

Presented by

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Speaker: John J. Schroeder

- Thirty one years in electric/energy business and played critical role in formation of first trading group at KeySpan
- Prior responsibility included bidding the over 5000MW of electric assets in the NYISO and the economic scheduling of over 1000MW of external interfaces in three ISO's for LIPA
- Currently, Manager of LIPA Fuel Management Services in Energy Procurement area
 - Fuels Management for LIPA's portfolio
 - Emission Trading for Nat Grid's Generation fleet
 - Fleet Fuel requirements

About National Grid

- National Grid is an International Energy Company operating in the U.K. and the U.S.
- In the U.K., National Grid:
 - Owns and operates high voltage electric transmission networks
 - Owns and operates the high pressure gas transmission system
 - Distributes gas to 11 million customers
- In the U.S, National Grid:
 - Distributes electricity to nearly 5 million customers in Massachusetts, New Hampshire, New York and Rhode Island
 - Owns and operates approximately 4,200 MW of generating capacity
 - Distributes natural gas to 3.4 million gas customers in Massachusetts, New Hampshire,
 New York and Rhode Island through its 8 local distribution companies
 - Service contract with LIPA to maintain and operate electric transmission and distribution system on Long Island

Agenda

- National Grid
 - Fuel Management
 - Portfolio Managed
- Use of OSIsoft PI System
- Challenges
- Applications
- Results
- Future plans/steps

Fuel Management

- Operate under two service contracts with Long Island Power Authority (LIPA)
- Responsibility as Fuels Manager
 - Natural Gas and Fuel Oil Procurement
 - Inventory Management
 - Scheduling/ Monitoring
 - Fuel Oil Quality testing
 - Price Forecasting
- Interface with Gas Trading on procurement
- Interface with Con Ed Energy (CEE) LIPA's Power Supply Manager

Portfolio served – under contract

- Fuel for over 5000 Mw of generation capacity
 - National Grid/ LIPA PPA generation
- 68 Electric Generators
 - 11 Base load (gas only; dual fired)
 - 3 Combined Cycle (gas/distillate)
 - 54 Simple Cycle (gas /distillate)
- 120 Million gallons of residual and distillate fuel oil storage
- 2010 Consumption
 - 83.5 BCF Natural Gas
 - 64.4 M-Gals of fuel oil

OSIsoft products, services and points employed

- Two PI Servers (Generation/System Operations)
- PI Clients
 - PI DataLink (excel add-in)
 - PI ProcessBook
 - e-Note (third party)
- PI Points (use approx. 330)
 - Net MW (Actual, Economic Basepoints)
 - % Natural Gas
 - Natural Gas: Dth/hr, Dth/Day
 - Fuel Oil Volume/flow
 - Calculated (System Load, Plant totals, external public data)

Challenges

- Provide timely "next day" and "in-day" gas requirements to Gas Trading
- Minimize Local gas Distribution Company (LDC) cash outs
- Stay within LDC tolerances for National Grid generation fleet
- Ability to import estimates, NYISO generator day ahead market (DAM) awards, historical (actual) data and LDC metered data
- Track actual gas burn vs. allocation for procurement purposes
- Perform "what if" projections
- Provide information via email and intranet
- Produce monthly summaries including report on metrics
- Gas vs. Electric Day

Applications developed that use PI System

- PI ProcessBook (various)
- Gas Estimate and Monitor
- FTU Gas Estimate and Monitor
- NYISO Download
- Oil Estimator
- Load Analysis
- Tie line interchange
- Tank Level

Gas Estimate and Monitor

- Excel based application for gas burn management
- Each "day" contains calculation sheet creates database
- PI Tabs used to source PI System data used in application
 - Ability to override data when bad tags arise
- Import features: Daily estimates, dispatch model runs, NYISO DAM generation awards, historical data, load and temperature forecasts
- Ability to update generator I/O curves and Natural Gas heating value
- Model fuel burn % for co-fire operation
- Perform periodic true up with LDC metered data
- Reports and monthly summary

Projection - tab

- Uses PI MW tags for Fuel Burn apply I/O curves to calc fuel
- Uses current "gas day" saved case
- Displays hourly "final" MW schedule estimate
- Allows for automatic and/or manual update of PI System data
- Presents actual MW data and calculation of gas quantities to EOD
- Ability to modify rest of day energy schedule and fuel burn percentages to run alternate scenarios
- Ability to import estimate, DAM award and historical data
- Presents plant and portfolio variation summary (from Final estimate)

