

Water Use Trends of the Energy Industry in the Delaware River Basin

David Sayers

Supervisor, IT and Water Use Section

Kent Barr

Water Resources Analyst, Planning and IT
Branch

Delaware River Basin Commission

WRA 2012 Annual Conference:

Energy, Water and the Environment in the Delaware
River Basin



Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

November 7, 2012

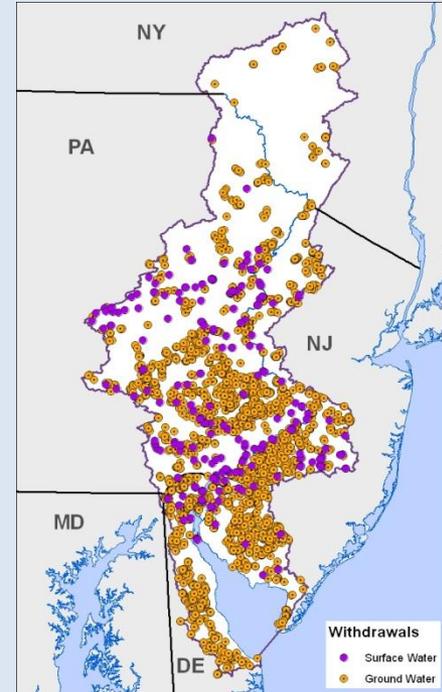
OVERVIEW:

- Data Sources
- Water Use in the DRB: The Big Picture
- Trends in Water Use: Power, PWS, Industry
- Water Use for Power Generation:
 - Water Withdrawals
 - Consumptive Use
 - Water Use by Cooling Type
 - Electricity Generation in the DRB
 - MWh produced per gallon
- Future Trends
 - Water Use for Natural Gas hydrofracking
 - Cooling Type changes; Clean Water Act: §316(b)
 - Projections



DATA SOURCES:

- Water Use Data:
 - States' reports to DRBC
 - DRBC's Surface Water Charging Program
- Energy Production Data (MWh):
 - DoE Energy Information Administration (EIA)



<http://www.eia.gov/>

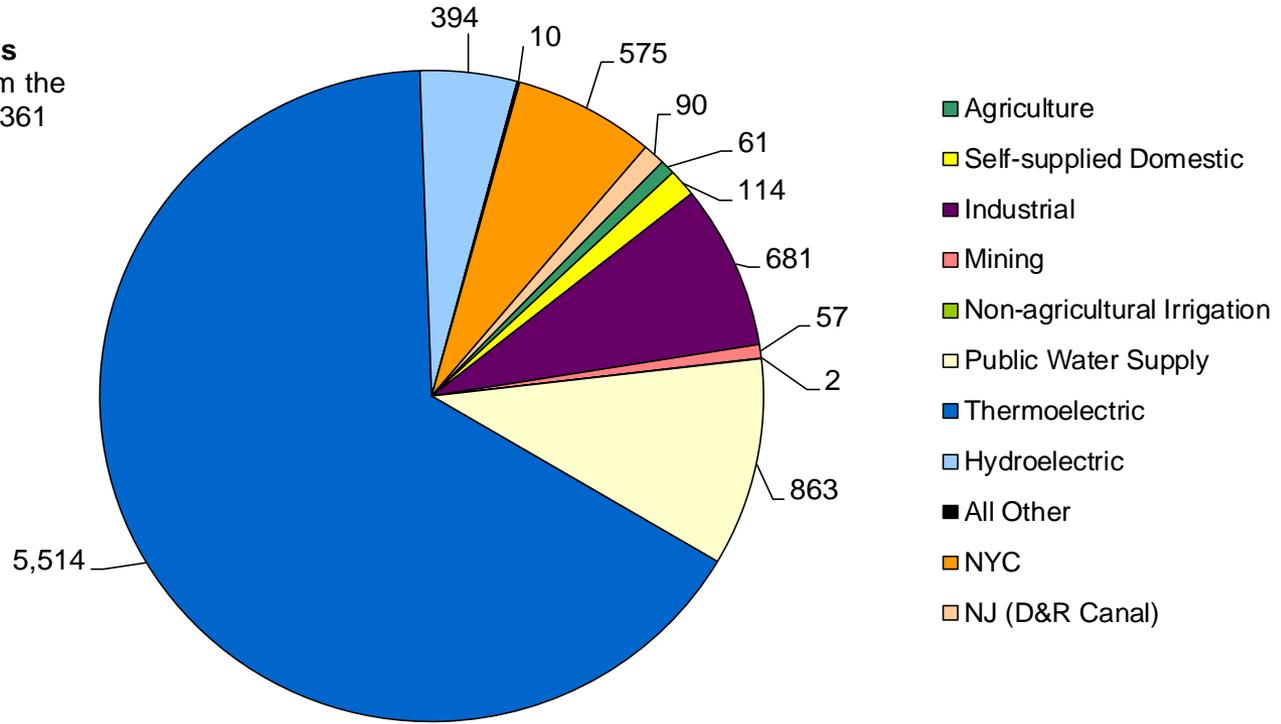
Delaware River Watershed Facts

- ❑ Approx. **15 million** people (almost 5% of the U.S. population) rely on the waters of the basin
- ❑ Drains **13,539 mi²** (34,659 km²), or 0.4% of the continental U.S. land area
- ❑ Flows **330** miles from Hancock, NY to Delaware Bay

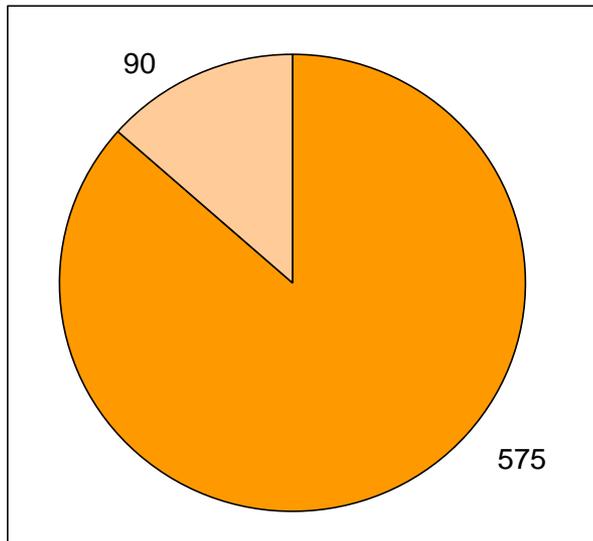


DAILY WATER WITHDRAWS, MAJOR EXPORTS AND CONSUMPTIVE USE IN THE DRB, 2007

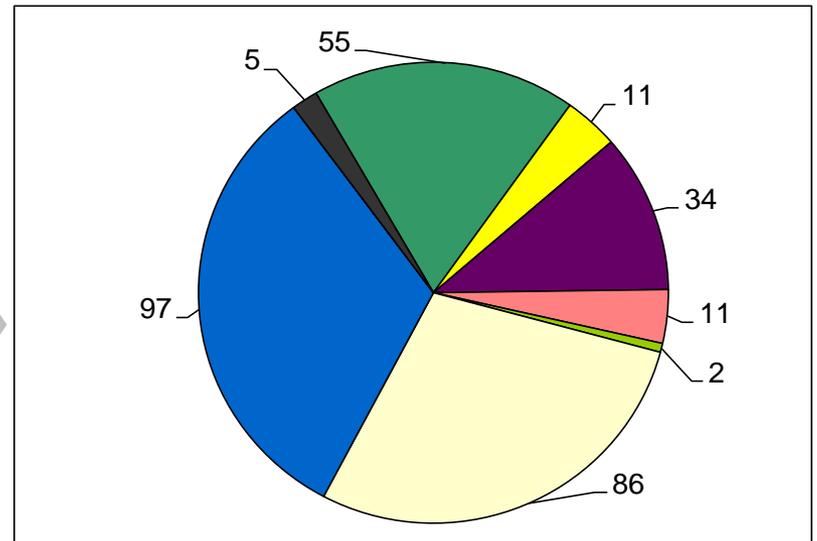
Total Water Withdrawals
(ground and surface) from the Delaware River Basin: 8,361 mgd



Major Exports from the Delaware River Basin: 665 mgd



Consumptive Use in the Delaware River Basin: 302 mgd



Pie chart values in mgd
(million gallons per day)

