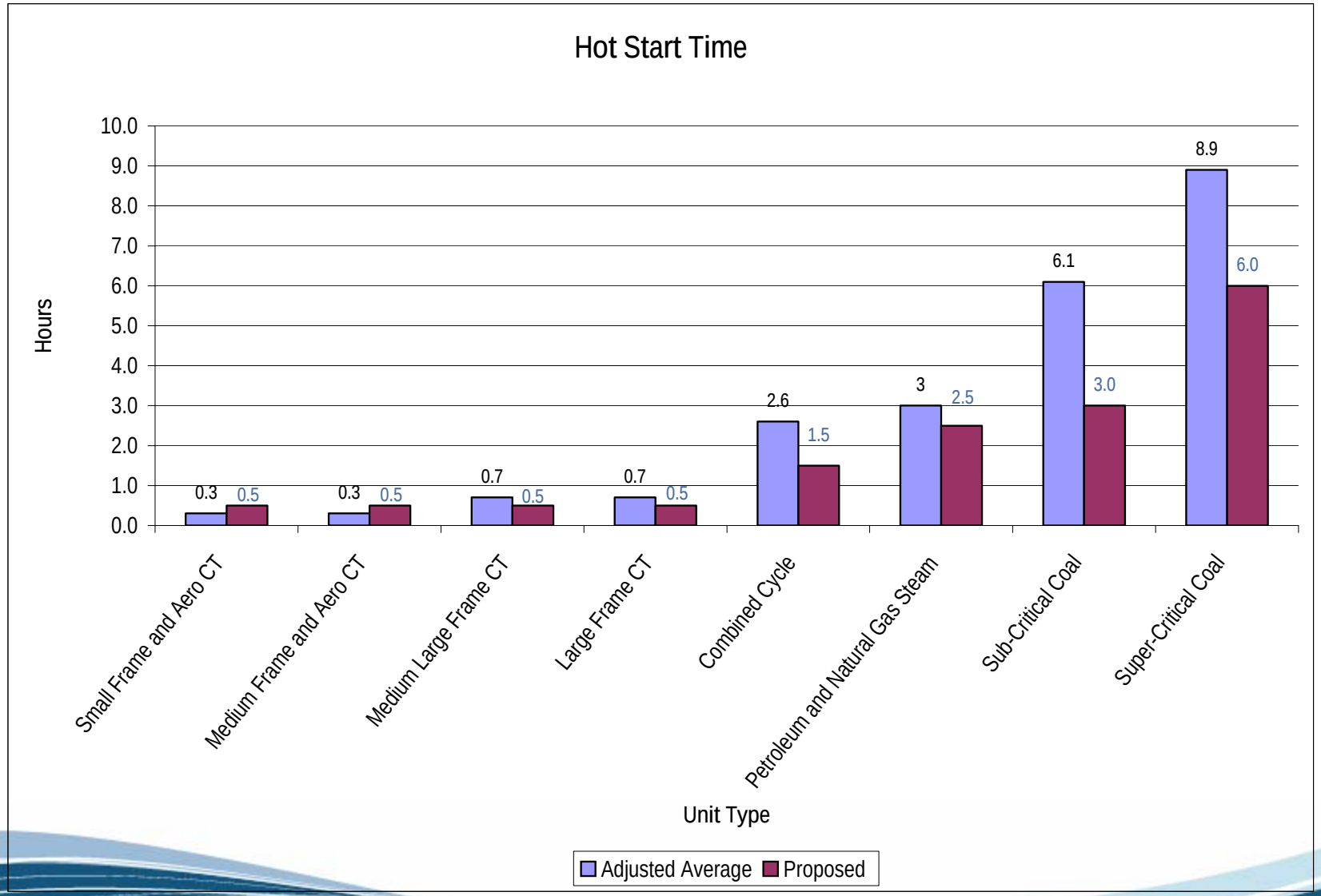
Warm Start Time



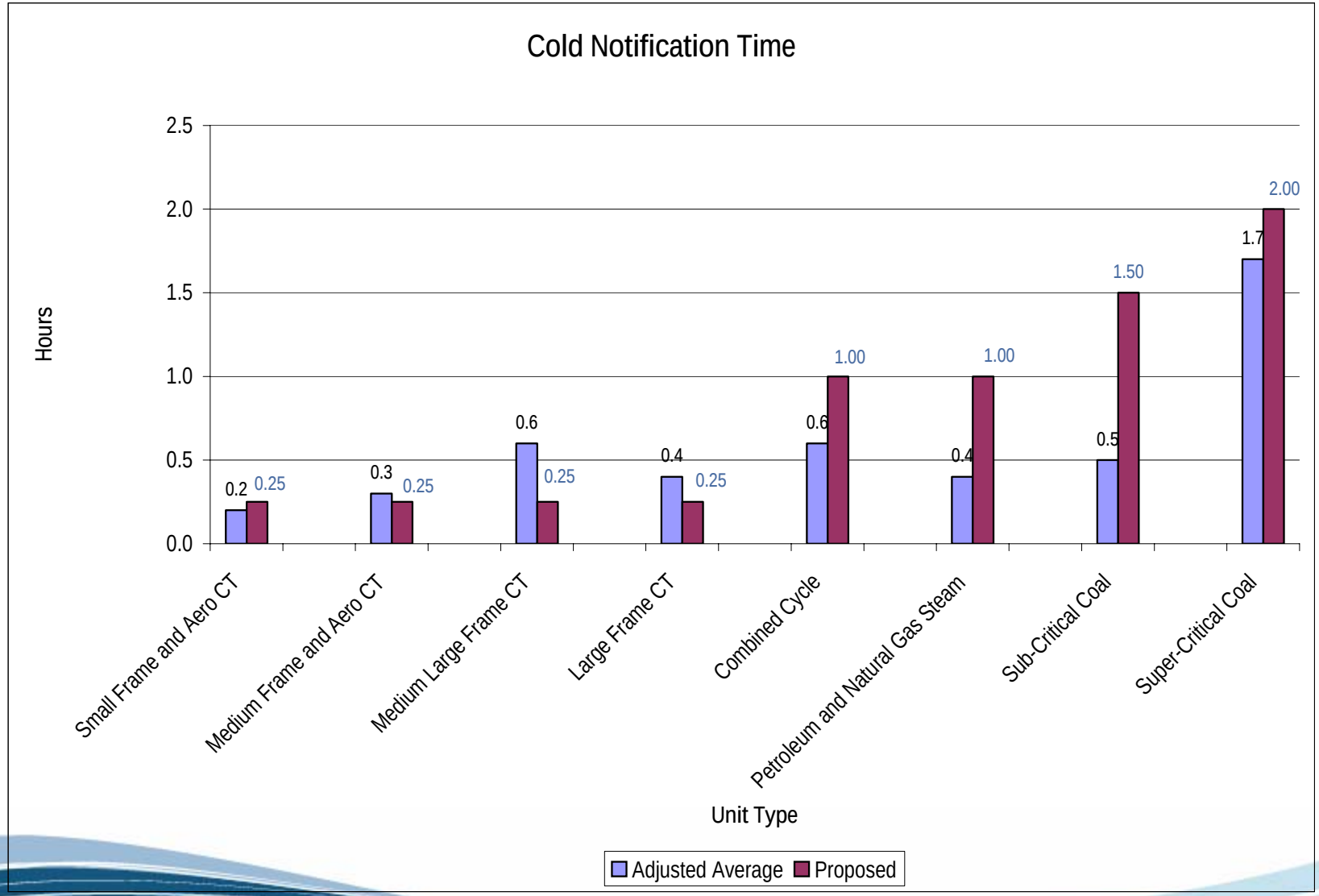
Cold Start Time



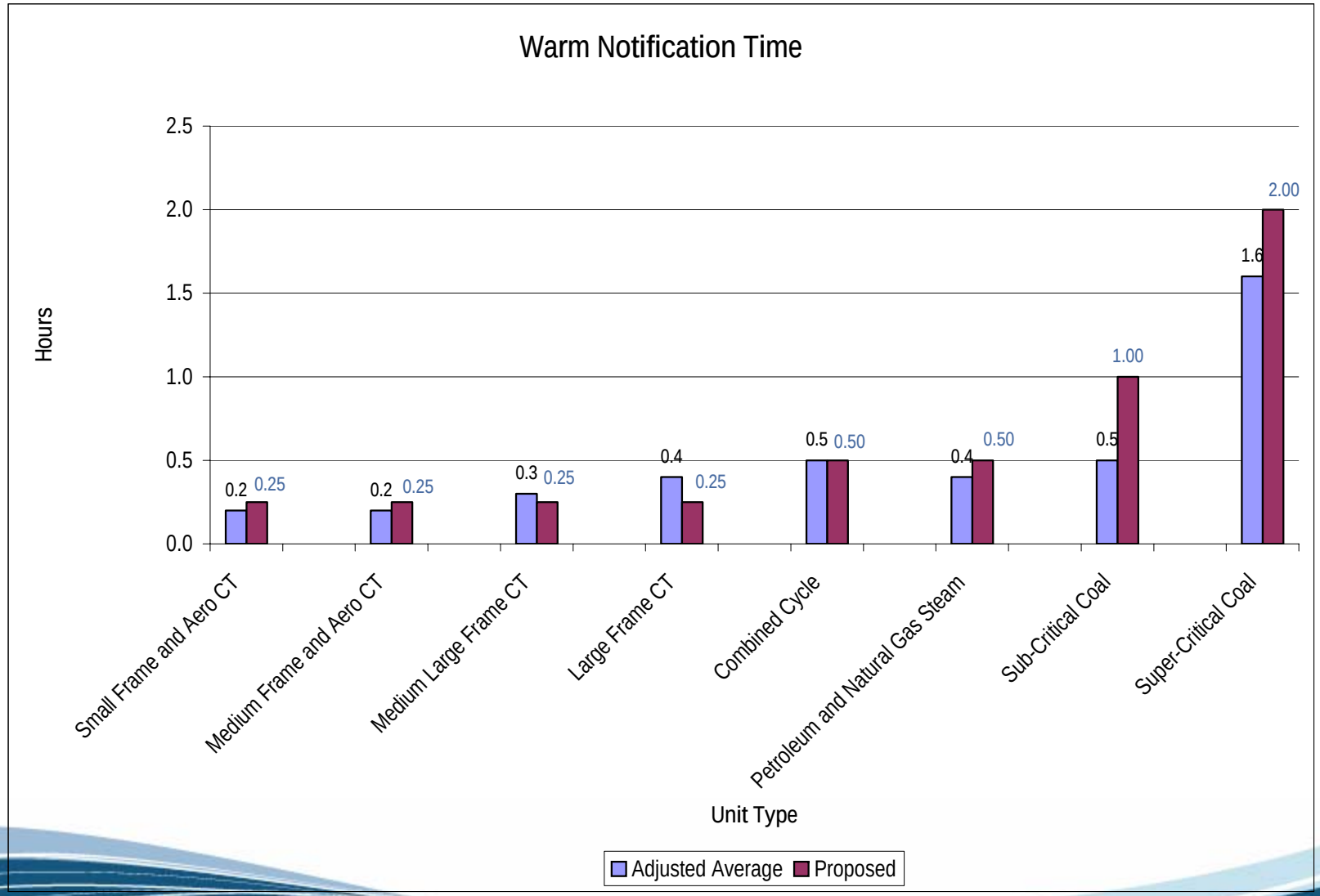
Hot Start Time



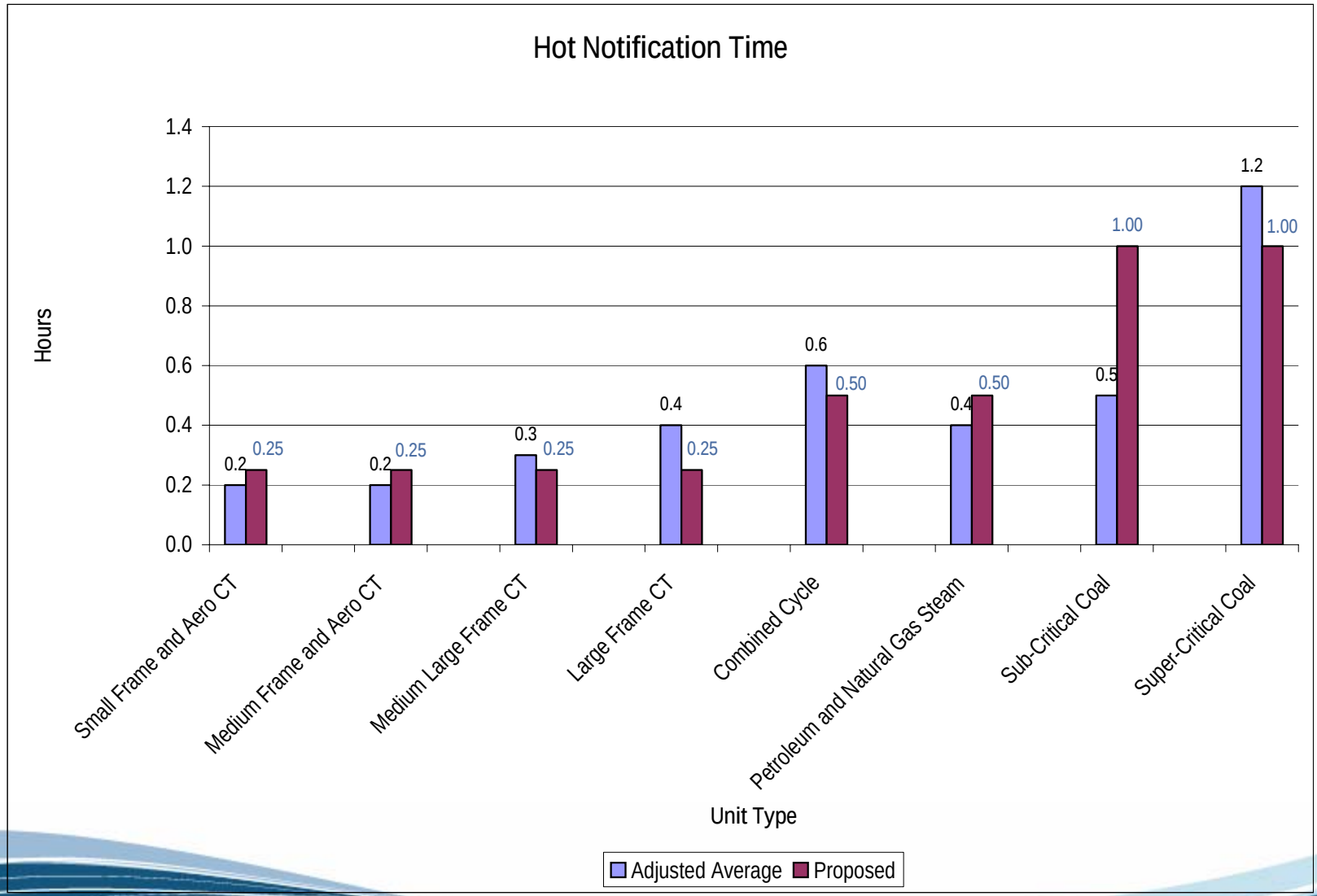
Cold Notification Time



Warm Notification Time



Hot Notification Time



Ramp Time

Unit Category	Ramp Time %ICAP per Minute	
	Current Average	Proposed
Small Frame and Aero CT	21.3%	
Small Frame CT		7.5%
Small Aero CT		22.5%
Medium Frame and Aero CT	18.3%	
Medium Frame		7.5%
Medium Aero CT		22.5%
Medium Large Frame CT	8.3%	7.5%
Large Frame CT	6.6%	7.5%
Combined Cycle	1.6%	2.0%
Petroleum and Natural Gas Steam	2.7%	
Petroleum and Natural Gas Steam Hot Start		1.0%
