Alaska Energy Data:
The Good, the Bad, the Missing

Available in the internet at:

Created by:
Neil McMahon, DOWL
Funding Provided by:
University of Alaska Fairbanks, Alaska Center for Energy and Power
Published:
June 2023

Main Sources of Data:

Alaska Energy Authority
Power Cost Equalization Program Data , Calendar Year 2021
http://www.akenergyauthority.org/
AEA - Various Infrastructure datasets

Energy Information Administration
EIA final data files from survey forms 860, 861 and 923.
http://www.eia.gov/electricity/data/eia860/index.html
http://www.eia.gov/electricity/data/eia923/
http://www.eia.gov/electricity/data/eia860/index.html

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Sales, Revenue, and
Average Annual Ene

Installed Capacity (MW) of utilities & operators by AEA Energy Region, 2021

AEA Energy Region	Fossil Fuel Turbines	Reciprocating Internal Combustion Engine	Hydroelectric	Wind	Solar	Storage	Region Total	Percent of Statewide Total
Aleutians	0	56	2	1	0	0	59	2%
Bering Straits	0	33	0	3	0	0	37	1%
Bristol Bay	0	40	1	0	0	0	42	1%
Copper River/C.Hubach	5	30	26	0	0	1	62	2%
Kodiak	0	39	34	9	0	5	87	3%
Lower Yukon/Kuskokwim	0	60	0	6	0	1	67	2%
North Slope	43	33	0	0	0	0	75	2%
Northwest Arctic	0	24	0	4	1	2	31	1%
Railbelt	1,589	234	191	45	2	90	2,150	68%
Southeast	113	156	234	0	0	1	503	16%
Yukon-Kovukuk/Upper Tanana	0	27	0	0	0	0	27	1%
Total	**1,750**	**732**	**488**	**68**	**3**	**100**	**3,141**	**100%**

Source: Aggregated from Table 2.1a

ACEP Energy Symposium
August 17, 2023

prepared by Steve Colt, Research Professor
sgcolt@alaska.edu

ACEP
Alaska Center for Energy and Power

UAF
UNIVERSITY OF ALASKA FAIRBANKS

Outline

- Focus on “meso-scale” data corresponding to our day-to-day economic realities
  - Building, utility, community, regional scales
  - Monthly, annual time periods
- *Alaska Energy Statistics* – views from the trenches
- What about Heat?
- What about Transport?
- A few final thoughts

Prepare to be bored….or fascinated

AK Energy Statistics:
A View from the Trenches

Mini Case Study 1: Southeast Diesel Generation

What's wrong with this picture?

Net Generation by Fuel Type by Operators/Utilities (MWh) by AEA Energy Regions, 2014						
AEA Energy Region	Oil	Gas	Coal	Hydro	Wind	Solar
Aleutians	102,128	0	0	2,498	1,695	0
Bering Straits	48,287	0	0	0	3,205	0
Bristol Bay	52,816	0	0	3,908	14	0
Copper River/Chugach	42,095	0	0	74,580	0	0
Kodiak	2,019	0	0	134,174	23,323	0
Lower Yukon-Kuskokwim	59,020	0	0	0	3,912	0
North Slope	29,378	130,548	0	0	0	0
Northwest Arctic	31,297	0	0	0	4,673	0
Railbelt	325,635	3,213,640	558,292	547,735	124,092	0
Southeast	-243,316	0	0	774,201	0	0
Yukon-Koyukuk/Upper Tanana	35,028	0	0	0	0	9
Total	**484,387**	**3,344,188**	**558,292**	**1,537,096**	**160,914**	**9**

What's wrong with this picture?

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Aleutians	102,128	0	0	2,498	1,695	0
Bering Straits	48,287	0	0	0	3,205	0
Bristol Bay	52,816	0	0	3,908	14	0
Copper River/Chugach	42,095	0	0	74,580	0	0
Kodiak	2,019	0	0	134,174	23,323	0
Lower Yukon-Kuskokwim	59,020	0	0	0	3,912	0
North Slope	29,378	130,548	0	0	0	0
Northwest Arctic	31,297	0	0	0	4,673	0
Railbelt	325,635	3,213,640	558,292	547,735	124,092	0
Southeast	-243,316	0	0	774,201	0	0
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Total	**484,387**	**3,344,188**	**558,292**	**1,537,096**	**160,914**	**9**

Energy Stats T2.3c

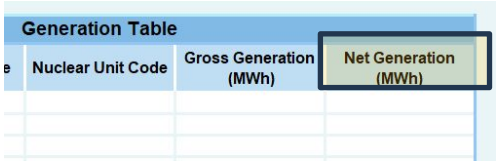
Utility Name	Plant Name	Intertie Name	Energy Region	Fuel Type	Prime Mover	Net Generation MWh
Ketchikan Public Utilities	S W Bailey	SEAPA_grid	Southeast	DFO	IC	-262901.99
Metlakatla Power & Light	Centennial	Metlakatla_grid	Southeast	DFO	IC	-39
Alaska Power & Telephone Compan	Thorne Bay Plant	Prince of Wales Is._grid	Southeast	DFO	IC	-24
Alaska Power & Telephone Compan	Viking	Prince of Wales Is._grid	Southeast	DFO	IC	-15

EIA 923 data:

		Electricity Net Generation (MWh)											
Plant Nan	Operator Name	Netgen Januar	Netgen Februa	Netgen March	Netgen April	Netgen May	Netgen June	Netgen July	Netgen Augus	Netgen Septemb	Netgen Octobe	Netgen Novemb	Netgen Decemb
Swan Lake	Ketchikan Public Utilities	6,081	5,488	4,965	5,322	4,653	4,321	4,086	5,081	7,857	5,721	5,891	6,723
Ketchikan	Ketchikan Public Utilities	2,245	2,026	1,832	1,964	1,717	1,595	1,508	1,875	2,900	2,112	2,174	2,481
S W Bailey	Ketchikan Public Utilities	-27,254	-25,859	-25,243	-23,718	-20,026	-11,936	-21,102	-16,978	-19,975	-26,406	-19,301	-25,105
Beaver Falls	Ketchikan Public Utilities	4,181	3,774	3,414	3,659	3,199	2,971	2,809	3,493	5,402	3,934	4,050	4,622
Silvis	Ketchikan Public Utilities	1,261	1,138	1,029	1,103	965	896	847	1,053	1,629	1,186	1,221	1,394

EIA 923 instructions

EIA 923 form



https://www.eia.gov/survey/#eia-923

Another View from the Trenches

Mini Case Study 2: Northwest Arctic Renewables

What's wrong with this picture?