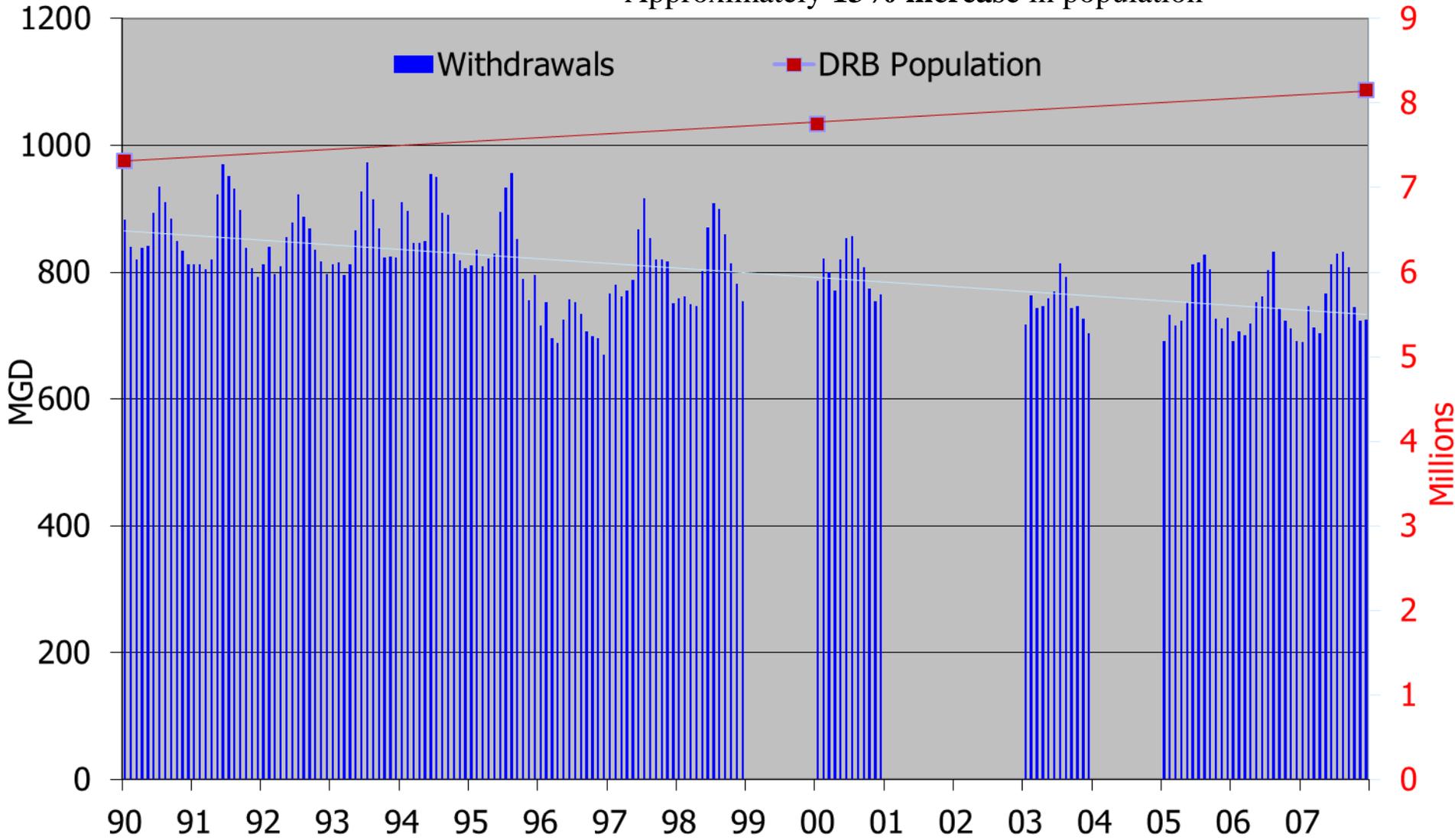
Water Withdrawals for

Public Water Supply (PWS)



Aggregated Withdrawals of 40 Public Water Supply Systems in the DRB (MGD)

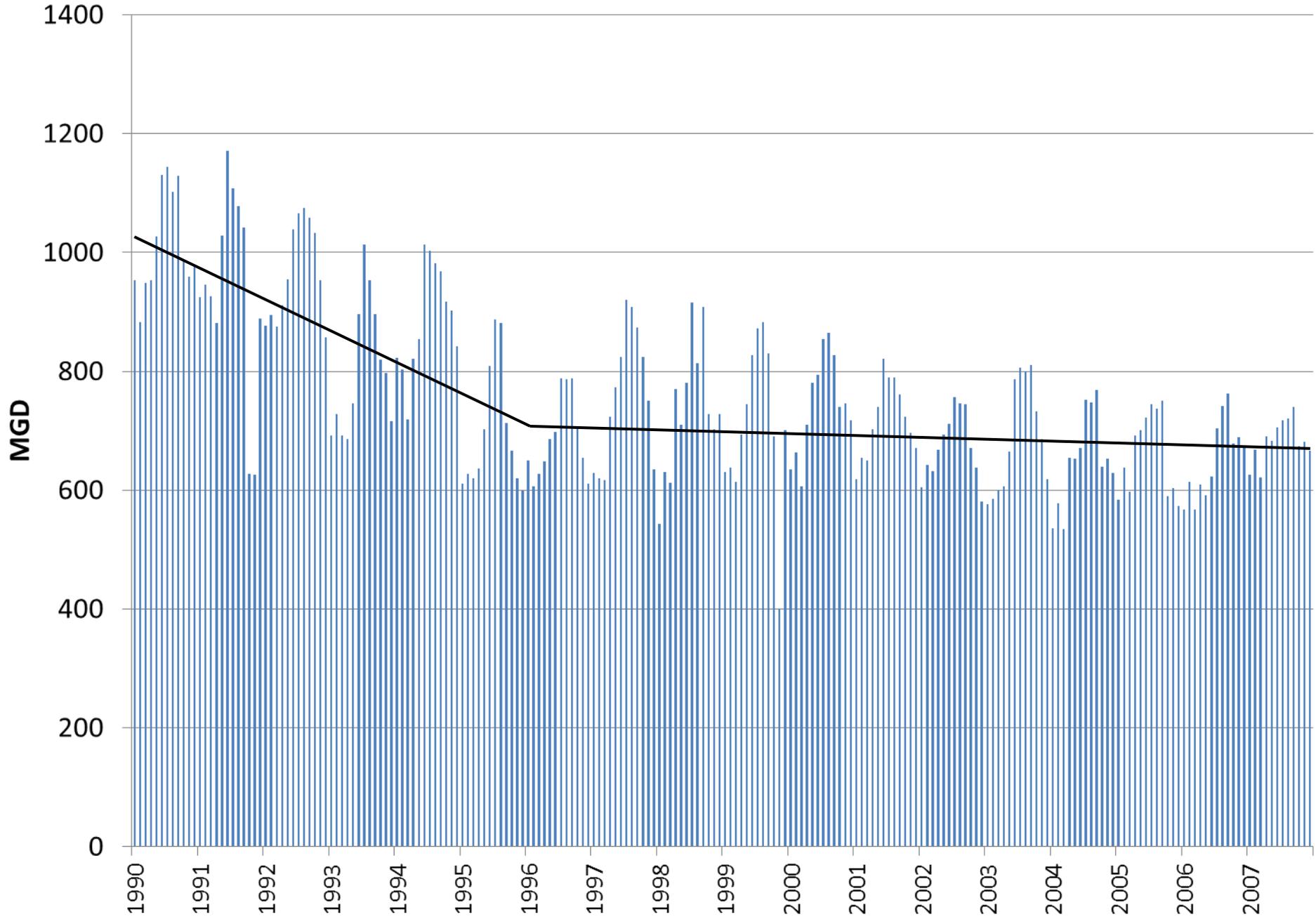
Trendlines 1990 - 2007: Approximately **15% decline** in withdrawals
Approximately **13% increase** in population