Projection

 Gas Estimate ₩	orksheet				Actual	Vs. Fore	cast @ C	urrent Ti	me				11/11/	2011		Proj	ection v	s. Forec	ast @ End	of Day			La	st Revised:
11/11/2011	11			MWh	Dth			MWh		DELTA MWK	DELTA Deli		Revised		MWh	Dth		IE.O.D	MWh	Dth	DELTAMWK	DELTA Deli		
Friday		Barrett S		568	5,782	Barrett S		600	6,340	-32	-559		Barrett Ste	am	2,268	24,830	Barrett 9		2,219	24,294	49	536		
	-	Barrett 6		247	2.870	Barrett G Far Rock		378	4,158	-131	-1,287	-	Barrett GT Far Book		1,402	15,754	Barrett 0		1,610	17.942	-208	-2,188		
Monitor =	Menu	Glenwoo		537	6,410	Glenwoo		525	6,208	12	202	-	Glenwood		1,402	12,194			980	17,942	-208 12	-2,188 184		_
		Northpo		1,820	18,888	Northpor		2,040	21,754	-220	-2,867		Northport		8,266	88,836	Northpo		8,637	94,162	-370	-5,326		0
Hide Deta	ails	Port Jeff		629	6,880	Port Jeff		550	5,922	79	958		Port Jeff		1,699	17,91	Port Jef		2,090	23,334	-391	-5,423		E.O.C
				3,801	40,829			4,093	44,382	-292	-3,553				14,628	159,525	Į –		15,536	171,742	-908	-12,217		-12,217
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NPT 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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NPT4	261	211	179	179	180	200	210	310	320	300	300	300	187	180	100	100	100	100	100	100	100	120	140	180
NPT	400	410	410	410	410	410	460	590	540	500	500	500	387	330	200	200	200	200	200	200	200	200	350	430
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PTJ	110	110	110	110	110	110	125	125	130	125	125	120	100	100	40	40	40	40	40	40	40	40	60	100
TOTALS	138	124	123	122	122	120	125	125	130	125	125	120	100	100	0	0	0	0	0	0	0	0	0	0
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BART 2	0	0	0	0	Ö	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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EFB TOTALS	118	115	113	112	111	115	120	120	135	120	120	120	100	100	50	50	50	40	40	50	50	90	110	120
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BART GT 1-8		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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Totals	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	870	795	706	707	723	730	850	996	966	895	895	865	692	580	296	290	290	280	280	290	296	376	440	520
Load Fest Projected (2,438	2,427	2,411	2,399	2,401	2,542	2,811	2,818	2,731	2,620	2,490	2,295	2,088	1,894	1,769	1,706	1,677	1,677	1,717	1,820	1,954	2,116	2,241
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NPT 2	100																							100
NPT3	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
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NPT 2	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
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Projection