Operators/Utilities Net Generation by Fuel Type (MWh), 2021								
Plant Name	Intertie Nam	Energy Region	Oil	Gas	Coal	Hydr	Wind	Solar
Deering	Deering_grid	Northwest Arctic	679	0	0	0	61	43
Ambler	Ambler_grid	Northwest Arctic	1,331	0	0	0	0	0
Kivalina	Kivalina_grid	Northwest Arctic	1,874	0	0	0	0	0
Kiana	Kiana_grid	Northwest Arctic	1,715	0	0	0	0	0
Noatak	Noatak_grid	Northwest Arctic	1,853	0	0	0	0	0
Shungnak	Shungnak_grid	Northwest Arctic	1,634	0	0	0	16	0
Noorvik	Noorvik_grid	Northwest Arctic	1,963	0	0	0	13	0
Buckland	Buckland_grid	Northwest Arctic	1695.8	0	0	0	239.392	0
Selawik	Selawik_grid	Northwest Arctic	2,860	0	0	0	0	0
Kotzebue	Kotzebue_grid	Northwest Arctic	18343.458	0	0	0	2583.924	594.163

Hint

Photo:
USDOE

Again, What's wrong with this picture?

Operators/Utilities Net Generation by Fuel Type (MWh), 2021								
Plant Name	Intertie Nam	Energy Region	Oil	Gas	Coal	Hydr	Wind	Solar
Deering	Deering_grid	Northwest Arctic	679	0	0	0	61	43
Ambler	Ambler_grid	Northwest Arctic	1,331	0	0	0	0	0
Kivalina	Kivalina_grid	Northwest Arctic	1,874	0	0	0	0	0
Kiana	Kiana_grid	Northwest Arctic	1,715	0	0	0	0	0
Noatak	Noatak_grid	Northwest Arctic	1,853	0	0	0	0	0
Shungnak	Shungnak_grid	Northwest Arctic	1,634	0	0	0	16	0
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Kiana	Kiana_grid	Northwest Arctic	1,715	0	0	0	0	0
Noatak	Noatak_grid	Northwest Arctic	1,853	0	0	0	0	0
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Noorvik	Noorvik_grid	Northwest Arctic	1,963	0	0	0	13	0
Buckland	Buckland_grid	Northwest Arctic	1695.8	0	0	0	239.392	0
Selawik	Selawik_grid	Northwest Arctic	2,860	0	0	0	0	0
Kotzebue	Kotzebue_grid	Northwest Arctic	18343.458	0	0	0	2583.924	594.163

Look at installed capacity

Installed Capacity by Prime Mover by Plant (MW), 2021						
Plant Name	Total Capacity	Fossil Fuel Turbine	Internal Combustion	Hydroelectric	Wind Turbine	Solar PV
Ambler	1.1	0	1.1	0	0	0
Buckland	1.675	0	1.152	0	0.2	0.046
Deering	0.7955	0	0.37	0	0.1	0.0485
Kiana	1.2	0	1.2	0	0	0
Kivalina	1.1	0	1.1	0	0	0
Kotzebue	17.1	0	11.8	0	3.3	0.8
Noatak	1.252	0	1.252	0	0	0
Noorvik	1.649	0	1.626	0	0	0.023
Selawik	2.51	0	2.25	0	0.26	0
Kobuk	0.18	0	0.18	0	0	0
Shungnak	1.959	0	1.5	0	0	0.224

Look at source data: PCE monthly from AEA

Community	Fiscal Year	Fiscal Month	Fuel Used Gallons	Diesel kWh Generated	Hydro kWh Generate	Other 1 kWh Type	Other 1 kWh Generated
Shungnak PCE	2021	1	7303	94002	0		0
Shungnak PCE	2021	2	8330	112699	0		0
Shungnak PCE	2021	3	9035	124409	0		0
Shungnak PCE	2021	4	9839	138106	0		0
Shungnak PCE	2021	5	12696	157918	0		0
Shungnak PCE	2021	6	12641	151974	0		0
Shungnak PCE	2021	7	12819	160909	0		0
Shungnak PCE	2021	8	13648	176437	0		0
Shungnak PCE	2021	9	12484	166480	0		0
Shungnak PCE	2021	10	11732	146645	0		0
Shungnak PCE	2021	11	8049	108751	0		0
Shungnak PCE	2021	12	9075	97146	0		0
Shungnak PCE	2022	1	7444	108869	0		0
Shungnak PCE	2022	2	9691	118978	0		0
Shungnak PCE	2022	3	8968	111507	0	WIND	6976
Shungnak PCE	2022	4	9481	125223	0	WIND	4659
Shungnak PCE	2022	5	14523	125223	0	WIND	4659
Shungnak PCE	2022	6	27862	187520	0	WIND	8
Shungnak PCE	2022	7	12088	166939	0	WIND	39
Shungnak PCE	2022	8	14448	205579	0	WIND	2904
Shungnak PCE	2022	9	11006	136300	0	WIND	26128
Shungnak PCE	2022	10	9565	118552	0	WIND	22682
Shungnak PCE	2022	11	6786	87048	0	WIND	39492
Shungnak PCE	2022	12	5393	64116	0	WIND	34886

Granular data to t rescue?

