Suggestions Regarding Review of "Peaking" EGU Emissions and Reliability Considerations

Bruce Alexander
Exelon Corporation
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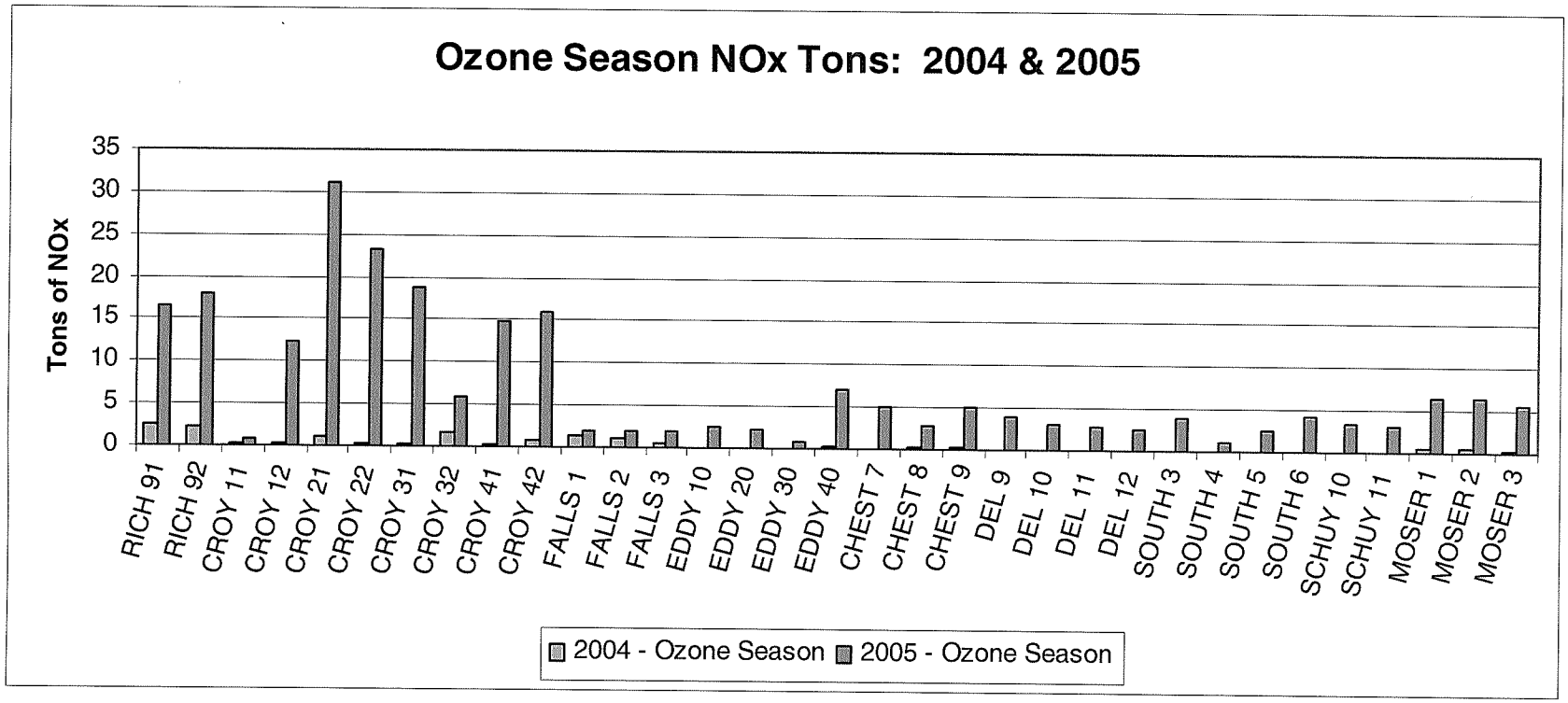
Exelon Power Combustion Turbine (CT) Fleet – SE PA