Estimate V	• Vorksheet Actual Vs. Forecast @ Current Time															Proi	ection us	Fore	ast @ End			Last Revised:			
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		Northport		8,546	87,189	Northport		8,453	91,334			-			9,545	101,116 Northport		9,503	102,229	42 -1,113				IIICI a	
III Dele					01,103			0,493 55	91,334 93 -4,146 1,206 -55 -1,206		-	Northport		3,345	101,116			3,303 165	2,546	-165			l" = 0 r	D with	
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				12,144	125,967			12,157	132,648	-13	-6,681				13,517	144,485			13,637	148,387	-120	-3,902		-3,902	_
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Dii			nday												11/14/	2011	Mon	aay		_					
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NPT 4	230	230	230	230	230	323	343	343	343	250	250	200	241	130	100	100	100	100	100	100	150	200	200	300	-
NPT1	0	0	0	0	0	0	0	0	U	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
NPT2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	_
NPT3	224	229	229	205	204	230	253	280	283	287	285	268	198	106	107	102	102	102	102	103	129	155	210	260	
NPT4	242	242	242	211	202	249	262	277	265	285	285	283	236	123	106	101	101	101	101	102	152	195	240	290	4
NPT	450	450	450	450	450	543	623	623	623	450	450	400	391	250	200	200	200	200	200	200	250	400	450	600	
TOTALS	466	472	471	416	406	479	515	556	548	572	570	551	434	229	213	203	202	203	202	204	281	351	450	550	
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PTJ3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
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PTJ4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
PTJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	10	20	20	40	70	
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IUIALS		-	-	-	-	-		-		-	-	-	•		•	•	•	•	_ •	•	•	-	-	<u> </u>	-
BART1	120	120	120	120	120	140	140	165	105	165	140	120	120	120	40	40	40	40	40	40	40	80	80	110	
BART2	120																								
BART1	91	121	121	126	125	153	156	153	142	144	142	127	123	113	91	51	46	45	45	45	63	76	90	130	
BART2	0	121	121	126 O	0	103	106	193	192 O	194 O	192 O	0	0	0	91	91 0	46 0	49 N	40 N	40 N	0	/6 0	0	0	-
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EFB	120	120	120	120	120		140	165	165	165	140	120	120	120	40	40	40	40	40	40	40	80	80	110	
TOTALS	91	121	121	126	125	153	156	153	142	144	142	127	123	113	91	51	46	45	45	45	63	76	90	130	
GLNVD 4	0	0_	0_	0_	0	0_	0_	0_	0	0	0	0 _	0	0_	0	0	0	0 _	0	0	0	0	0_	0	
GLNVD 5	0																								
GLNVD 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
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FRUCK 4	50	50	50	50	83	83	90	95	101	101	101	90	80	60	40	40	40	40	40	40	40	50	60	70	-
FROCK 4	50	60	60	57	53	61	73	78	81	82	81	71	63	46	43	41	40	40	40	40	50	59	60	65	4

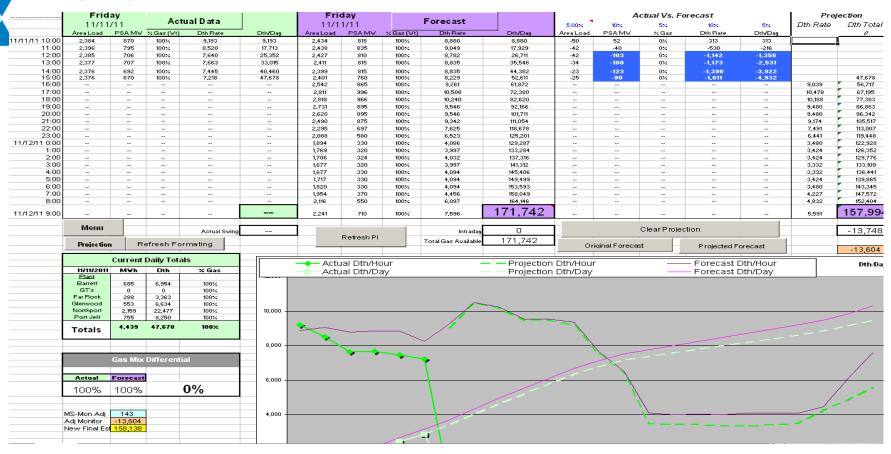
Projection – table summary

Gas Estimate Vo	orksheet			Actual	Ys. Forecast @	Current T	i n e				11/13/2011		Projection vs. Fore			f Dag			Last R	vised: 11/14/117:35 AM
11/13/2011	13		MWh	Dth		MWh	Dth	DELTAMWK	DELTA DAN		Revised E.O.D.	MWh	Dth	Original E.O.D	MWh	Dth	DELTAMWK	DELTA Deli		
Sunday		Barrett Steam	2,300	23,582	Barrett Steam	2,235	24,250	65	-668		Barrett Steam	2,519	27,336	Barrett Steam	2,425	26,313	94	1,022		
		Barrett GT	30	454	Barrett GT		0	30	454		Barrett GT	53	445	Barrett GT		0	59	445		
Monitor	Menu	Far Rock	1,269	14,568	Far Rock	1,414	15,857	-145	-1,289		Far Rock	1,393	15,588	Far Rock	1,544	17,298	-151	-1,711		
		Glenwood		173	Glenwood		0	0	173		Glenwood		0	Glenwood		0	0	0		Intraday
		Northport	8,546	87,189	Northport	8,453	91,334	93	-4,146		Northport	9,545	101,116	Northport	9,503	102,229	42	-1,113	0	
Hide Detai	ls	Port Jeff		0	Port Jeff	55	1,206	-55	-1,206		Port Jeff		0	Port Jeff	165	2,546	-165	-2,546		E.O.D with Intraday
			12,144	125,967		12,157	132,648	-13	-6,681			13,517	144,485		13,637	148,387	-120	-3,302	-3,	902
	Sheet	eet Refresh Actuals			Get DAM Get Historical D			ata Create Repo		ort	Get CEE Intraday Data		CopyFor		cast	Delta		ısted		
Projected M																(4592)	-8	495		
	11/13/2011	uchau?	2mdsu									11/1/17	AJ2011 Mondon							