Community	Fiscal Year	Fiscal Month	Fuel Used Gallons	Diesel kWh Generated	Hydro kWh Generate	Other 1 kWh Type	Other 1 kWh Generated
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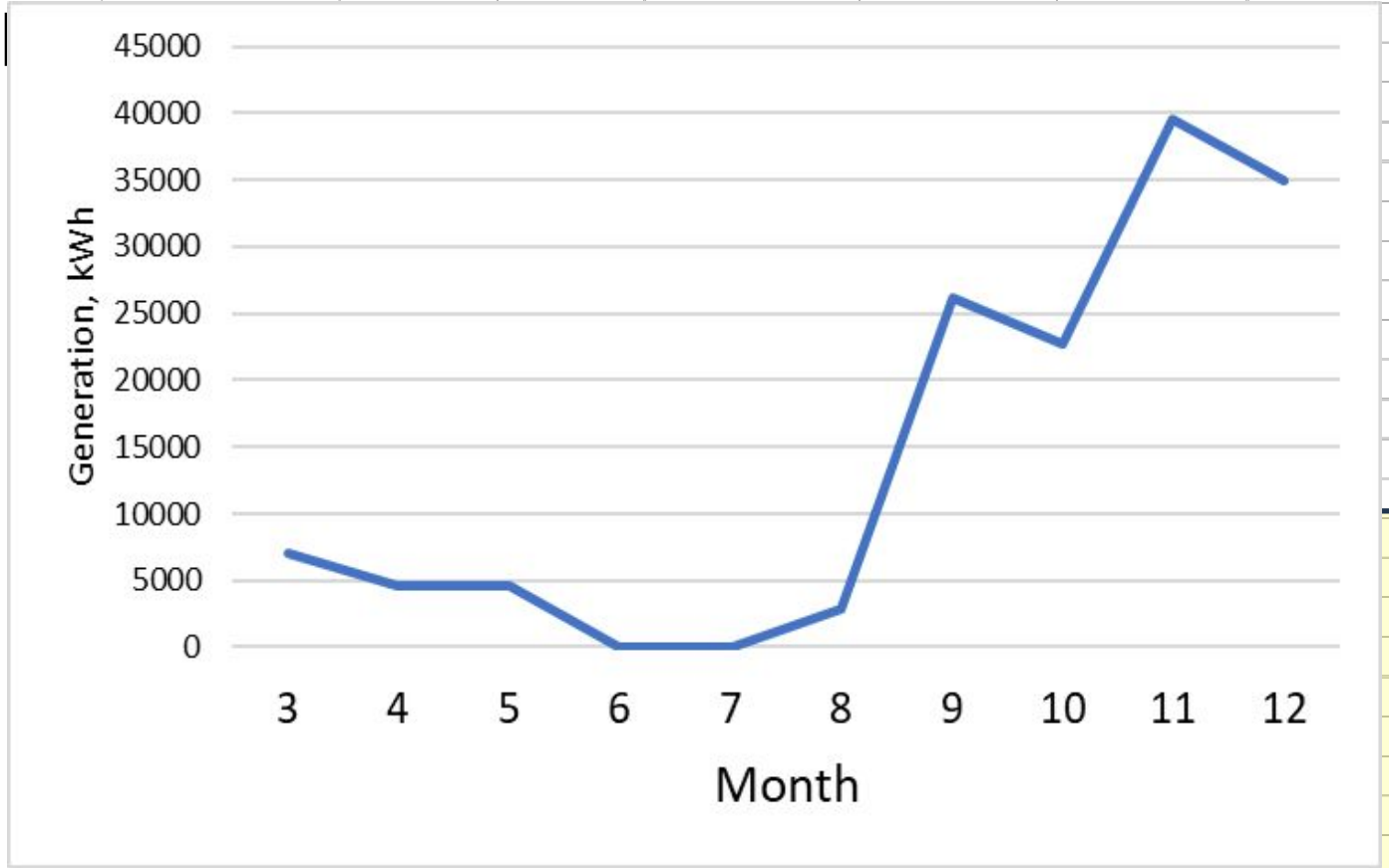
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							6976
							4659
							4659
							8
							39
							2904
							26128
							22682
							39492
Shungnak PCE	2022	12	5393	64116	0	WIND	34886



Granular data to the rescue!!

This is SOLAR.