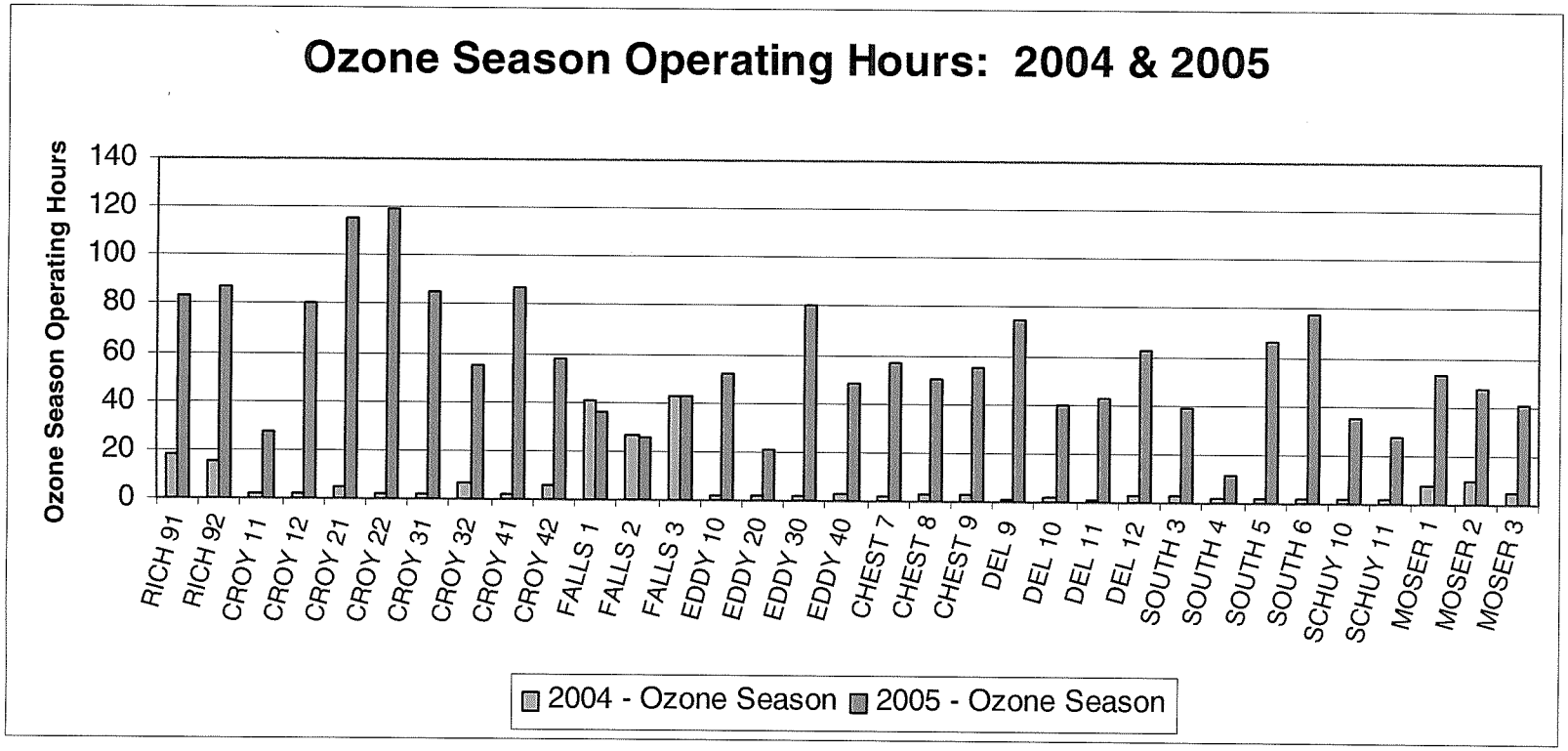
Types of CTs on System	CT Names and Locations	Summer Rating Per Unit (MW)	Number of CTs in Fleet	Total Capacity Per CT Type (MW)
Pratt & Whitney FT4A-8 (aeroderivative)	Eddystone 10,20; Chester 7,8,9; Delaware 10,11,12; Southwark 3,4,5,6; Schuylkill 10	13	13	169
Pratt & Whitney FT4A-9 (aeroderivative)	Falls 1,2,3; Eddystone 30, 40; Schuylkill 11; Moser 1,2,3; Delaware 9	17	10	170
GE Frame 7	Richmond 91, 92	48	2	96
GE Frame 7	Croydon 11, 12, 21,22, 31,32,41,42	49	8	392
		Totals:	**33**	**827**

- Exelon Power operates 33 CTs at 9 locations in southeast Pennsylvania (SE PA) totaling 827 MW.
- All CTs use #2 oil only. Natural gas not available at some locations.
- Exelon Power CT stations play various roles in the PECO Energy T&D system:
  - 7 of 9 CT locations are viewed as having critical black start units (23 aero-derivative turbines).
  - 4 of 9 provide either voltage support or assist in managing power flows.
  - In event of CT retirement, transmission upgrades may be needed in 7 of the 9 CT locations.

