Agenda Item 4.2

PSPC Meeting 277

May 13, 2010

Assumptions for the ICR
- Summer Generator Maintenance

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PSPC Meeting

Outline

- Background
  - How we model generator maintenance currently
  - Objective of this study

- Proposed Modeling Method
  - Modeled as equivalent unit with negative capacity
    - What are the historical outage data available
    - Major Assumptions in Base Case
    - Sensitivity Study

- Preliminary Results

Background

- How we model the maintenance currently
  - In LOLE calculations, individual unit EFORd and Maintenance weeks are modeled.
  - In the current system condition, all units' maintenance were scheduled during the non-summer season by the software.
- Objective of this study
  - Historical data shows there was generator maintenance during the summer season.
  - The objective of this study is to find the impact of the maintenance in the summer and determine should we model the maintenance in summer in the ICR calculation

Proposed Modeling Method

- Modeling Maintenance requirement in summer as equivalent unit with negative capacity

  - What are the historical outage data available:
    - FO: forced outage
    - AI: annual Inspection
    - AIO: annual Inspection overrun
    - EO: outage for economic operation
    - STO: short term outage with14 days notice

  - Major Assumptions in Base Case
    - Only STO and AIO are used for estimation
    - Only weekday is counted
    - Summer months June, July, August and September are considered
    - Only hour ending 7 to 22 are included

  - Sensitivity Study
    - STO only
    - All of STO, AIO and AI

Calculation Procedures

- Step 1 : Collect outage event data
  - MW reduction by outage type, STO, AIO, AI.
  - Starting and Ending event time in hour, day, month and year
- Step 2: Filter the event data due to outage type
- Step 3: For each outage type, aggregate outage reduction MW in each hour due to different events
- Step 4: Calculate average hourly reduction MW by day
- Step 5: Calculate average daily reduction MW by Month
- Step 6: Model monthly reductions in the ICR calculation

Estimate the MW Value of Daily Summer Maintenance – Using Mean Value

Table 1 Average MW on Maintenance

Summer Daily Maintenance Outage Reduction in MW (June-Sept.)					
	STO	STO+AIO	STO+AIO+AI	AIO	AI
2005	172	342	689	170	347
2006	206	546	966	340	420
2007	312	399	1135	87	736
2008	346	361	636	15	276
2009	452	528	892	76	364
5 yr Mean	298	435	863	137	428