Community	Fiscal Year	Fiscal Month	Fuel Used Gallons	Diesel kWh Generated	Hydro kWh Generate	Other 1 kWh Type	Other 1 kWh Generated
Shungnak PCE	2021	1	7303	94002	0		0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
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							39
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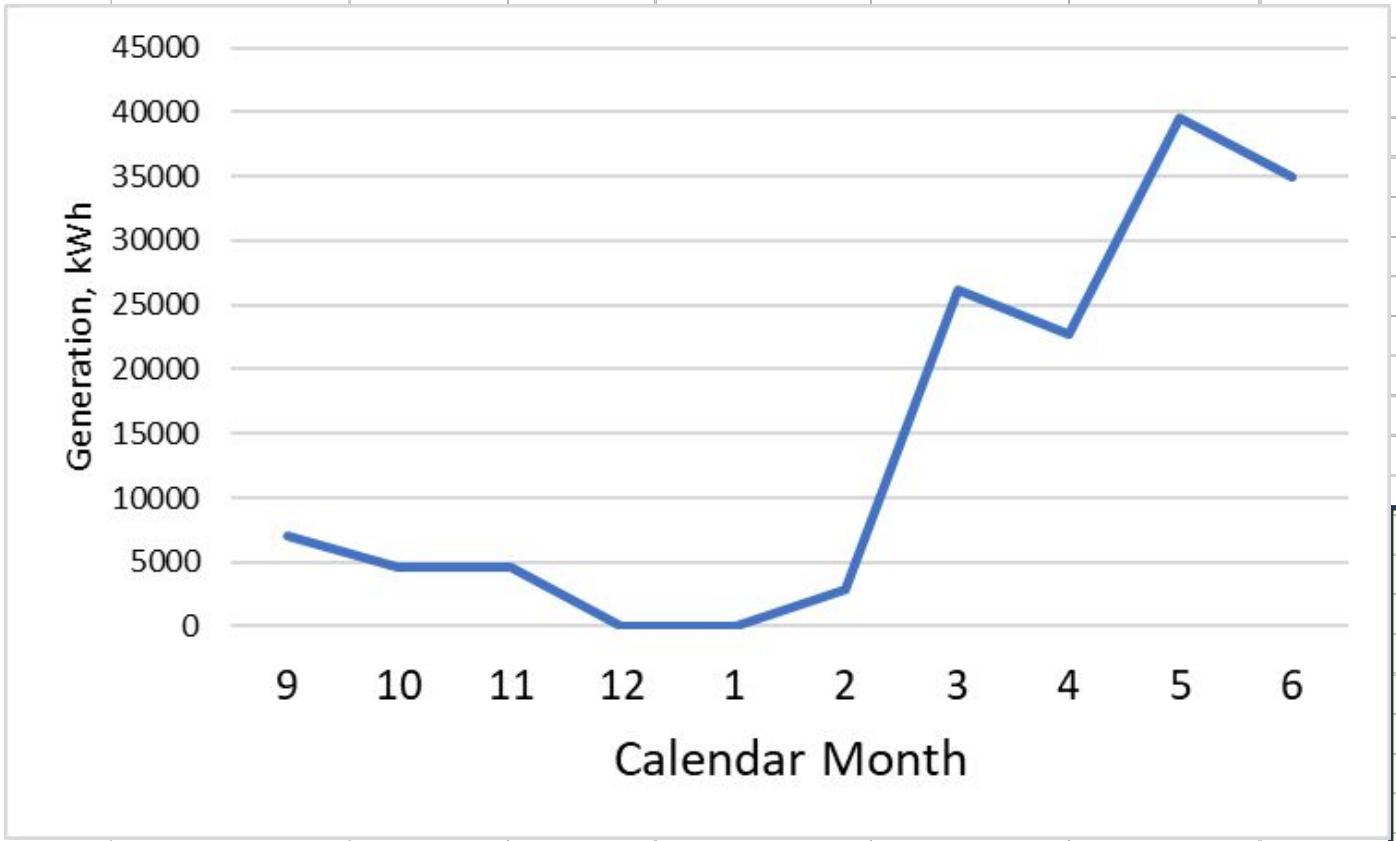
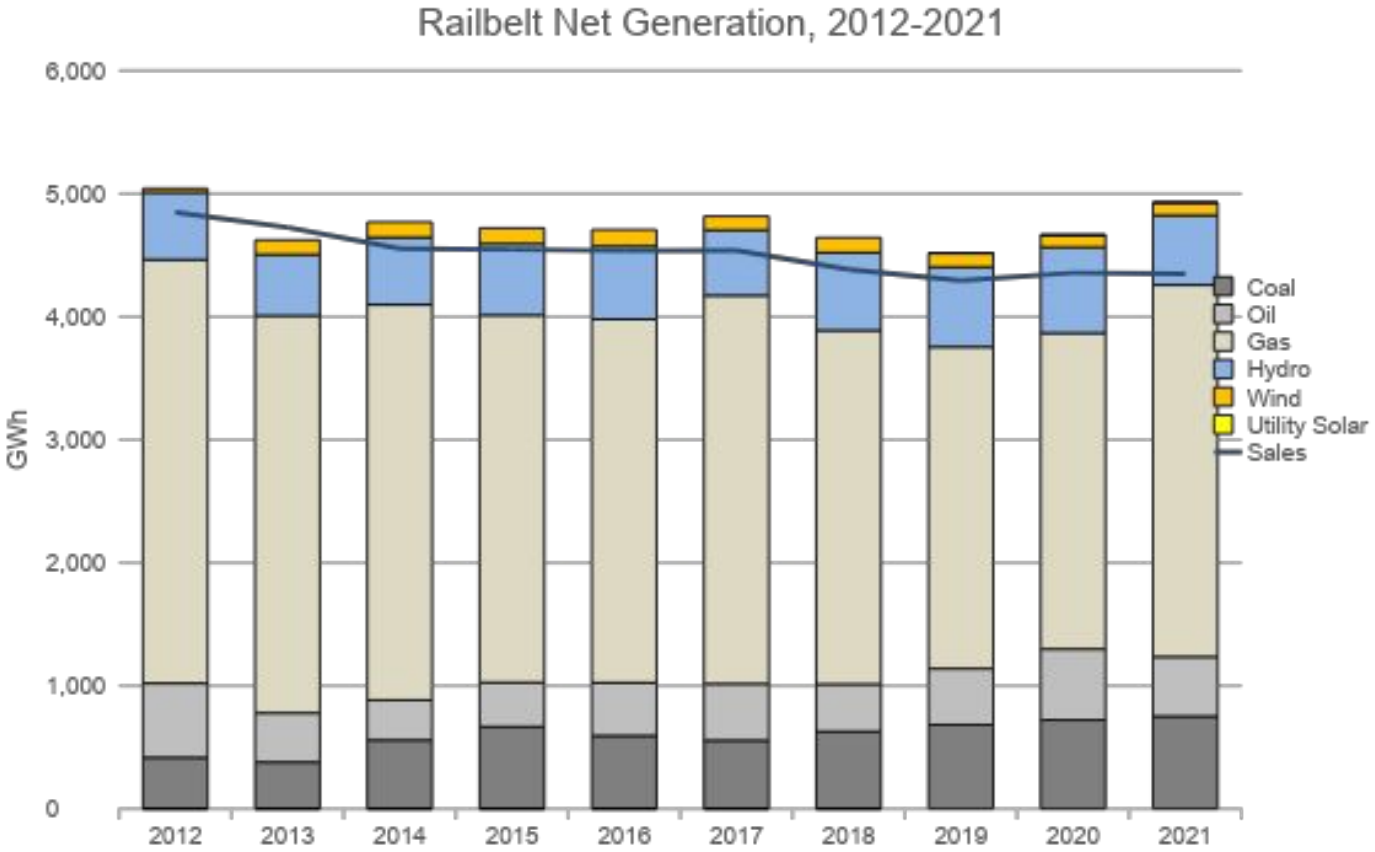