Water Withdrawals for Industry



Industrial Withdrawals in the DRB

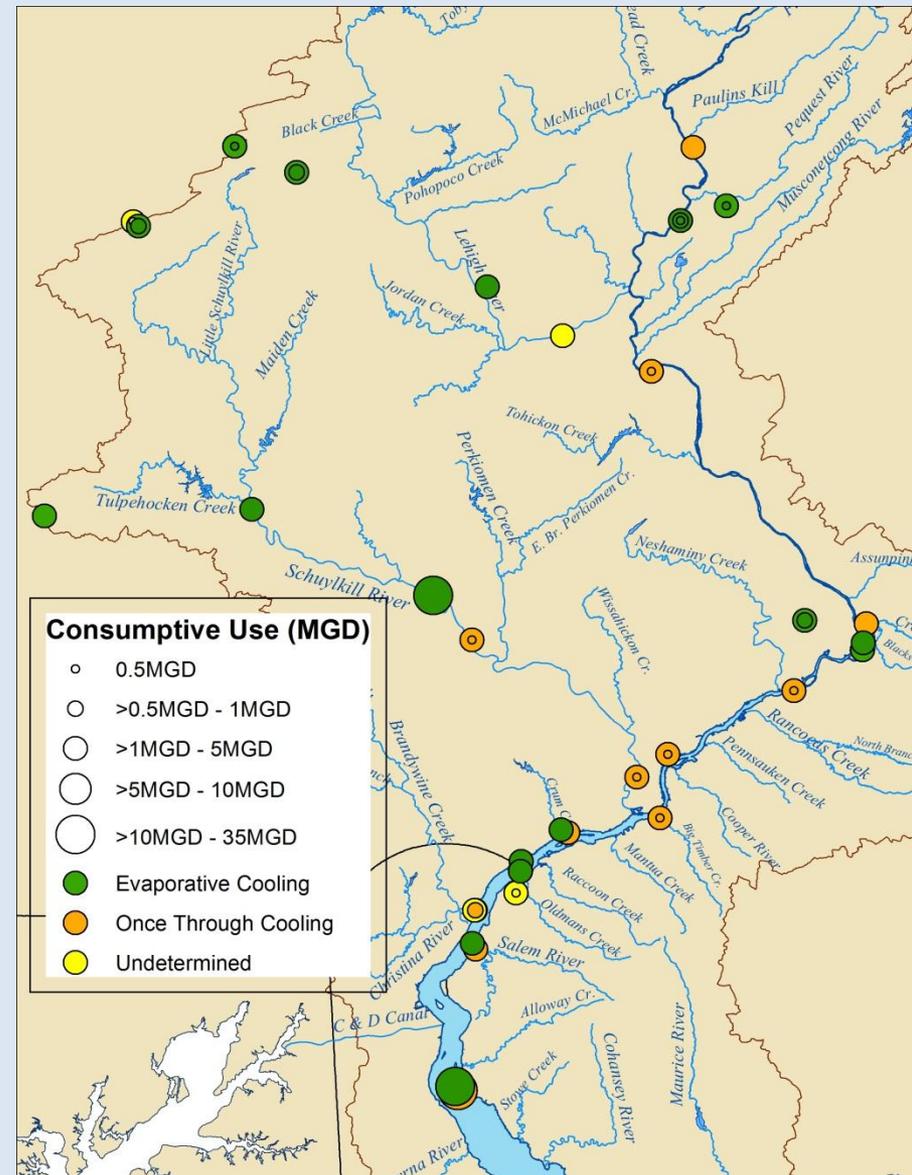


Water Withdrawals and Consumptive Use for Power Generation

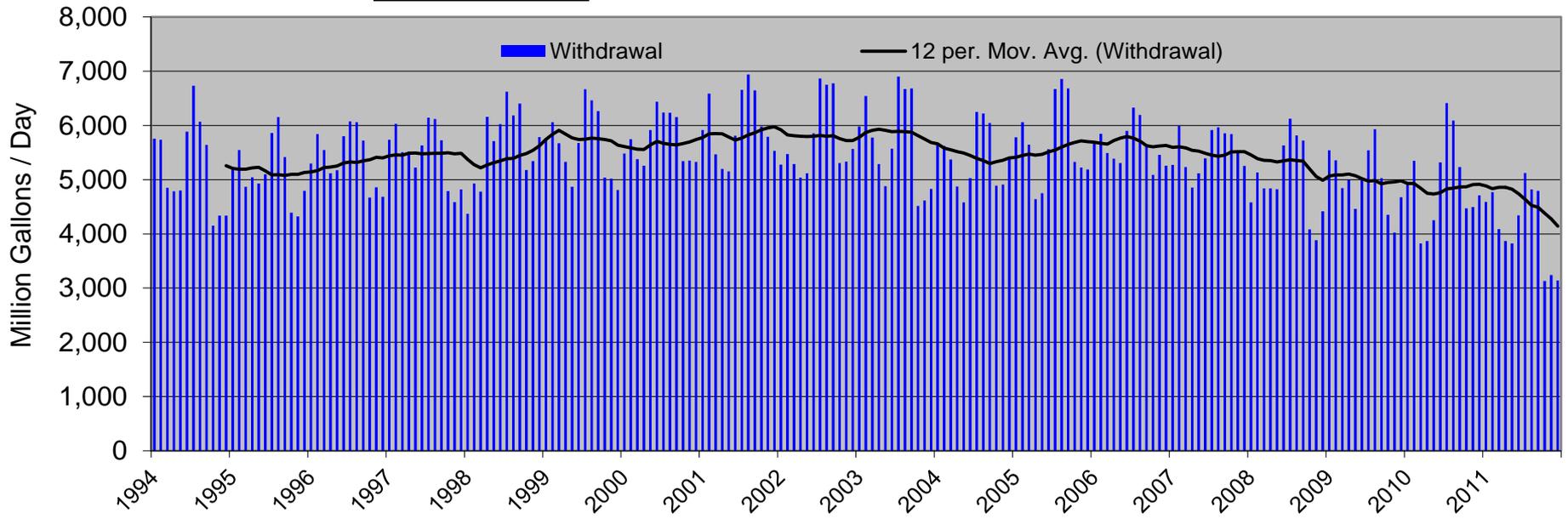


ENERGY GENERATION FACILITIES IN DRB:

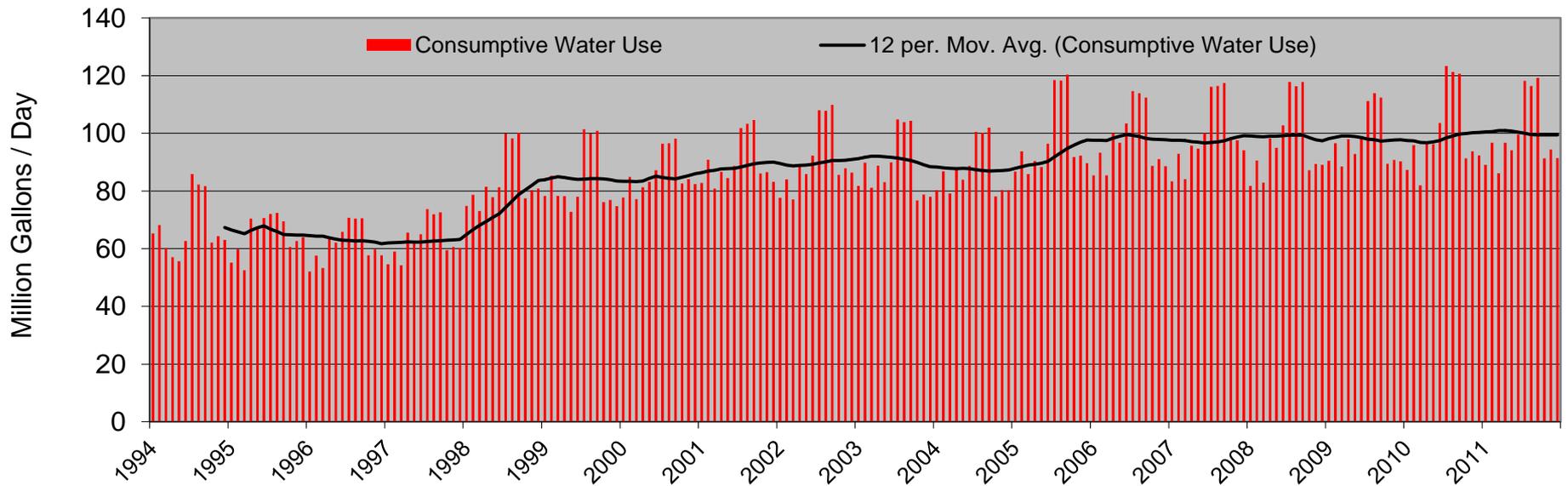
- 141 facilities generate energy (EIA - MWh)
- 37 “facilities” require significant water source
- >99% of MWh produced require dedicated water source