Monitor - tab

- Uses PI System fuel tags (no calculations)
- Provides variance analysis of various metered values
 - LI Area Load, MW, Dth Rate and Dth/Day
- Presents EOD variance
- Ability to perform hourly Dth scenario analysis for EOD
- Provides graphical display: Actual vs. forecast and projection
- Used to perform check against "projection" tab EOD variance

Monitor

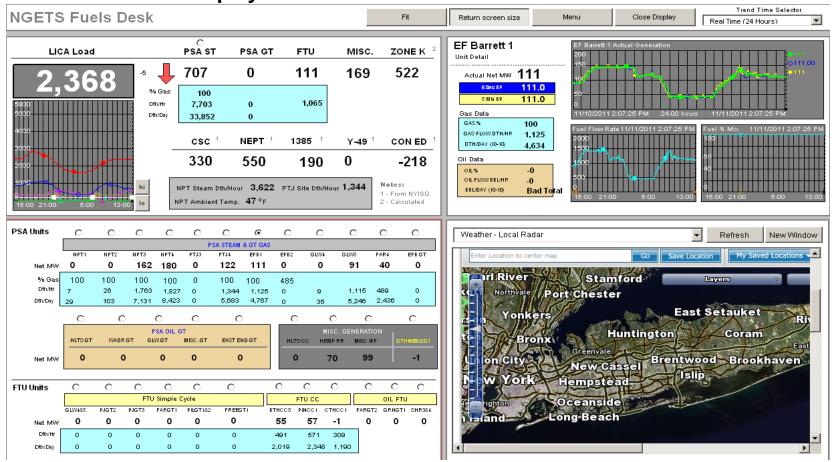


Monitor – Hourly metrics

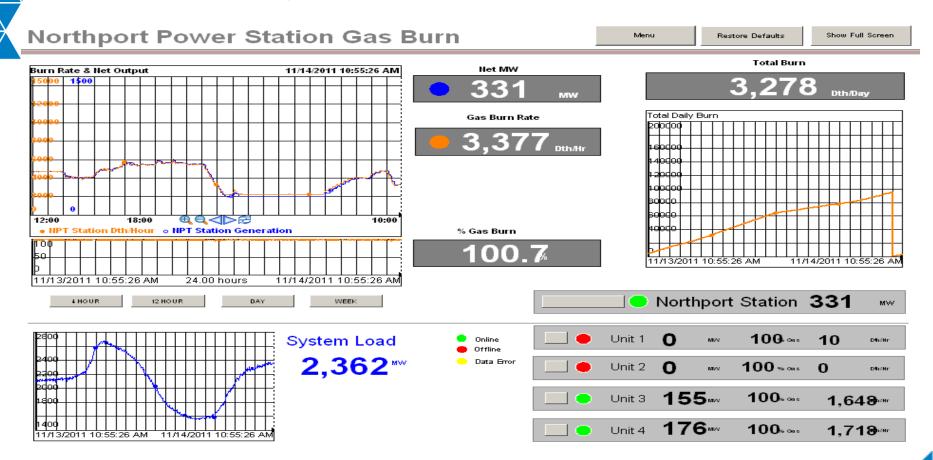
	Sunday		Actual Data		1	Sur	iday		E-v		Ι.	A	Actual Vs. Forecast Pi							
	11/13	/11	Acti	iai Data		11/1	3/11		Forecast		5.00%	10%	5%	10%	5%	Dth Rate	Dth Total			
	Area Load	PSAMV	% Gas (Vt)	Dth Rate	Dth/Day	Area Load	PSA MV	% Gas (Vt)	Dth Rate	Dth/Day	Area Load	PSA MV	% Gas	Dth Rate	Dth/Day	J	0			
11/13/11 10:00	2,090	608	100%	6,215	6,215	2,069	620	100%	6,578	6,578	21	-12	0%	-364	-364					
11:00	2,111	652	100%	6,634	12,849	2,105	620	100%	6,578	13,157	6	32	0%	56	-308					
12:00	2,118	652	100%	6,624	19,472	2,112	620	100%	6,578	19,735	6	32	0%	45	-263					
13:00	2,129	598	100%	6,119	25,591	2,111	620	100%	6,578	26,313	18	-22	0%	-460	-722					
14:00	2,148	584	100%	5,983	31,574	2,108	653	100%	6,919	33,232	40	-69	0%	-936	-1,658					
15:00	2,207	694	100%	7,097	38,670	2,132	766	100%	8,001	41,233	75	-72	0%	-905	-2,563					
16:00	2,407	744	100%	7,572	46,243	2,298	853	100%	8,832	50,065	109	-109	0%	-1,260	-3,823					
17:00	2,641	802	100%	8,177	54,419	2,588	883	100%	9,135	59,200	53	-81	0%	-958	-4,781					
18:00	2,621	785	100%	8,012	62,431	2,542	889	100%	9,202	68,403	79	-104	0%	-1,191	-5,971					
19:00	2,550	797	100%	8,040	70,471	2,492	716	100%	7,564	75,967	58	81	0%	476	-5,496					
20:00	2,460	793	100%	7,997	78,468	2,432	691	100%	7,316	83,283	28	102	0%	681	-4,815					
21:00	2,308	749	100%	7,544	86,012	2,285	610	100%	6,530	89,813	23	139	0%	1,014	-3,801					