View from the Trenches

Trends vs snapshots

Trends vs Snapshots



Trends can be tedious to compile

Net Generation by Fuel Type by Operators/Utilities (MWh) by AEA Energy Regions, 2014

Net Generation by Fuel Type by Operators/Utilities (MWh) by AEA Energy Regions, 2015

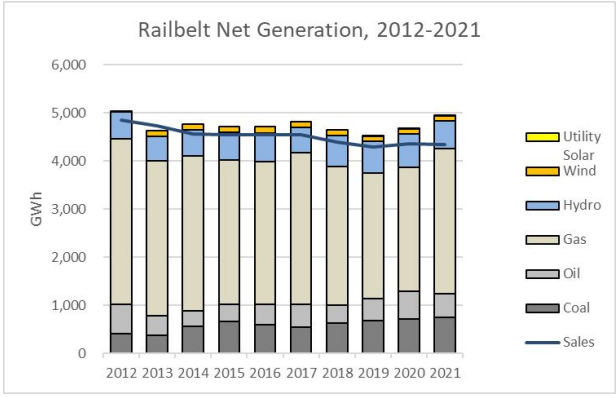
Net Generation by Fuel Type by Certified Utilities (MWh) by AEA Energy Regions, 2018

Net Generation by Fuel Type by Operators/Utilities (MWh) by AEA Energy Regions, 2019

Net Generation by Fuel Type by Operators/Utilities (MWh) by AEA Energy Regions, 2020

Net Generation, GWh, compiled from above, divided by 1000, pasted as values)

Year	ACEP Energy Region	Oil	Gas	Coal	Hydro	Wind	Utility Solar	Storage	Other	Total	Sales
2012	Railbelt	603	3,444	417	546	32	0	0	0	5,043	4,848
2013	Railbelt	400	3,230	379	498	117	0	0	0	4,624	4,726
2014	Railbelt	326	3,214	558	548	124	0	0	0	4,769	4,554
2015	Railbelt	360	2,986	668	580	127	0	0	0	4,721	4,545
2016	Railbelt	431	2,954	594	594	134	0	(2)	0	4,705	4,537
2017	Railbelt	460	3,157	556	532	112	0	(3)	0	4,814	4,539
2018	Railbelt	385	2,876	629	632	122	0	(2)	0	4,641	4,384
2019	Railbelt	456	2,615	683	651	112	0	(3)	0	4,514	4,294
2020	Railbelt	577	2,569	722	698	97	2	(3)	0	4,662	4,356
2021	Railbelt	483	3,022	753	567	102	2	(3)	0	4,925	4,349



The Alaska Energy Data Gateway automates this process…at least somewhat. (AEDG is not maintained.)

AEDG

Data Search | 1: Start | 2: Select Dataset | 3: Filter Data | 4: View/Download | Help/

Alaska Energy Statistics Table 2.3b - Certified Utilities Net Generation by Fuel Type (MWh)

Information about electric net generation by fuel source and fuel use of c

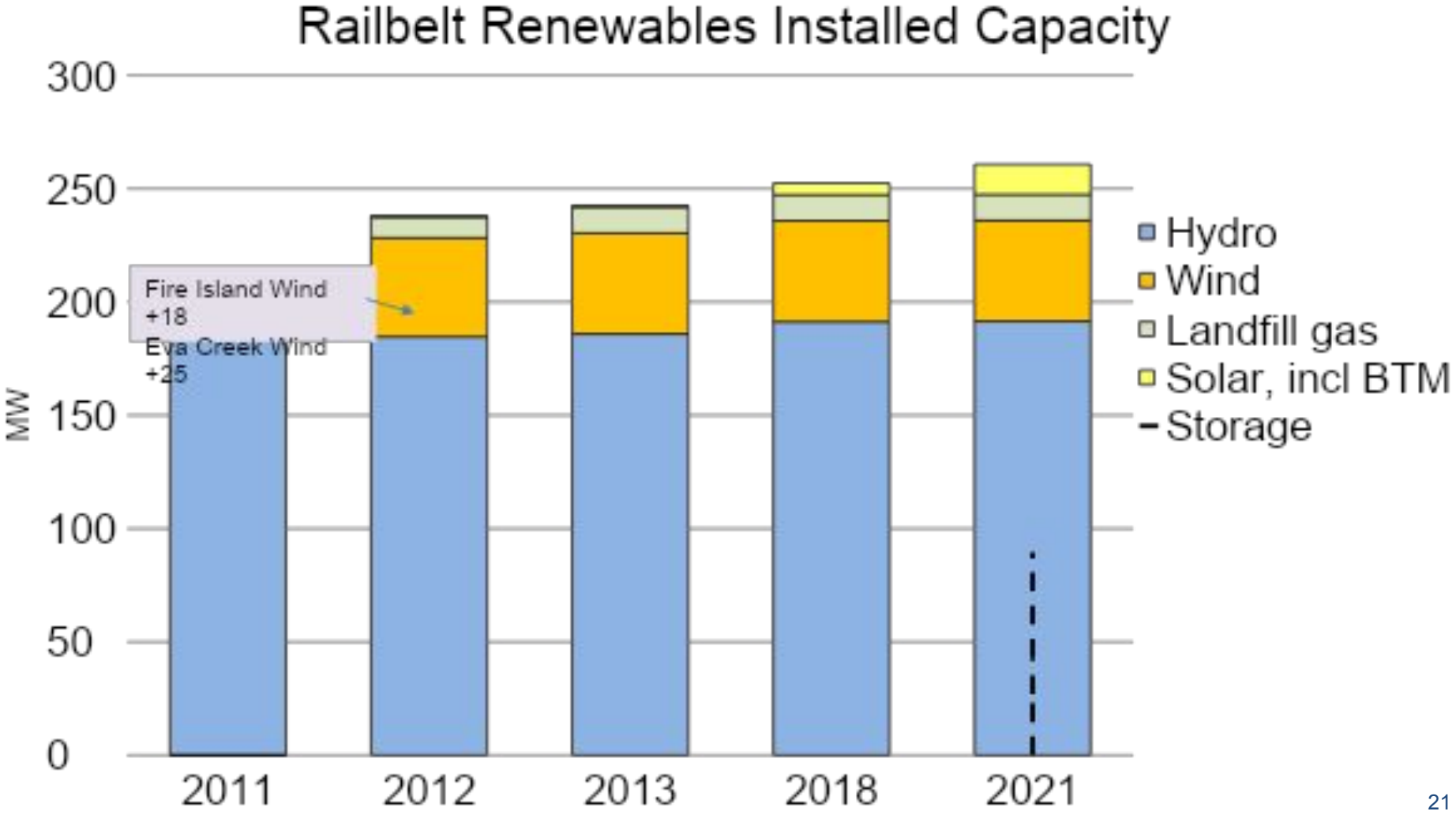
Alaska Energy Statistics 1960-2011 Final Report (PDF) *Dataset revised A*