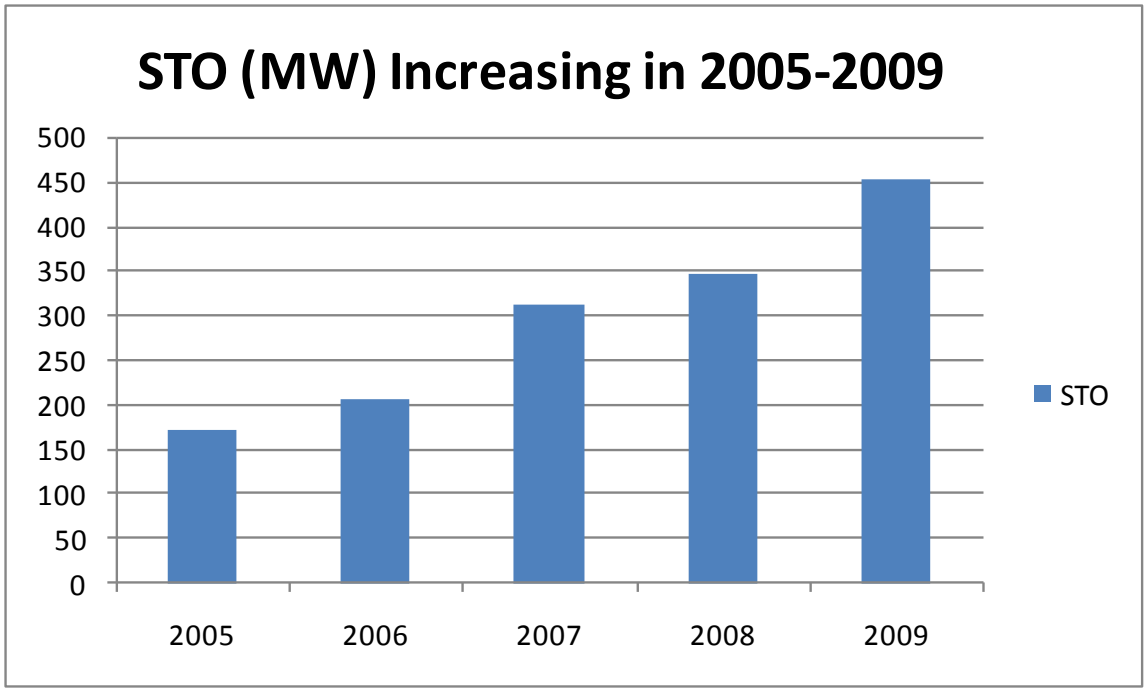
Note: oo2.xlsm\Tables

Observation - Summer Maintenance Outage Data

- The five year average data shows the summer maintenance outage due to STO, AIO and AI are 298, 137 and 428 MW respectively
- There are significant differences among the five years
- STO increased in the five year period, from 172 MW to 452 MW
- The large AIO reduction of 340 MW occurred in 2006 is due to a large (700 MW) CC unit outage during the summer from May to July 21.
- In the past three years, AIO has been all under 100 MW.

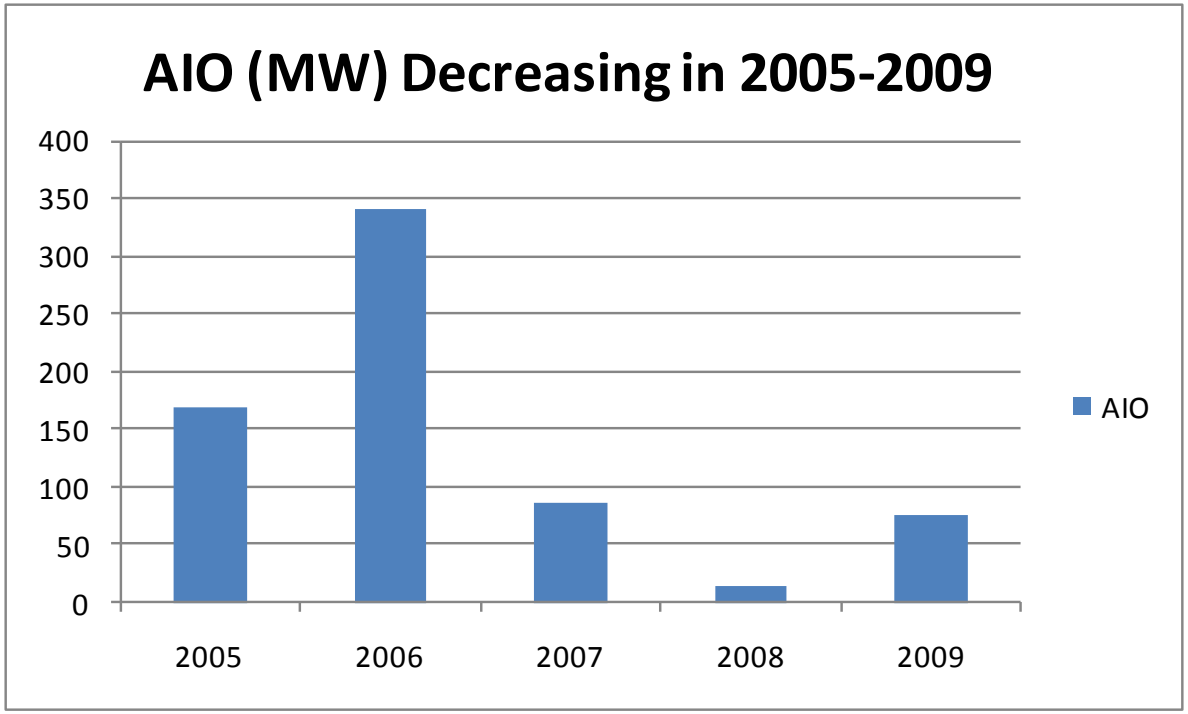
Maintenance Outage Due to STO in Increasing Trend