Note: Exelon Power also operates six combustion turbines at the Medway Plant in Massachusetts with a total capacity of 110 MW. 3 Year average ozone season NOx emissions = 8.6 tons.



- The last two years roughly approximate the extremes of Exelon Power's SE PA CT ozone season NOx emissions over the last five years:
  - **In 2004, total ozone season NOx emissions = 16 tons.**
  - **In 2005, total ozone season NOx emissions = 238 tons.**



- In 2004, 28 out of 33 CTs had less than 10 ozone season operating hours. All CTs less than 0.5% ozone season capacity factor.
- In 2005, all CTs had less than 150 ozone season operating hours. All CTs less than 3.5% ozone season capacity factor.

Concerns: EGU Peaking Candidate Measures

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- "One size fits all" approaches are very expensive at low capacity factor CTs:
  - **Candidate Control Measure 1** (water injection on all frame and aero-derivative CTs in 2009):
    - Water injection capital cost ≈ +/- $ 750K per CT.
    - Cost effectiveness could reach mid- to upper-10s of thousands of $ per ton removed at low capacity factor CT locations, depending on historic operations and emissions. Higher in event Candidate Control Measure 2 is adopted 3-4 years after 2009.
  - **Candidate Control Measure 2** (replacement of all aero-derivative CTs with Dry Low NOx 'DLN' CTs in 2012):
    - New DLN CT cost ≈ $500/kW. E.g. at $500/kW, a 50 MW unit = $25 million.
    - Cost effectiveness could reach mid- to upper-10s of thousands of $ per ton removed, or higher, at low capacity factor CT locations, depending on historic operations and emissions.
  - Concern that Candidate Control Measure 2 "strands" capital investment made to comply with Candidate Control Measure 1 after only 3 to 4 years of operation.
  - For generators in competitive markets, current energy prices and capacity payments are unlikely to support cost recovery of capital investments to retrofit and/or replace low capacity factor CTs.
- Need to identify a mix of options to address CT emissions with greater cost effectiveness and flexibility. Need to maintain fuel diversity.

- **Suggest that the OTC defines clear sub-categories of CTs to review**
  - CAIR-affected CTs 25MW & larger.
  - Non-CAIR affected CTs < 25 MW (down to what capacity size?).
  - Include industrial and commercial CTs?
- Oil/Gas Steam units – Need to consider these separate from CTs to understand issues and options for this generation type?
- Need to make sure that any measures aimed at CTs and/or oil/gas steam units first consider the effects of any "beyond CAIR" policies to tighten EGU emission caps, as well as other new regulatory programs.
  - Any tightening of NOx and SO2 caps associated with "beyond CAIR" will have an effect on all existing and new generating unit operations and these effects should be considered before finalizing any "peaking measures."
    - Also, need to consider effects of state multi-pollutant programs, AEPS/RPS requirements, RGGI, CAMR, state mercury regulations and other initiatives.
  - "Dispatch modeling" could help to examine these issues.

Concerns: Modeling Issues and Questions

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- **Exelon would like better understanding of what is going into models and the opportunity to provide constructive comment:**
  - **Existing CT emission rates**. Concern that "default" emission rates used by some CTs to calculate allowance surrender requirements could be included in OTC modeling assumptions. Exelon and industry are willing to review CT assumptions on an expedited basis so that the best possible data is utilized to develop CT emission baselines, forecasts and control effectiveness estimates.
  - **Water injection assumptions**. Generators with water injection installed may have data to support NOx removal rates under different operating conditions. E.g. under different temperature and ambient humidity conditions.
  - **Market assumptions**. Exelon interested in providing input regarding key assumptions around future dispatch of existing and new units. Can provide latest data on unit retirements. E.g. Exelon retired Mystic 4,5,6 and Delaware 7,8 steam units after 2002 … over 700MW of capacity.
  - **Geography**. Need to understand implications of OTR-only versus super-regional programs. What does an OTR-only program get us if sources to west and south of OTR are subject to less stringent requirements?
  - **Isolate Candidate Control Measures**. Modeling should look at candidate measures on an individual basis so that cost-effective and appropriate strategies can be developed for specific generation categories where warranted.
  - **Modeling Platforms**. Information on modeling platforms and process being utilized would be helpful to industry to provide constructive input to the OTC.