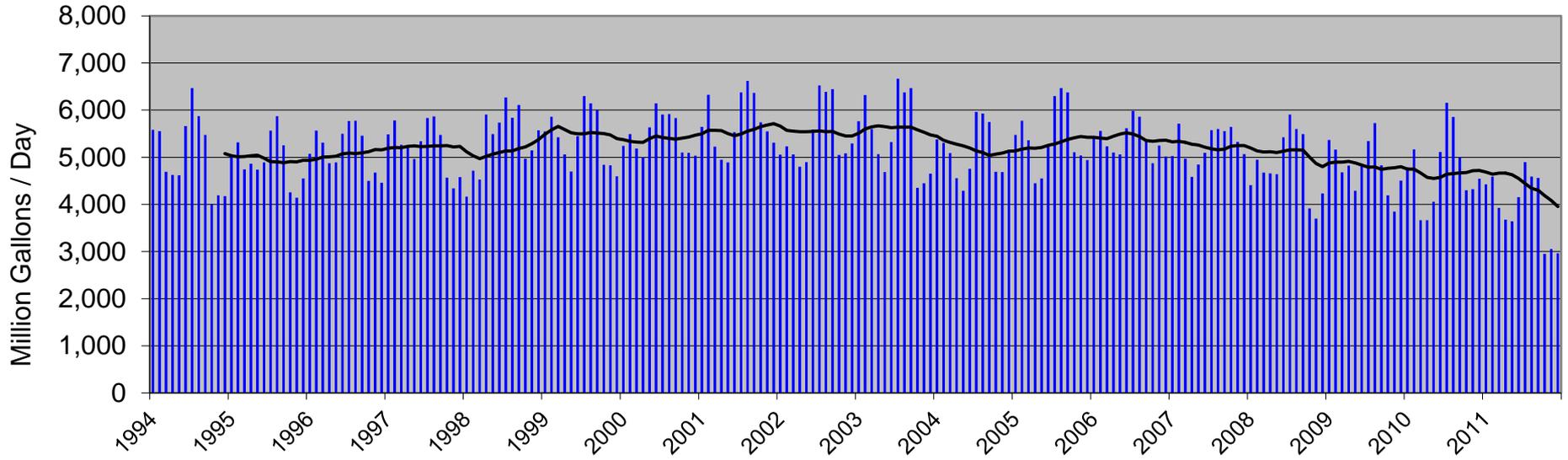
Total Withdrawals for Thermoelectric Facilities in the DRB



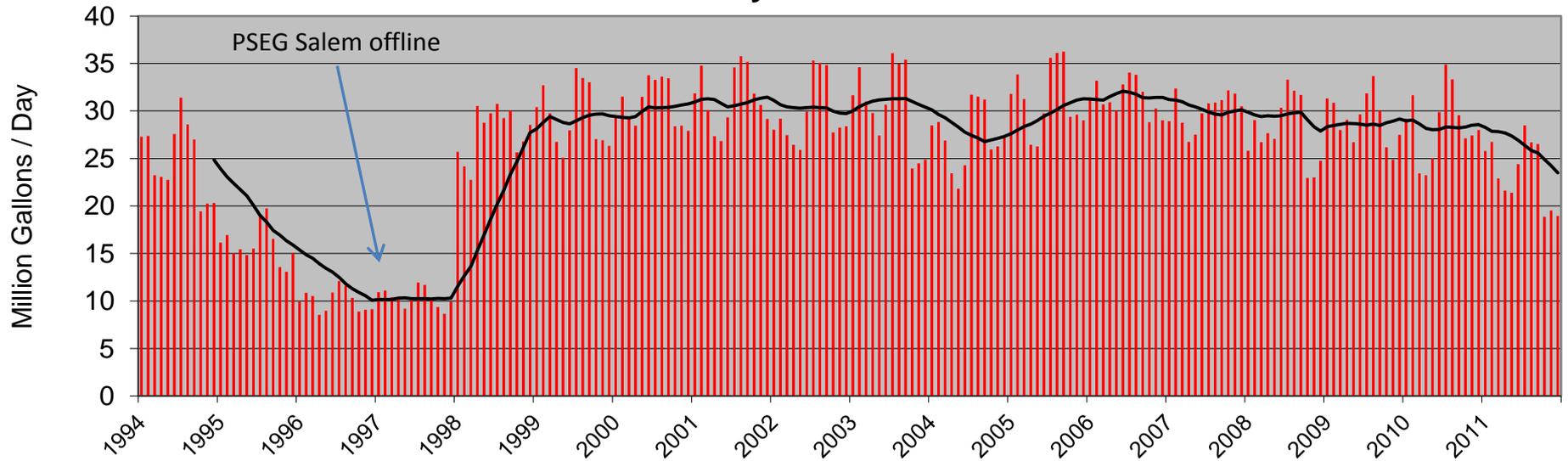
Total Consumptive Use for Thermoelectric Facilities in the DRB



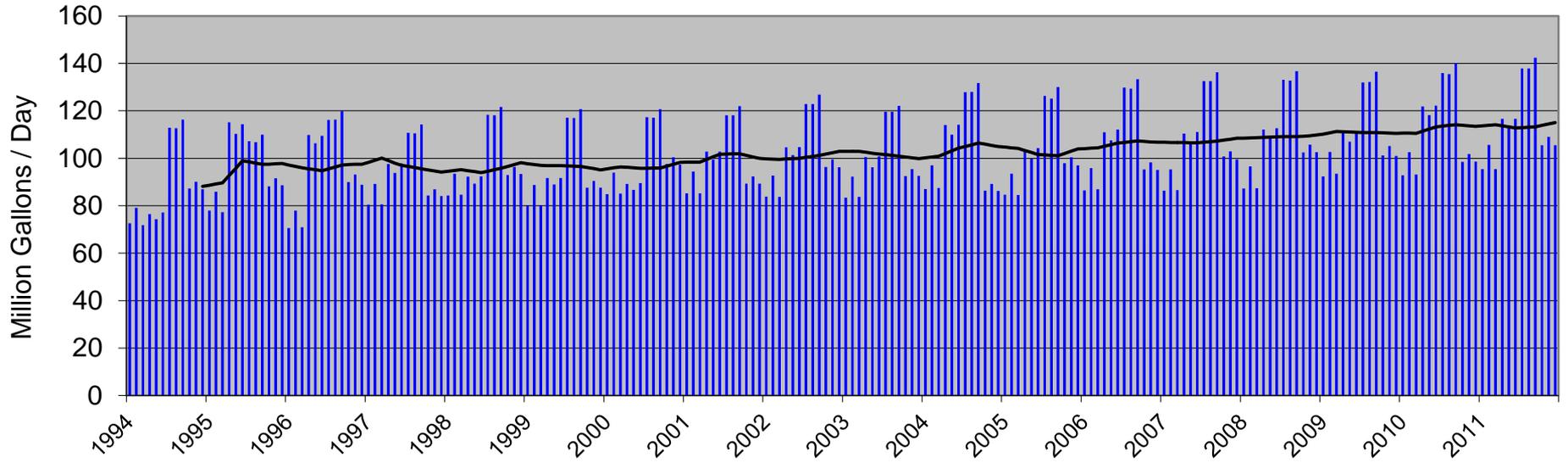
Total Withdrawals for Thermoelectric Facilities with Once Through Cooling Systems



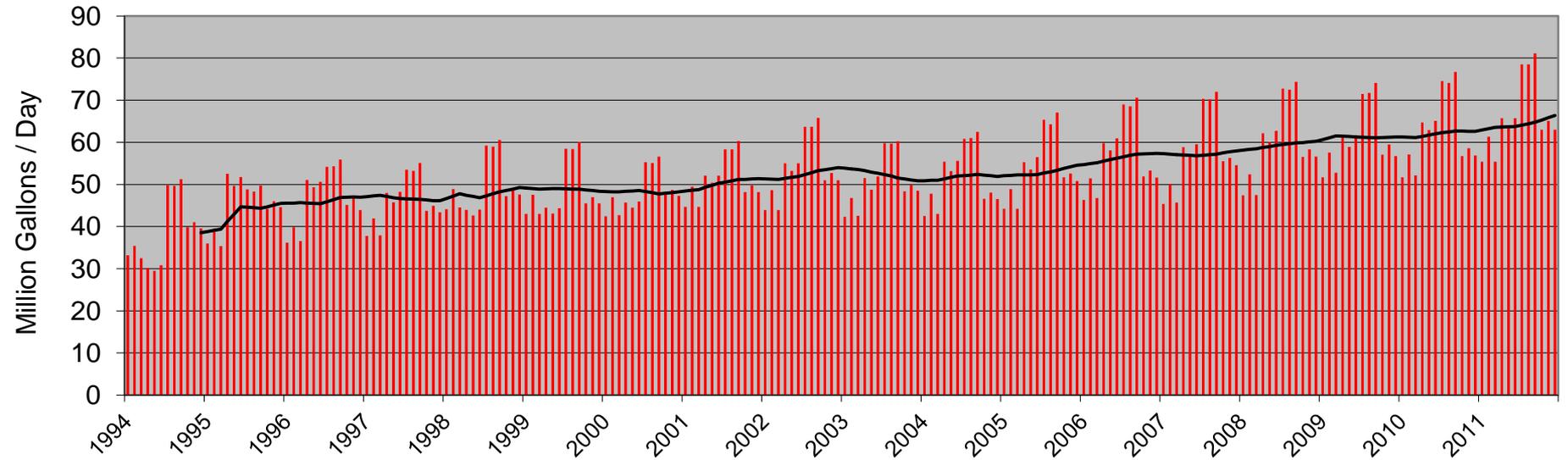
Total Consumptive Use for Thermoelectric Facilities with Once Through Cooling Systems