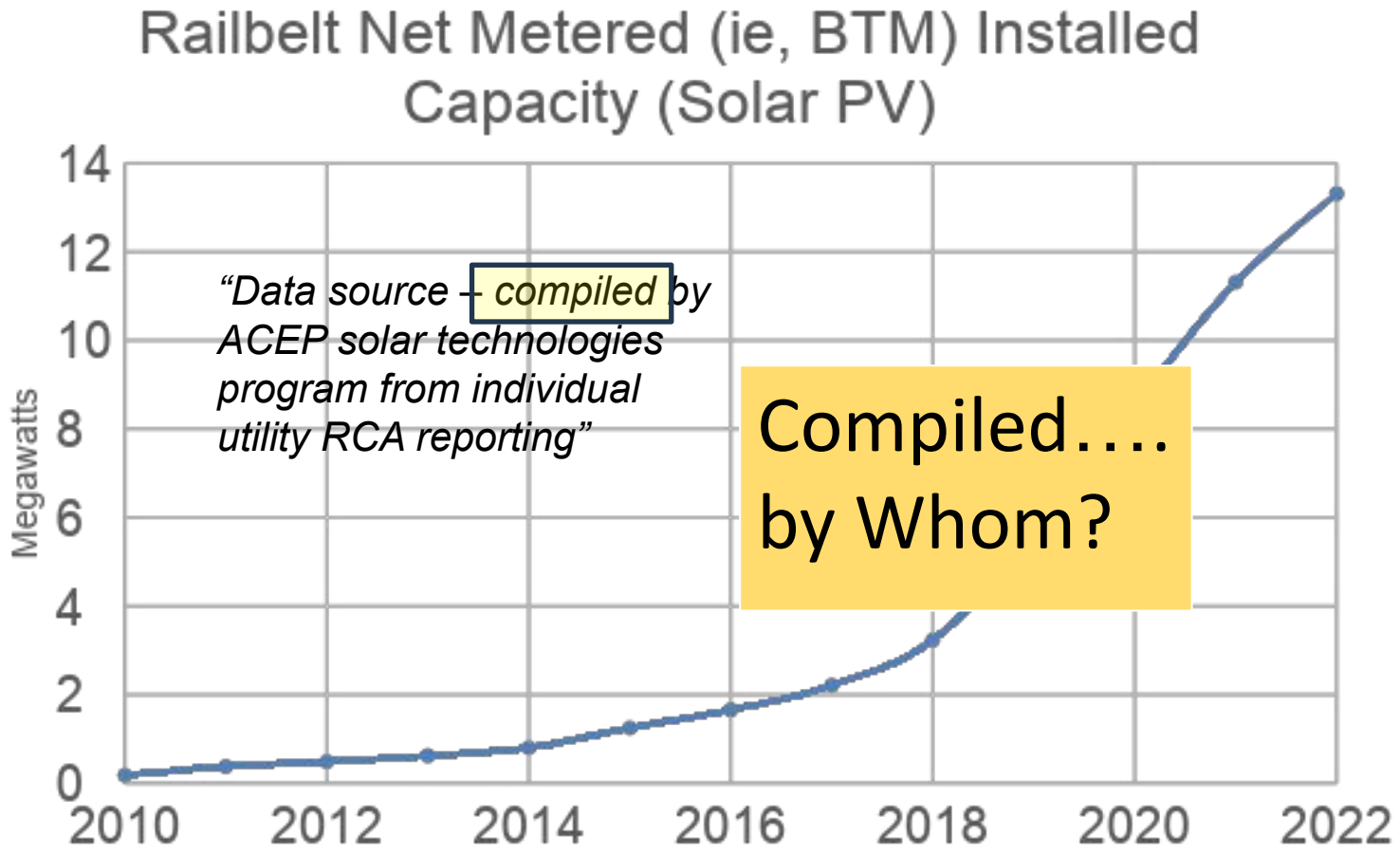
Download Dataset

year	utility__name	utility__regulatory_status__name	utility__certificate
2008	Anchorage Municipal Light & Power	Regulated	TRUE
2008	Anchorage Municipal Light & Power	Regulated	TRUE
2008	Anchorage Municipal Light & Power	Regulated	TRUE
2008	Aurora Energy LLC Chena	Regulated	TRUE
2008	Chugach Electric Assn Inc	Regulated	TRUE
2008	Chugach Electric Assn Inc	Regulated	TRUE
2008	Chugach Electric Assn Inc	Regulated	TRUE
2008	Chugach Electric Assn Inc	Regulated	TRUE
2008	Golden Valley Elec Assn Inc	Regulated	TRUE
2008	Golden Valley Elec Assn Inc	Regulated	TRUE
2008	Golden Valley Elec Assn Inc	Regulated	TRUE
2008	Golden Valley Elec Assn Inc	Regulated	TRUE
2008	Homer Electric Assn Inc	Regulated	TRUE
2008	Homer Electric Assn Inc	Regulated	TRUE
2008	Homer Electric Assn Inc	Regulated	TRUE
2009	Anchorage Municipal Light & Power	Regulated	TRUE
2009	Anchorage Municipal Light & Power	Regulated	TRUE
2009	Anchorage Municipal Light & Power	Regulated	TRUE