Concerns: Reliability Issues

- **Some existing CTs are required for system reliability and black start. In many cases, these may be otherwise low capacity factor units.**
- **In Northeast and mid-Atlantic competitive markets, a rational generator could determine to retire a unit if it is unable to recover its capital costs associated with a new OTC requirement.**
  - ISOs must approve retirement applications and could impose reliability must run (RMR) requirements on some units.
  - How would the ISOs address a potential abnormally large number of retirement applications?
- **If new generating units are not sited, transmission upgrades could be required to address reliability.**
  - These could potentially involve FERC, state commission and/or ISO approvals. Approval process and construction could take 3+ years.

Possible Solutions to Model / Investigate

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I. Market-based Allowance Surrender Concept

- **CAIR-Affected EGU CTs (greater or equal to 25 MW)**
  - DLN and controlled CTs surrender at 1:1 ratio of allowances to emissions.
  - Uncontrolled CTs surrender at a 2:1 ratio.
  - Require that current ozone season NOx allowances are used.

- **Non-CAIR Affected EGU CTs (<25 MW)**
  - Actual to allowable test similar to Pennsylvania Small Source NOx regulation (Chapter 129).
  - Controlled CTs surrender allowances equal to amount actual over allowable.
  - Uncontrolled CTs surrender allowances equal to two times the amount that actual emissions are over allowable emissions.
  - Require that current ozone season NOx allowances are used.
  - Exemption for low capacity factor CTs.

- **Benefits of Approach**
  - Consistent with OTC support of market-based programs.
  - Dispatch stack generally re-ordered based on NOx rate with controlled CTs running first.
  - Incentive for more uncontrolled CTs to install controls, or repower, based on economics.
  - More cost effective than "one size fits all" approach.
  - Less impact to system reliability than an across the board requirement.
  - Simple to implement through adjustments to unit dispatch price.

Possible Solutions to Model / Investigate (cont.)

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II. ISO incentive approaches

- Update bidding rules to allow for an appropriate level of capital cost recovery related to pollution control equipment. Current bidding rules limit cost-based energy market bids to variable O&M only.

III. Air Regulatory Incentives

- Consider updates to administrative policies and permitting regulations to facilitate deployment of water injection and/or new CTs:
  - **Water Injection**. Policies to address how potential increased CO, VOC and PM emissions associated with water injection would be handled under permits/NSR.
  - **New Combustion Turbines**. Work with industry to remove impediments to deploying new CTs:
    - Consider flexibility around capacity factor limits at new CTs so that economics can be improved to justify the capital cost of projects.
    - Flexibility and regulatory emission limits to allow use of #2 oil at new CTs replacing old CTs at locations without natural gas access.

Possible Solutions to Model / Investigate (cont.)

IV. Voluntary Load Response Programs

- ISOs work with distribution companies to discuss opportunities for load response programs to support peak hour load reduction on days when attainment is at risk. E.g. discuss with PJM Load Response Working Group.

- ISOs and some distribution companies have incentive programs in place now to reduce electric consumption during peak demand periods:

  - PECO Energy Smart Returns Programs: 70 large customers, 300 MW under various programs (80 MW mandatory).

- **Challenges**

  - Many large customers want to "do the right thing," but if they are called on too frequently, it may reduce participation.

  - Energy and capacity prices (the basis for participant compensation) have not been high enough in recent years to provide a big incentive to participate in load response programs.

  - SIP credit available?

- **Possible Incentives**

  - RPS credits for distribution companies based on MWh of load reduced on high ozone days.

PECO Smart Returns url:
http://www.exeloncorp.com/ourcompanies/peco/pecobiz/energy_savings_products_and_services/smart_returns/

Suggested Next Steps

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- Formalize the current stakeholder process to allow continued constructive input to the OTC. Examples of possible activities:

  - **Industry**

    - Provide continued input on policy alternatives and permutations of policy options.
    - Provide OTC expedited review of emission rates, and other, assumptions used to develop OTC baseline and forecasts (data compilation could be coordinated by single point of contact).
    - Provide data on water injection performance and costs.
    - Provide comment on marketplace assumptions:
      - Unit retirements, firmly planned pollution control installations, new unit costs and plans, etc.
    - Opportunity to share joint industry modeling of option(s).

  - **ISOs**

    - Evaluation of candidate control measures 1 and 2 on system reliability, as well as other options such as allowance surrender concept.
    - Consider updating bidding rules to allow for an appropriate level of capital cost recovery related to pollution control equipment.
    - Consider opportunities to increase participation in new and existing load response programs.