Total Withdrawals for Thermoelectric Facilities with Cooling Tower Systems



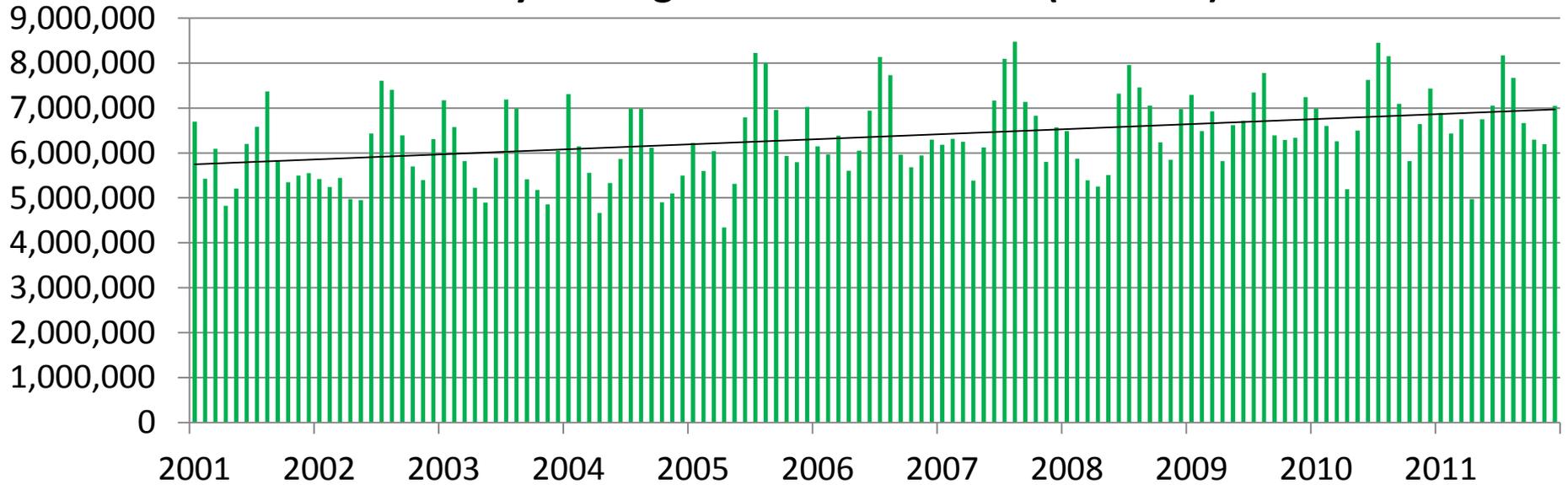
Total Consumptive Use for Thermoelectric Facilities with Cooling Tower Systems



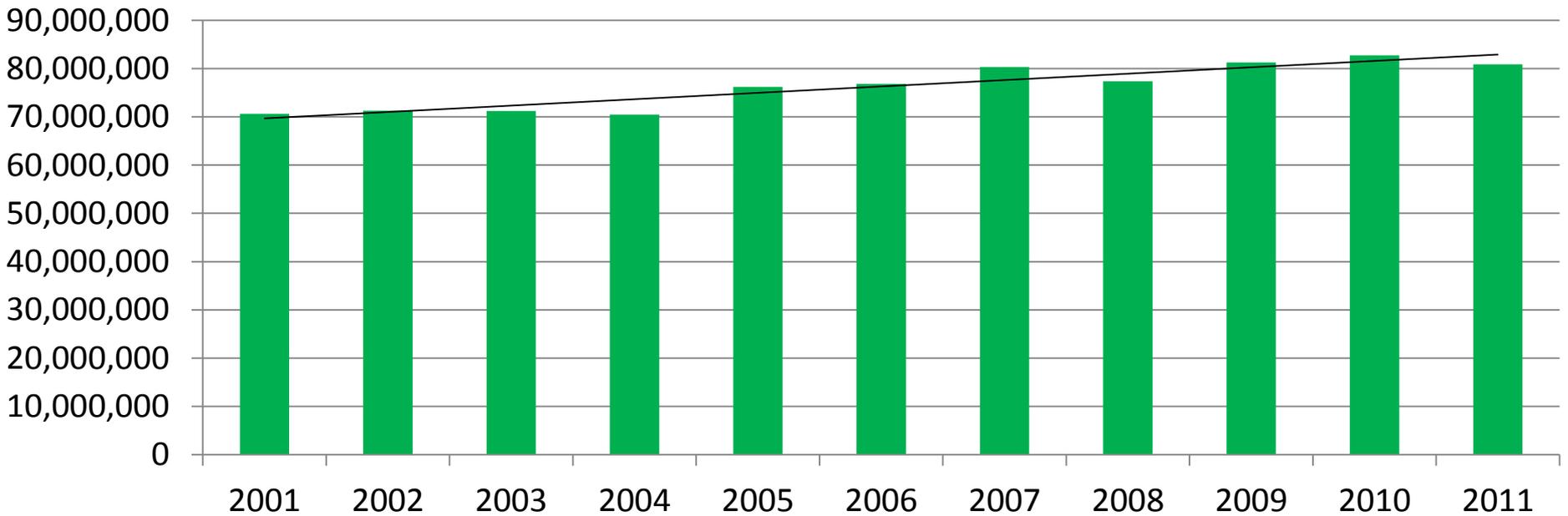
WATER USE TRENDS:

- Once Through (OT) cooling plants reduced withdrawals (~1BGD) and consumptive use (~8MGD)
- Some OT plants taken off line (e.g, Exelon Cromby)
- Evaporative Cooling plants have increased withdrawals (~30MGD) and consumptive use (~25MGD)
- What about MWh generated?

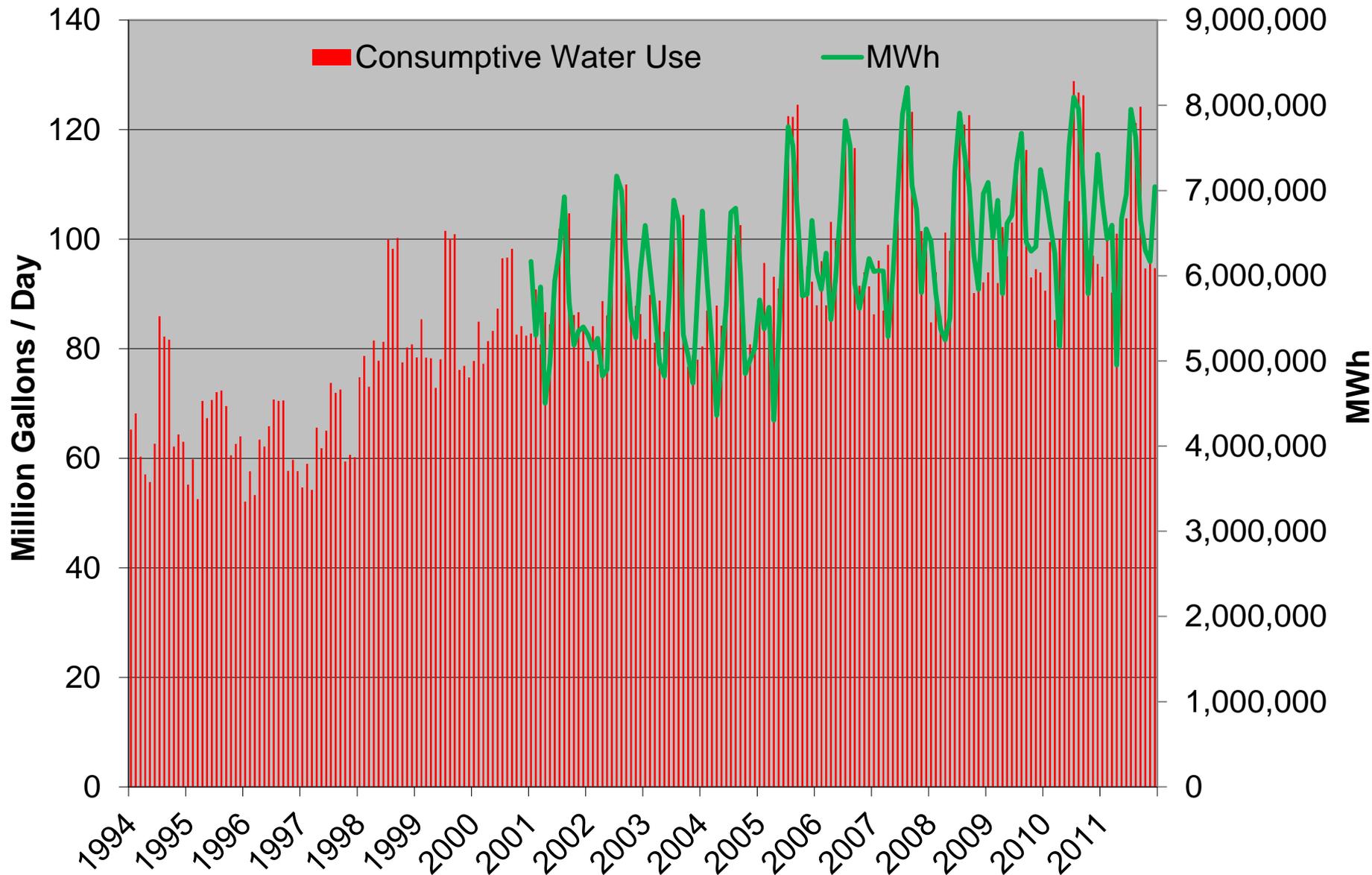
Monthly MWh generated in the DRB (EIA data)