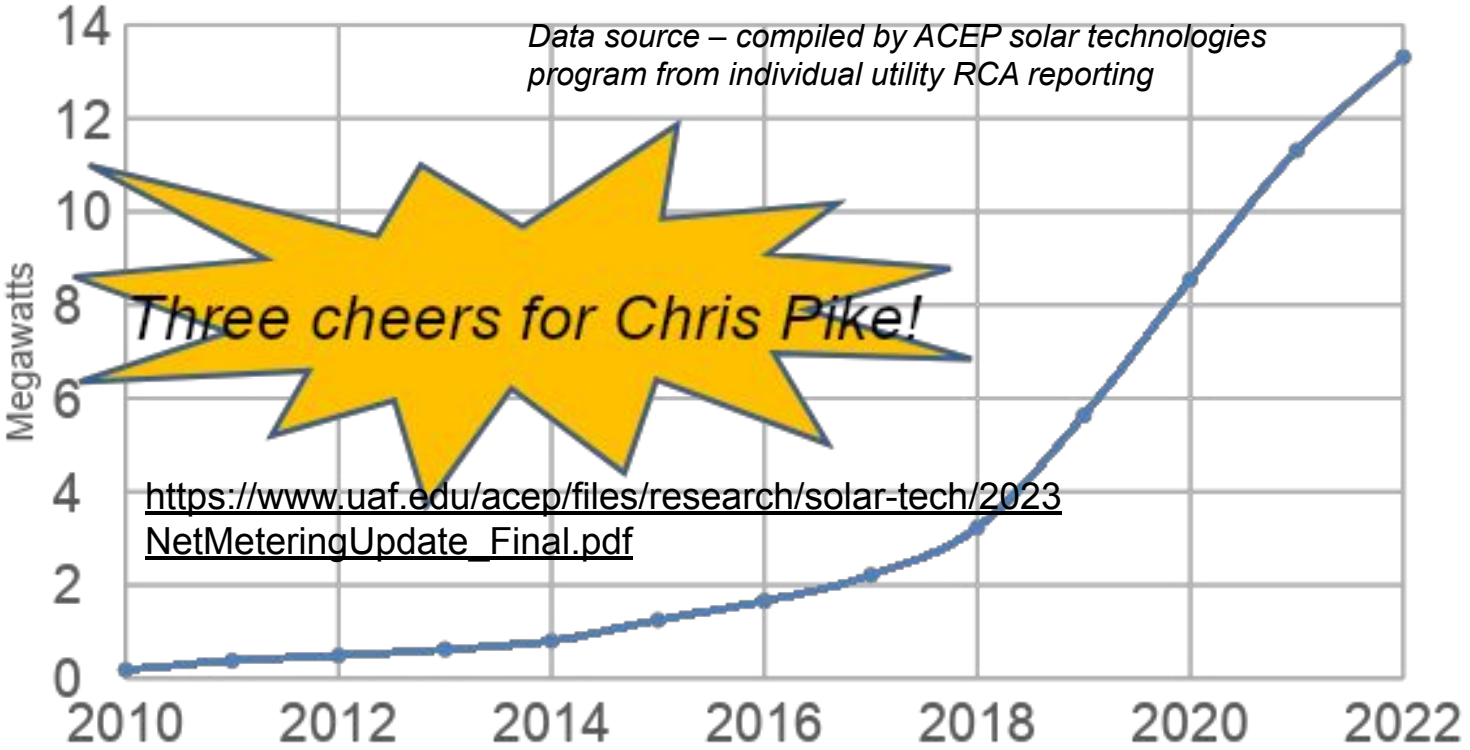
Bonus view from the Trenches

Where’s Rooftop Solar?


Railbelt Renewables Installed Capacity
300
250
200
150
100
50
0
MW
2011
2012
2013
2018
2021
Fire Island Wind
+18
Eva Creek Wind
+25
Hydro
Wind
Landfill gas
Solar, incl BTM
Storage


Railbelt Net Metered (ie, BTM) Installed Capacity (Solar PV)
Megawatts
0
2
4
6
8
10
12
14
2010
2012
2014
2016
2018
2020
2022
"Data source – compiled by ACEP solar technologies program from individual utility RCA reporting"
Compiled…. by Whom?

Railbelt Net Metered Installed Capacity (Solar PV)

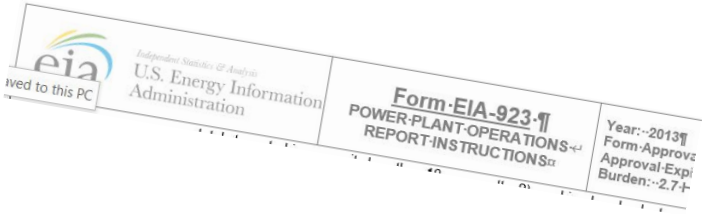


Data source – compiled by ACEP solar technologies program from individual utility RCA reporting

Three cheers for Chris Pike!

https://www.uaf.edu/acep/files/research/solar-tech/2023NetMeteringUpdate_Final.pdf

Possible Takeaways



- Much potentially useful energy data comes from fallible people.
- Unreliable/uncleaned data is worse than no data. GIGO.
- Clean, timely, consistent data requires sustained human effort.
- Who is / should be accountable for spotting glitches and cleaning data?
  - Not obvious – recall that the mighty EIA did not catch SW Bailey Plant kWh vs MWh – a 1000-fold error
  - How can “peer review” be used to ensure data quality
- No good substitute for people developing and sustaining relationships with key energy data sources and the raw data therefrom. (Three cheers for P. Haldane!)

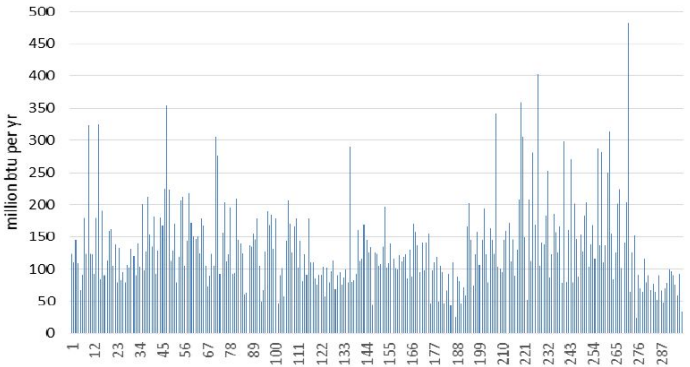
WHAT ABOUT HEAT?

