Energy-Water Nexus Research: Data Challenges

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AlChE Food-Energy-Water Workshop Oct. 7, 2015



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Water for Electricity (2008)



Freshwater Intensity (gallons/kWh)



Withdrawals By Source (2008)



Effluent Temperatures



Averyt et al. 2013a; Madden et al., 2013; EW3 2011

Challenge #1: Geolocation



Challenge #1: Geolocation





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Challenge #1: Geolocation





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Challenge #2: Power Plant Water Use



Challenge #2: Power Plant Water Use

Mechanism to Estimate Water Use



CIRES

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Challenge #2: Power Plant Water Use

Verify Cooling Technology & Water Source





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The Outcome

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	S21 ▼ (*	- f _x	Gas		K	W										
	A B	С	E	F	S	W		Х	Y	Z	AB	AC	BD	BE	BF	Ē
	🧧 Plant Name	State	Plant	Generator	Primary Fue	eGRID		Best Estimate	Best Estimate	Generation	EIA Lat	EIA Lon	Generator	Generator	Unit should	٦
	N N N N N N N N N N N N N N N N N N N		Code	Code	Туре	Subregion		Generation in	Capacity Factor	Data Source			Estimated Water	Estimated	be cooled?	
	¥				(Definition)			2008	in 2008				Withdrawal Rate	Water		
	E C												(Gallons/WWW)	Consumption (Gallons/MWb)		
3	v	· •	•		-		-	•	-		• •	-	Ļ	(Gallonsinivi)	•	L
4	0 B C Cobb	MI	1695	1	Gas	RFCM		120	0%	EIA 923 5A	43.28	-86.27	388,617,540	-	1	
5	0 B C Cobb	MI	1695	2	Gas	RFCM		87	0%	5 EIA 923 5A	43.28	-86.27	388,617,540	-	1	
6	0 R E Burger	он	2864	3	Coal	RFCW		4,069	0%	5 EIA 923 5A	39.96	-80.76	208,830,719	-	1	
7	0 Lake Catherine	AR	170	2	Gas	SRMV		167	0%	5 EIA 923 5A	34.52	-93.06	160,472,355	-	1	
8	0 Havana	IL	891	3	Oil	SRMW		241	0%	5 EIA 923 5A	40.28	-90.08	38,387,328	6,687,504	1	
9	0 Havana	IL	891	4	Oil	SRMW		207	0%	5 EIA 923 5A	40.28	-90.08	38,387,328	6,687,504	1	
10	0 Lake Catherine	AR	170	1	Gas	SRMV		670	0%	5 EIA 923 5A	34.52	-93.06	37,146,339	-	1	
11	1 Grays Harbor Energy Facili	ty WA	7999	ST1	Gas	#N/A		1,191	0%	EIA 923 5A	46.97	-123.48	15,053,594	11,963,646	1	
12	0 Sam Bertron	IX	3468	SI1 5	Gas	ERCI		26,572	2%	5 EIA 923 5A	29.73	-95.17	9,499,438	888	1	
13	0 Deepwater	NJ	2384	1	Gas	RECE		3,457	0%	5 EIA 923 5A	39.65	-75.52	8,748,367	-	1	
14	0 Jemeries	SC	3319	2	01	SRVC		2,422	1%	5 EIA 923 5A	33.24	-79.92	8,590,784	9,740	1	
10	U Jemeries	SC	3319	2	01	SRVC		3,1/8	1%	5 EIA 923 5A	33.24	-79.92	6,547,162	7,423	1	
10	0 Rock River	VVI	4057	2	Gas	MROE		1,261	0%	EIA 923 5A	42.58	-89.58	5,107,760	33,882	1	
10	0 C D Moletech Ir		4057	2 0T4	Cas	FROE		7,024	10/	EIA 923 DA	42.00	-09.00	5,107,760	50,002	1	
10	0 C D Multiosh Ji	TV	2620	511 5	Can	FREE		7,004	79/	EIA 923 UA	20.00	-01.92	5,095,730	50,606	1	
20	0 Clean Flood	MA	1600	\$	Oil	NEWE		2,007	10/	EIA 923 JA	32.00	-90.01	4,002,542	11 872		
21	0 Cleary Flood	EI	660	\$	Cae	ERCC		1.015	1.2	EIA 022 EA	41.07 27.4F	-/ 1.11	4,502,542	22.242	1	
22	0 Vero Reach Municipal Row	0 El	603	5	Cae	FROC		2,094	10/	EIA 022 5A	27.4	-00.34	3,001,404	23,242	1	
23	0 Harding Street	IN	990	4	Oil	RECW		207	0%	EIA 923 5A	39.71	-86.19	3 646 851		1	
24	0 Eddystone Generating Stat	tir PA	3161	Š.	Oil	RECE		23.449	1%	EIA 923 5A	39.86	-75 32	3 367 206	1.006	1	
25	0 Eddystone Generating Stat	tic PA	3161	4	Oil	RECE		21 493	1%	EIA 923 5A	39.86	-75.32	3 109 481	1,000	1	
26	0 Valley	тх	3508	4	Gas	FRCT		69 448	4%	EIA 923 5A	36.64	-96.37	2 822 457		1	
27	0 Astoria Generating Station	NY	8906	2	Gas	NYCW		29.249	2%	EIA 923 5A	40.78	-73.92	2,426,080	-	1	
28	1 Bowline Point	NY	2625	2	Gas	NYUP		42,944	1%	EIA 923 5A	41.20	-73.97	2,417,066	549	1	
29	0 Herbert A Wagner	MD	1554	1	Gas	RFCE		38,695	3%	EIA 923 5A	39.18	-76.53	2,083,188		1	
30	0 R W Miller	ΤХ	3628	2	Gas	ERCT		124,545	14%	5 EIA 923 5A	32.66	-98.31	2,023,889	-	1	
31	0 R W Miller	ΤХ	3628	3	Gas	ERCT		276,524	16%	5 EIA 923 5A	32.66	-98.31	1,644,115	-	1	
32	0 AES Alamitos LLC	CA	315	1	Gas	CAMX		33,908	2%	5 EIA 923 5A	33.77	-118.10	1,435,972	696	1	
33	0 AES Alamitos LLC	CA	315	2	Gas	CAMX		23,101	2%	5 EIA 923 5A	33.77	-118.10	1,362,271	1,021	1	
34	0 Glenwood	NY	2514	4	Gas	NYLI		43,702	4%	5 EIA 923 5A	40.83	-73.65	1,344,115	-	1	
35	1 Montville Station	СТ	546	6	Oil	NEWE		20,062	1%	EIA 923 5A	41.42	-72.10	1,314,637	-	1	
36	1 McKee Run	DE	599	3	Gas	RFCE		488	0%	EIA 923 5A	39.16	-75.57	1,208,533	241,707	1	
37	0 Port Everglades	FL	617	ST1	Oil	FRCC		175,464	8%	5 EIA 923 5A	26.09	-80.13	1,189,854	2,694,313	1	
38	0 PSEG Sewaren Generating	g NJ	2411	2	Gas	RFCE		6,399	1%	EIA 923 5A	40.56	-74.25	1,137,688	334	1	
39	0 PSEG Sewaren Generating	g NJ	2411	1	Gas	RFCE		7,563	1%	EIA 923 5A	40.56	-74.25	1,137,688	334	1	
40	0 PSEG Sewaren Generating	g NJ	2411	3	Gas	RFCE		20,324	2%	EIA 923 5A	40.56	-74.25	1,137,688	334	1	
41	0 PSEG Sewaren Generating	g NJ	2411	4	Gas	RFCE		36,277	3%	EIA 923 5A	40.56	-74.25	1,137,688	334	1	
42	1 Gould Street	MD	1553	3	Gas	#N/A		26,457	3%	5 EIA 923 5A	39.27	-76.62	1,081,580	-	1	
43	1 Lake Catherine	AR	170 Column D:	4 Dyna	Gas mic Databac	SRMV	Roil	118,000	2% 60 Roiler-Cooling C	EIA 923 5A	34.52 2 CoolingOps 0	-93.06	1,042,383	-	1	J
	te	water	Column Da	US Dyna	inic DataDas	EX EIA 800	000		co boller-cooling c	CIA 92	o coomigops o	CIA 80		J 110%		-(
Click h	ere to begin														~	