Figure 1 Summer Maintenance Outage Due to STO in MW



Maintenance Outage Due to AIO in Decreasing Trend

Figure 2 Summer Maintenance Outage Due to AIO in MW



Base Case - Outage Type by Month

– The following Table shows the ratio of maintenance outage MW due to AIO and STO.

Table 2 Summer Maintenance of STO and AIO ratio

Ratio between Summer Maintenance Outage MW from AIO and STO										
Year	June		July		August		September		June-September	
	AIO	STO	AIO	STO	AIO	STO	AIO	STO	AIO	STO
2005	77%	23%	32%	68%	13%	87%	24%	76%	53%	47%
2006	72%	28%	72%	28%	14%	86%	63%	37%	62%	38%
2007	34%	66%	0%	100%	20%	80%	10%	90%	20%	80%
2008	6%	94%	0%	100%	2%	98%	4%	96%	4%	96%
2009	21%	79%	17%	83%	5%	95%	9%	91%	13%	87%
Average	**42%**	**58%**	**24%**	**76%**	**11%**	**89%**	**22%**	**78%**	**30%**	**70%**

Base Case – Maintenance Outage MW by Month

Table 3 Monthly Summer Maintenance Outage MW – AIO and STO

Summer Daily Maintenance Outage in MW - STO and AIO					
Year	June	July	August	Sept.	June-Sept.
2005	775	143	176	334	342
2006	977	661	311	255	546
2007	633	209	334	411	399
2008	814	189	209	245	361
2009	708	216	652	522	528
5 yr Mean	782	284	337	354	435

Impact of Summer Maintenance on ICR – Calculation Detail

- Using ICR 1213 case
- Modeling the summer maintenance outage of categories STO and AIO
- ICR increased from 32,879 to 33,195 or
- Reserve margin (with HQICC) increased from 13.3% to 14.4% , or 1.1%.

	No Summer MTN	With Summer MTN
Senarios>>	ICR1213	STO & AIO
Annual Peak	29,020	29,020
Capacity	39,293	39,293
Tie Benefits	1,665	1,665
HQICCs	914	914
OP4 - Action 12 & 13	569	569
ALCC	4,625	**4,295**
Installed Capacity Requirements	32,879	33,195
Reserve Margin with HQICCs	13.3%	14.4%
Reserve Margin without HQICCs	10.1%	11.2%

$$Installed\ Capacity\ Requirement\ (ICR) = \frac{Capacity - Tie\ Benefits - OP4\ Load\ Relief}{1 + \frac{ALCC}{APk}} + HQICCs$$

Conclusion and Discussion

- In ICR 2012/2013 for FCA3, the ICR value is 32,879 MW, in which no maintenance was scheduled in summer months. Using the same case with the summer maintenance requirement modeled, The ICR value increases as well the Reserve Margin percentage (RM %).

- The change of ICR in MW and in Reserve Margin percentage (RM %) for the Base Case (only Maintenance outage types of STO and AIO) are shown below.

	Refernece	Model Summer Maintenace Base Case	
	No S. MTN	Mean MW	Changes
	(A)	(B)	(B)-(A)
ICR MW	32,879	33,195	316
RM% with HQICC	13.3%	14.4%	1.1%
RM% without HQICC	10.1%	11.2%	1.1%

- The modeling of summer maintenance increases ICR by about 1.1% in the base case

Appendix
Sensitivity Studies

Sensitivity Studies

Suggesting several types of sensitivity study

- Including more outrage type, i.e. AI
- Excluding certain unit type , i.e., AIO
- Using different statistic measures
  - Median
  - Top percent of outage MW