Annual MWh generated in the DRB (EIA data)



Total Consumptive Use and MWh Produced for Thermoelectric Facilities in the DRB

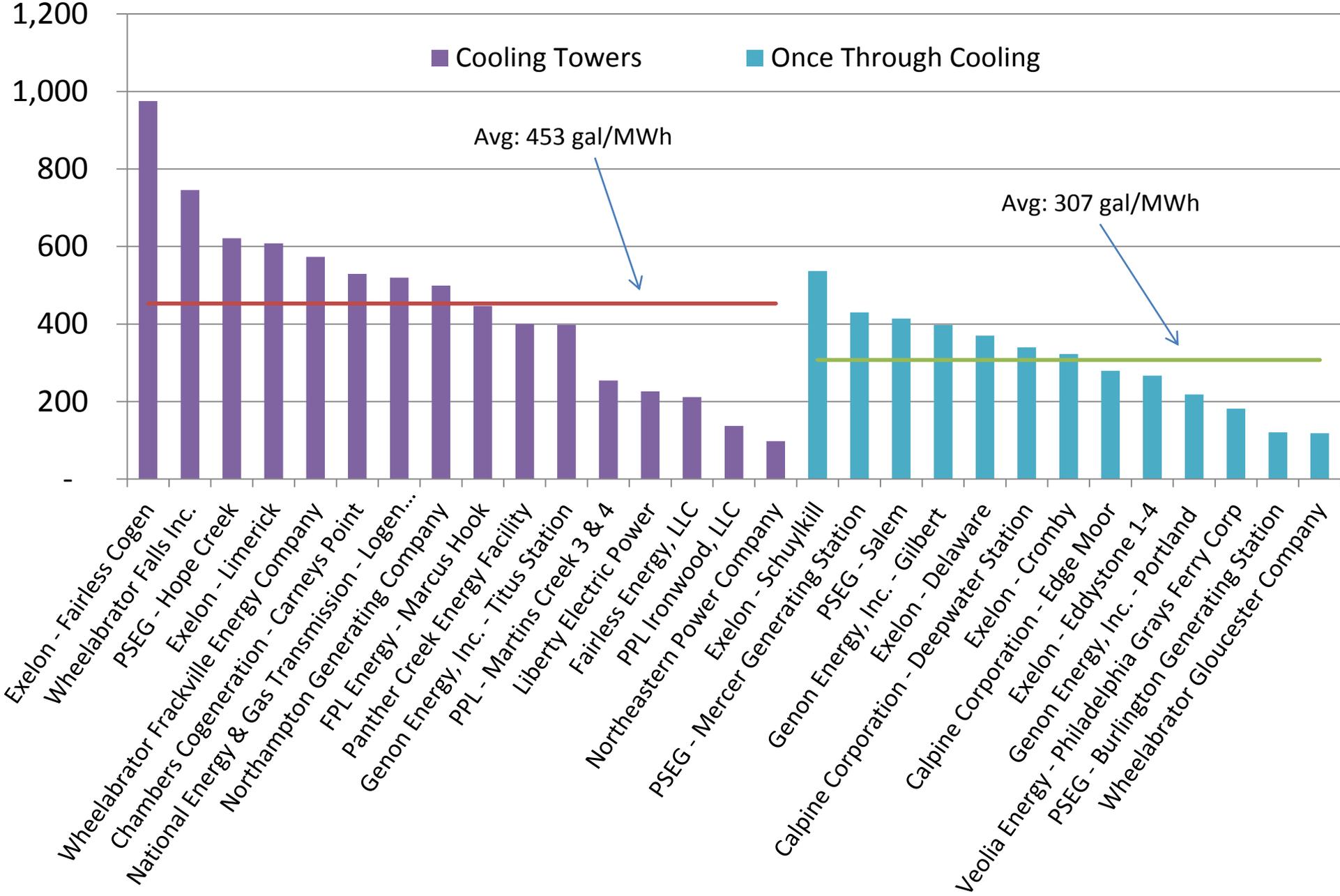


TOP 10 WATER USERS AND MWh GENERATORS (2011)

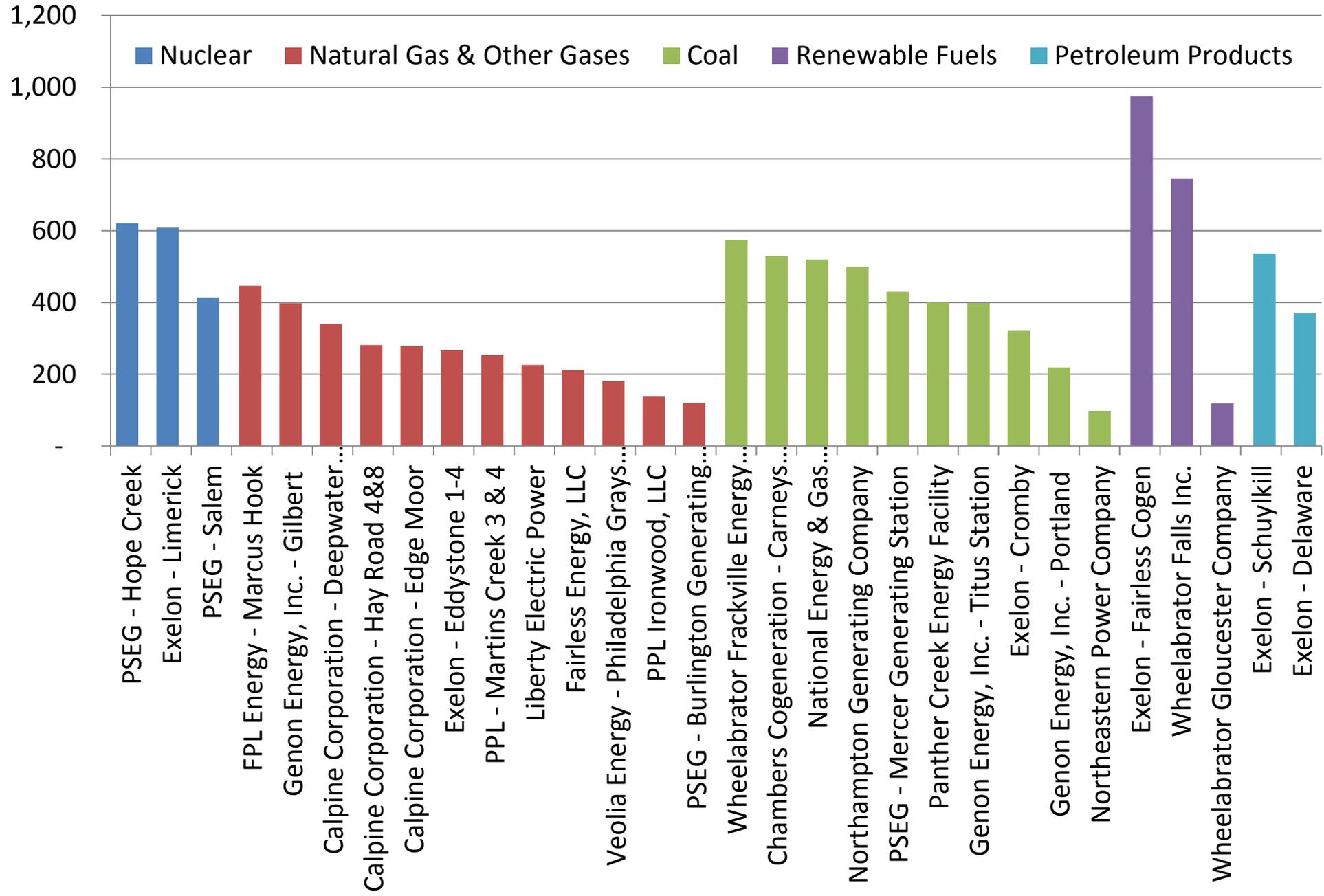
Facility Name	Cooling Type	Primary Fuel Type	Consumptive Use (MGD)	% of Total	Cumulative %	50%	100%
Exelon - Limerick	EC	Nuclear	32.9	33%	33%		
PSEG - Salem	OT	Nuclear	19.5	20%	53%		
PSEG - Hope Creek	EC	Nuclear	16.2	16%	69%		
FPL Energy - Marcus Hook	EC	Nat. Gas & Other Gases	4.2	4%	73%		
Fairless Energy, LLC	EC	Nat. Gas & Other Gases	4.1	4%	77%		
Calpine Corporation - Hay Road 4&8	Mixed	Nat. Gas & Other Gases	3.1	3%	80%		
Calpine Corporation- Bethelhem	Mixed	Solid Renewable Fuels	2.4	2%	83%		
Liberty Electric Power	EC	Nat. Gas & Other Gases	1.8	2%	85%		
PPL - Lower Mount Bethel Energy	EC	Petroleum Products	1.8	2%	86%		
PPL Ironwood, LLC	EC	Nat. Gas & Other Gases	1.6	2%	88%		