- Geolocation
- Cooling System
- Cooling Water Source
- Estimate Water Withdrawals
- Estimated
 Consumptive
 Use

Averyt et al. 2013a

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Water for Electricity: EIA v. Estimated (2008)



Surface Water Supply Stress (1999–2007)



Surface Water Supply Stress (1999–2007)



Power Intensity of Major Water Systems

Water Deliveries: 11.9 million acre-ft (14.7 km³)

3000 miles (4828 km) of pipelines, canals





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Central Arizona Project US Bureau of Reclamation



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Power Intensity of Major Water Systems

Water Deliveries: 11.9 million acre-ft (14.7 km³)

3000 miles (4828 km) of pipelines, canals

Proposed Deliveries: 4.5 million acre-ft (5.6 km³)





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(Gross) Power Intensity of Proposed Projects



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UNIVERSITY OF COLORADO BOULDER and NOAA



Groundwater Development Project Southern Delivery System Lake Powell Pipeline Project Yampa River Pumpback **Regional Watershed Supply Project** Cadiz Valley Water Conservation,... Northern Integrated Supply Project Eastern New Mexico Rural Water Project **Bay Delta Conservation Plan**



Thank you!

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Data Needs

- Accurate location information
- Simpler breakdown of information by generator, boiler, cooling system, etc.
- More accurate cooling type designation
- Enforcement and more accurate reporting of annual water use data
- More specific and accurate reporting of water source information
- Enforcement and more specific reporting of effluent temperature regimes
- Consistency among available data

From March, 2012 presentation to EIA



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Power Plant Water Use Data: No Nuclear







Power Plant Water Use Data: Non-Reporting



% Withdrawals Supporting Electricity Generation



Averyt et al. 2013b

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Power Intensity of Water Supplies*



The Outcome