22:00	2,106	620	100%	6,254	92,266	2,095	591	100%	6,351	96,164	11	29	0%	-97	-3,898					
23:00	1,889	387	100%	4,118	96,384	1,888	430	100%	4,848	101,012	1	-43	0%	-730	-4,628					
11/14/11 0:00	1,726	346	100%	3,790	100,174	1,715	280	100%	3,463	104,475	11	66	0%	327	-4,300					
1:00	1,637	294	100%	3,307	103,481	1,632	280	100%	3,463	107,938	5	14	0%	-156	-4,457					
2:00	1,581	289	100%	3,261	106,742	1,586	280	100%	3,463	111,401	-5	9	0%	-202	-4,658					
3:00	1,566	289	100%	3,254	109,996	1,568	280	100%	3,463	114,864	-2	9	0%	-209	-4,868					
4:00	1,595	287	100%	3,241	113,237	1,600	285	100%	3,688	118,552	-5	2	0%	-448	-5,315					
5:00	1,721	290	100%	3,267	116,504	1,720	290	100%	3,732	122,284	1	0	0%	-464	-5,780					
6:00	1,971	394	100%	4,267	120,771	1,972	350	100%	4,272	126,555	-1	44	0%	-5	-5,784					
7:00	2,135	488	100%	5,196	125,967	2,169	550	100%	6,093	132,648	-34	-62	0%	-897	-6,681		125,967			
8:00					-	2,284	630	100%	6,832	139,480			-			6,345	132,312			
11/14/11 9:00						2,332	850	100%	8,907	148,387			-			7,762	140,074			
	Menu								lass - J	0			Clear Proje	ction			-8,313			
				Actual Swing			Refresh PI		Intraday		+						-0,013			
	Projection	n Re	efresh For	mating					Total Gas Available	148,387	Or	iqinal Forecas	:t	Projected F	orecast		-8,676			

Monitor- Graph Current Daily Totals Actual Dth/Hour - Projection Dth/Hour Forecast Dth/Hour Dth/Day 11/13/2011 MVh Dth % Gas Actual Dth/Day Projection Dth/Day Forecast Dth/Day Plant Barrett 2,300 23,582 100% GT's 454 100% 9,000 Far Rock 1,269 14,568 100% Glenwood 173 100% Northport 8,546 87,189 100% Port Jeff 0% 8,000 12,144 125,967 100% Totals 7,000 **Gas Mix Differential** 6,000 Forecast Actual 5,000 0% 100% 100% 4,000 MS-Mon Adj (363) Adj Monitor -8,676 3,000 New Final Est 139,711 2,000 1,000 6:00 7:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00 1:00 2:00 3:00 4:00 5:00