Facility Name	Cooling Type	Primary Fuel Type	MWh	% of Total	Cumulative %	50%	100%
Exelon - Limerick	EC	Nuclear	18,462,503	23%	23%		
PSEG - Salem	OT	Nuclear	17,833,246	22%	45%		
PSEG - Hope Creek	EC	Nuclear	10,474,891	13%	58%		
Fairless Energy, LLC	EC	Nat. Gas & Other Gases	7,214,065	9%	67%		
PPL Ironwood, LLC	EC	Nat. Gas & Other Gases	4,741,290	6%	73%		
FPL Energy - Marcus Hook	EC	Nat. Gas & Other Gases	4,038,084	5%	78%		
Calpine Corporation - Hay Road 4&8	Mixed	Nat. Gas & Other Gases	3,915,575	5%	83%		
Liberty Electric Power	EC	Nat. Gas & Other Gases	3,095,061	4%	86%		
Genon Energy, Inc. - Portland	OT	Coal	1,165,848	1%	88%		
Veolia Energy - Phila. Grays Ferry	OT	Nat. Gas & Other Gases	1,016,991	1%	89%		

Gallons (consumed) /MWh - by Cooling Type



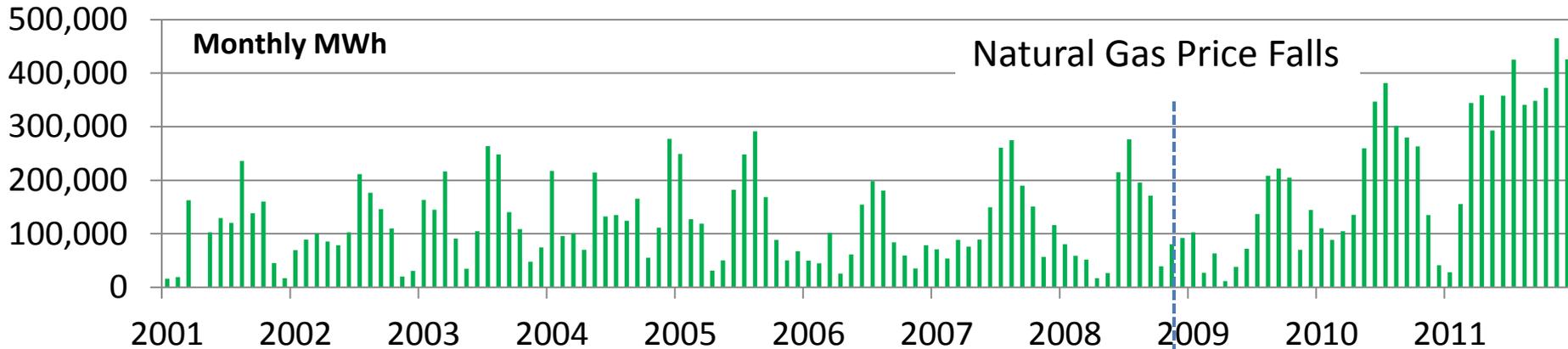
Gallons (consumed) / MWh - by Primary Fuel Type



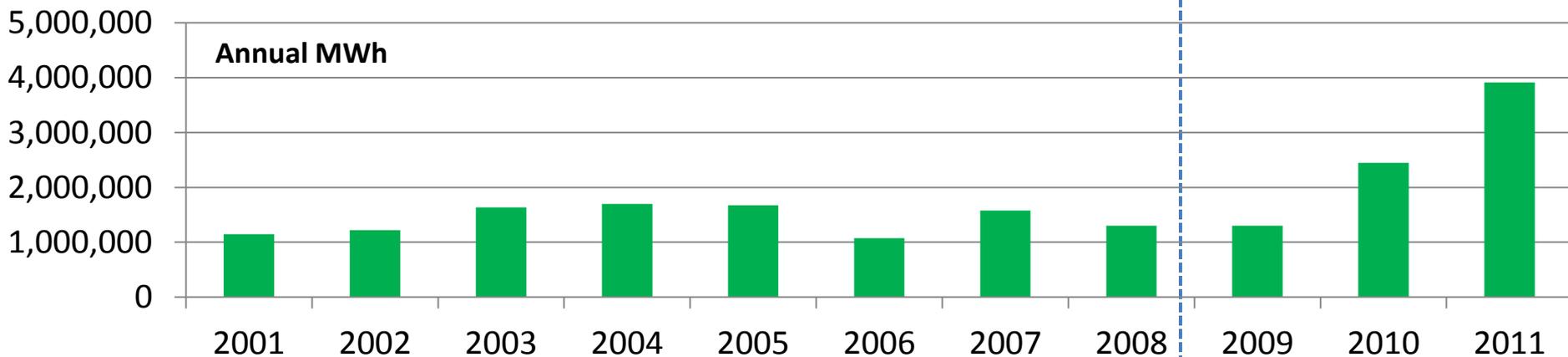
Calpine Corporation – Hay Road (DE) Natural Gas Plant

Monthly MWh

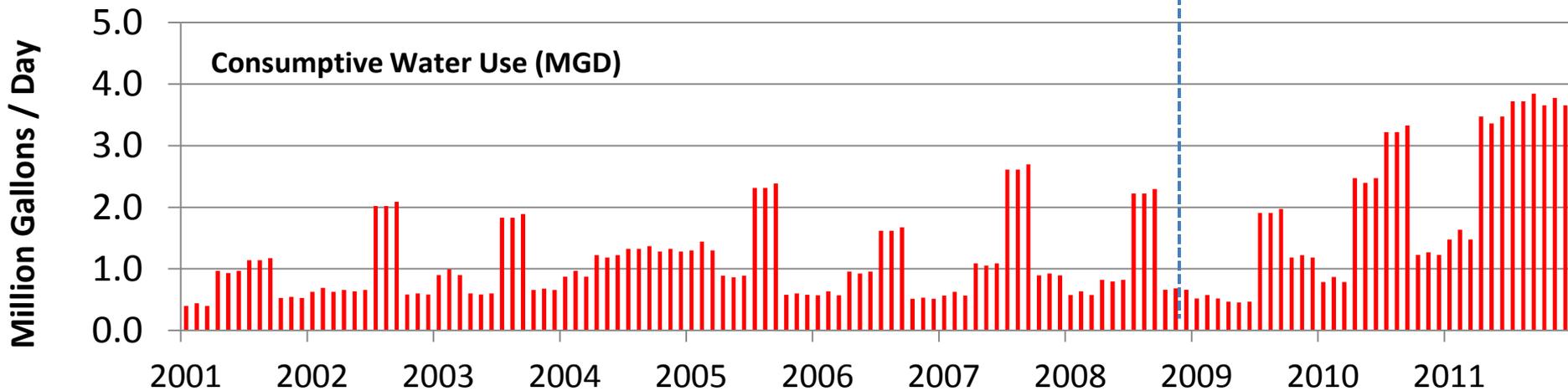
Natural Gas Price Falls



Annual MWh



Consumptive Water Use (MGD)