Petroleum and Natural Gas Steam Cold Start		0.5%
Sub-Critical Coal	1.8%	0.5%
Super-Critical Coal	0.6%	0.5%

- Operating reserve payments concentrated among a relatively small number of units/owners
- The top ten units generally have:
  - Relatively high mark ups
    - Price offer over cost offer
  - Relatively inflexible operating parameters
    - Long minimum run times
    - Small number of starts per day
    - Long minimum down time
- Need to define market for units providing operating reserves
  - Aggregate market
  - Locational issues

Summary Data for Top Ten Operating Reserves Units

- The top ten units receiving operating reserve payments
  - Average = 41 percent of total operating reserve payments over last four years
  - Maximum = 47 percent
  - Minimum = 32 percent
- The mark up for all top ten units
  - Average = 9 percent
  - Maximum = 17 percent
  - Minimum = 3 percent
- The maximum mark up among the top ten units receiving operating reserve payments
  - Average = 44 percent over last four years
  - Maximum > 40 percent in each year

Operating Reserves Goals

- Limit exercise of market power in operating reserve market
  - Limit mark up
- Ensure that only flexible units are paid operating reserves
  - Require flexible operating parameters

- When units have market power
  - Limit operating reserves payments to the higher of LMP or cost-based offer
- Issues
  - Market needs to be clearly defined
  - Definition of market is determined by the interaction of operator actions and system constraints
- Proposal
  - Market power exists for units when they are used for operating reserves on a repeated basis and competitive supply options do not exist
  - Mark up should be limited for units taken for operating reserves on a repeated basis if competitive supply options do not exist

- Operating reserve payments are payments for flexibility
- Proposal
  - Limit operating reserve payments to units with operating parameters based on the physical characteristics of the units
  - Operating parameters based on actual PJM market offers by unit class
  - Specify operating parameters range for unit classes