PI ProcessBook Display



PI ProcessBook Display



PI ProcessBook Display



Oil Estimator

<u> </u>			- 0- 0	-																		
	Į											MWH	Gal	#Trucks	Avg HR.							
											KERO	3693	92,975	7.7	12.78	Excl. Hot	tsville					
							Enter Date:	08/08	3/2011		NO. 2	2055	181,473	15.1	15.15							
								Monday			ULSD	77	6,379	0.5	9.83		Last update	08/09/2	011 0:15	See N	lote	
																				Truck		Est.
Hour Beginning	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	KERO	# Trucks	Size	Run Hrs	Burn rate
Holts 1-10	0	0	0	0	0	1,518	8,956	8,632	18,379	33,992	19,916	17,672	1,460	0	0	0	0	110,525	9.2		8	50,000
S Hmpt IC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0		0	1,500
Shold IC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0		0	1,600
PJ APG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0		0	1,800
JPwr Shrm 3&4	0	0	0	0	0	2,320	5,408	6,051	6,037	6,040	6,026	6,033	6,033	3,866	0	0	0	47,815	4.0		9	6,000
Frock GT 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0		0	4,200
Greenport GT	0	0	1,477	3,664	3,698	3,730	3,734	3,738	3,742	3,746	3,750	3,754	3,758	3,760	2,611	0	0	45,161	3.8		13	3,961
Equus GT 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0		0	3,600
Pinelawn CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0		0	3,600
KECD Glwd 485	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0		0	7,800
KEDC PJ 2&3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0		0	7,800
															Total (exc	d. Holtsvi	lle)	92,975	7.7	$ldsymbol{ldsymbol{eta}}$	22.0	
																				Truck		Est.
Hour Beginning	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	NO. 2	# Trucks	Size	Run Hrs	Burn rate
Wading River	0	0	0	0	0	5,972	17,756	18,338	18,291	18,377	18,615	18,793	18,893	18,986	13,303	0	0	167,324	13.9		10.0	21,000
E Hmpt GT	0	0	0	490	1,450	1,443	1,443	1,443	1,443	1,443	1,443	1,443	1,445	648	0	0	0	14,136	1.2	\perp	11.0	2,000
W Bab IC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0		0.0	4,900
Shrm IC 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	\perp	0.0	2,300
Shrm IC 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0		0.0	4,400
Glenwood IC 1-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0.0	\perp	2.0	10,000
NPT APG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0		0.0	1,800
EFB IC 1-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	\vdash	0.0	12,800
EFB IC 9-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0		0.0	17,000
																Total Gal	s/Trucks	181,473	15.1		23.0	
	_					4.0														Truck		Est.
Hour Beginning	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	ULSD	# Trucks	Size	Run Hrs	Burn rate
Mont Dsl	0	0	0	0	0	7	460	466	466	466	466	466	177	0	0	0	0	2,975	0.2	-	8.0	420
E Hmpt Dsl	0	0	0	0	0	333	436	438	442	440	435	440	441	0	0	0	0	3,405	0.3		8.0	420
Caithness CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	-	0.0	15,000
																Total Gal	s/Trucks	6,379	0.5		16.0	
Harm Basinains	7	8	9	10	11	12	42	14	15	40	17	18	19	20	21	22	23	b.6.07				
Hour Beginning	3,103	3,458	3,788	4,117	4.409	4,617	13 4,794	14 4.948	5,070	16 5,117	4.888	4.723	19 4.482	4,417	4,208	3,814	3,340	M/V 92,558				
Zone K Act Load	3,103	3,436	3,700	4,117	4,403	4,017	4,794	4,346	5,070	5,117	4,000	4,723	4,402	4,417	4,206	3,014	3,340	a∠,556				

Results

- ☑Ability to perform gas estimates within minutes
- ☑Ability to perform multiple scenario analyses
- ☑Time savings and ease of use
- ☑Procurement quantities are clear and documented
- ☑ Daily LDC Cash-outs minimized
- ☑LDC tolerances met
- ☑Metrics are tracked and presented
- ☑Monthly file contains full record of activities

Future plans and next steps

- PI Notifications (to replace e-Note)
- PI AF (PI Asset Framework)
- Error trapping
- New and improved PI ProcessBook displays

Questions?

John J. Schroeder

National Grid

Energy Procurement

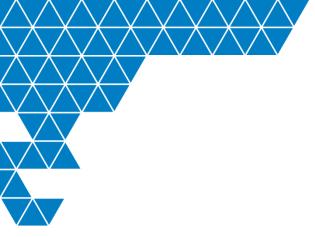
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Thank you