PROJECTED WATER NEEDS: NATURAL GAS DRILLING



Over 10-20 years:

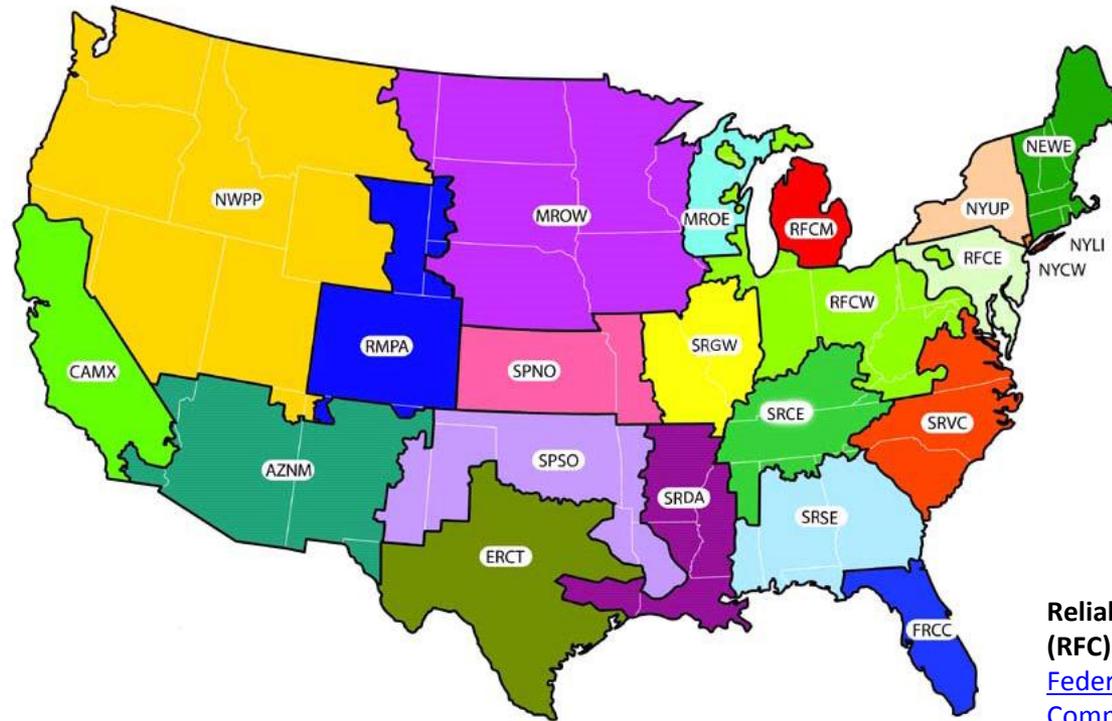
- 5 million gallons per horizontal well stimulated
- 21-90 BG (less w/recycling)
- Approx. 5 – 12 MGD
- Consumptive Use, in headwater location



[Home](#) > [Electricity](#) > NERC Regions

North American Electric Reliability Corporation (NERC) Regions

Electricity Market Module Regions



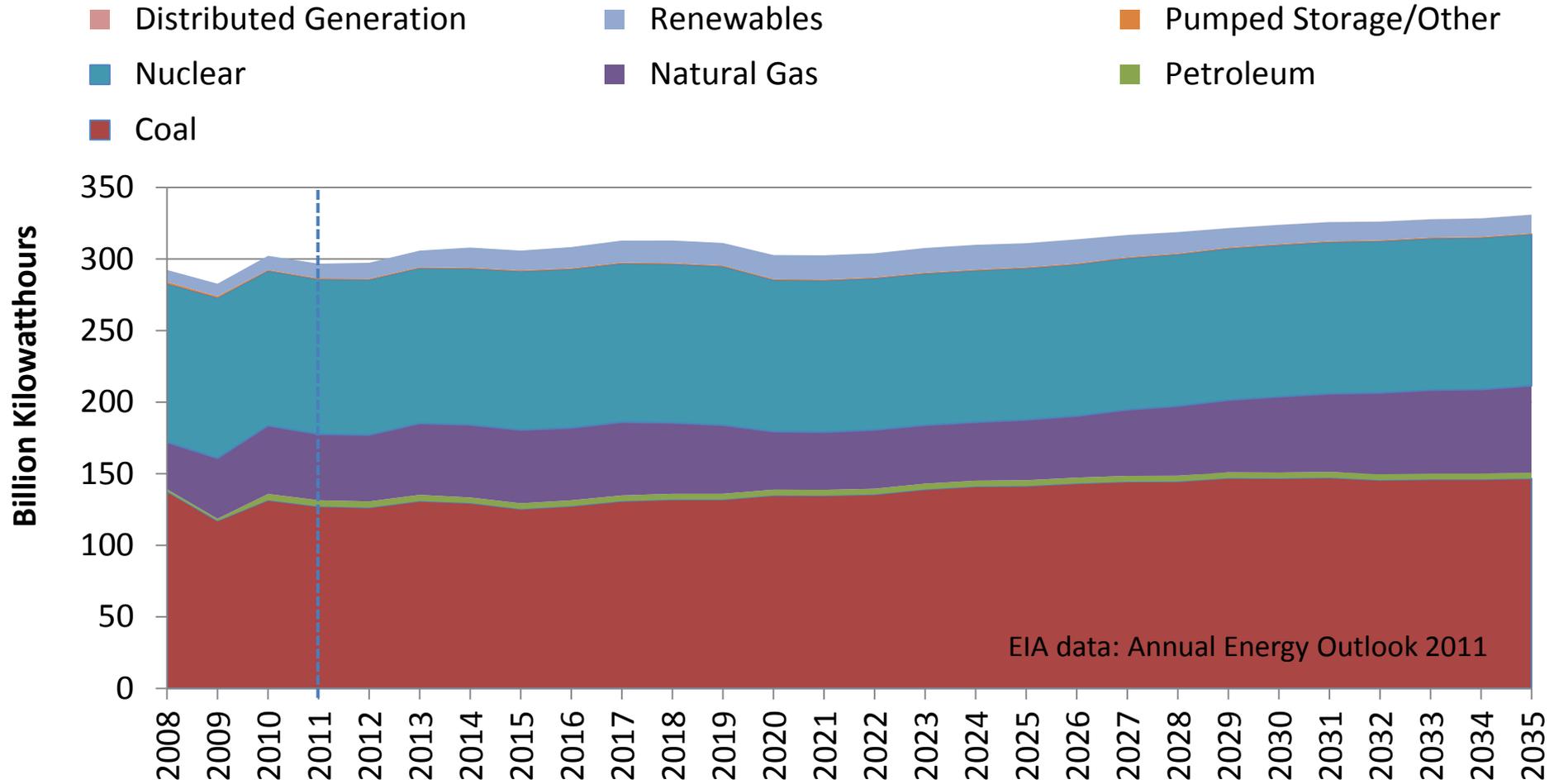
FRCC - Florida Reliability Coordinating Council
MRO - Midwest Reliability Organization
NPCC - Northeast Power Coordinating Council
RFC - ReliabilityFirst Corporation

SERC - SERC Reliability Corporation
SPP - Southwest Power Pool, RE
TRE - Texas Regional Entity
WECC - Western Electricity Coordinating Council

Note: The Alaska Systems Coordinating Council (ASCC) is an affiliate NERC member.
Source: North American Electric Reliability Corporation.

ReliabilityFirst Corporation (RFC) is one of the eight [Federal Energy Regulatory Commission](#) (Commission)-approved regional reliability organizations responsible for ensuring the reliability of the North American bulk power system, pursuant to the [Energy Policy Act of 2005](#).¹

Projected Electricity Generation (Reliability First Corporation / East)



12% increase in Electricity Generation 2011 – 2035

Should we expect same for consumptive water use?

Conclusions

- Trend away from Once Through Cooling to Evaporative Cooling
- Clean Water Act: §316(b)
 - Reduce I&E impacts
 - No more OT cooling plants constructed?
- Evaporative Cooling – potentially allows consumptive use to move upstream/tributaries (compared to Once-Through)
- Better Understanding of Gallons / MWh
 - Cooling Type
 - Fuel Type
- Electricity Generation expected to increase
- Consumptive water use (for thermoelectric) also expected to increase

Thank you for your interest in this presentation

David Sayers

Supervisor, IT and Water Use Section

David.sayers@drbc.state.nj.us

609 883 9500 x236

Kent Barr

Water Resources Analyst, Planning and IT Branch

Kent.barr@drbc.state.nj.us

609 883 9500 x237

Delaware River Basin Commission

Water Resources Association of the Delaware River Basin

November 7th 2012

Bordentown, NJ.