Heat: *The Good……*

- ARIS* data is now publicly available!

Three cheers for AHFC!

- Big sample, data at individual building level
  - *There is no "typical house" or "typical household"*



source: Alaska Retrofiit Information System; Alaska Energy Authority & WH Pacific, Alaska End Use Study (2012)

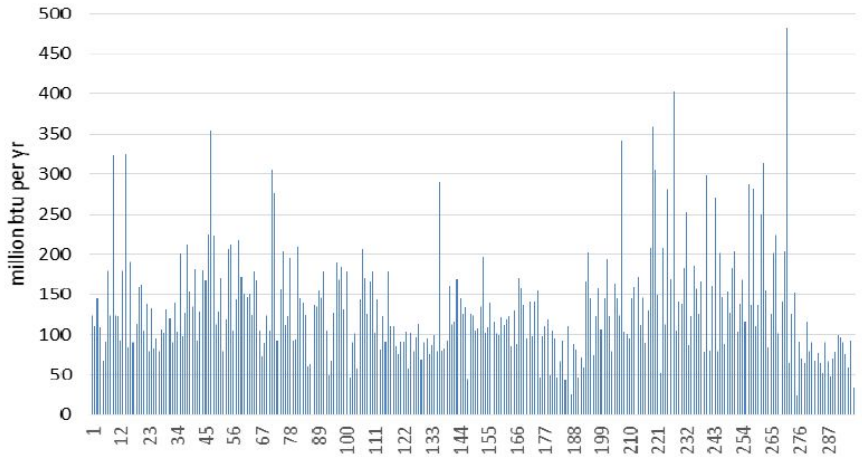
From: http://hdl.handle.net/11122/9564

*Alaska Retrofit Information System

Heat: *The "Bad"…*

- ARIS energy consumption "data" is mostly modeled estimates
  - *There has been little to zero groundtruthing of these estimates*

Figure 6. Variation in modeled heating fuel usage among 297 individual houses in the study area



source: Alaska Retrofiit Information System; Alaska Energy Authority & WH Pacific, Alaska End Use Study (2012)

From: http://hdl.handle.net/11122/9564

Heat: *The Missing*

We have almost zero measured fuel oil consumption data.

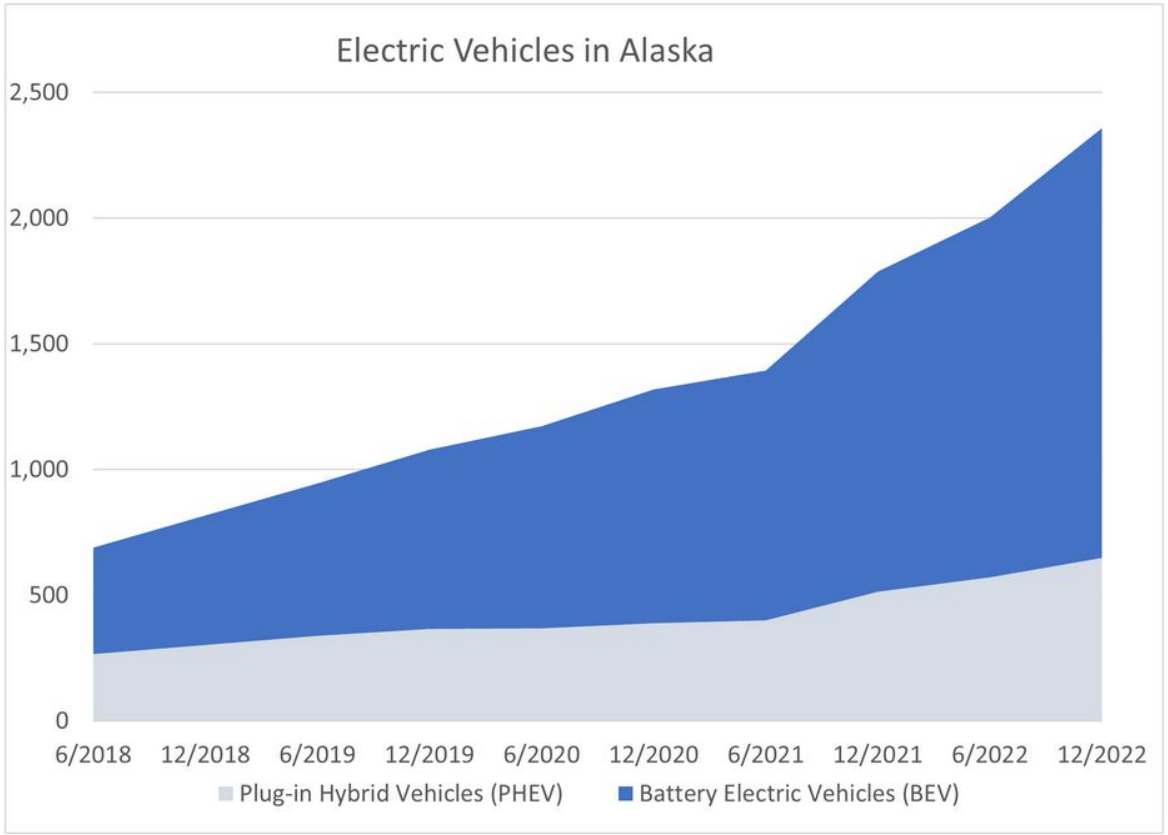
"we're working on it!" at ACEP, but it is slow going

We have almost zero publicly available fuel use data from fuel tax (exemption) data collected by DOR

For decades, we had no publicly available demographic data from the PFD application dataset….but now we do!

WHAT ABOUT TRANSPORTATION?

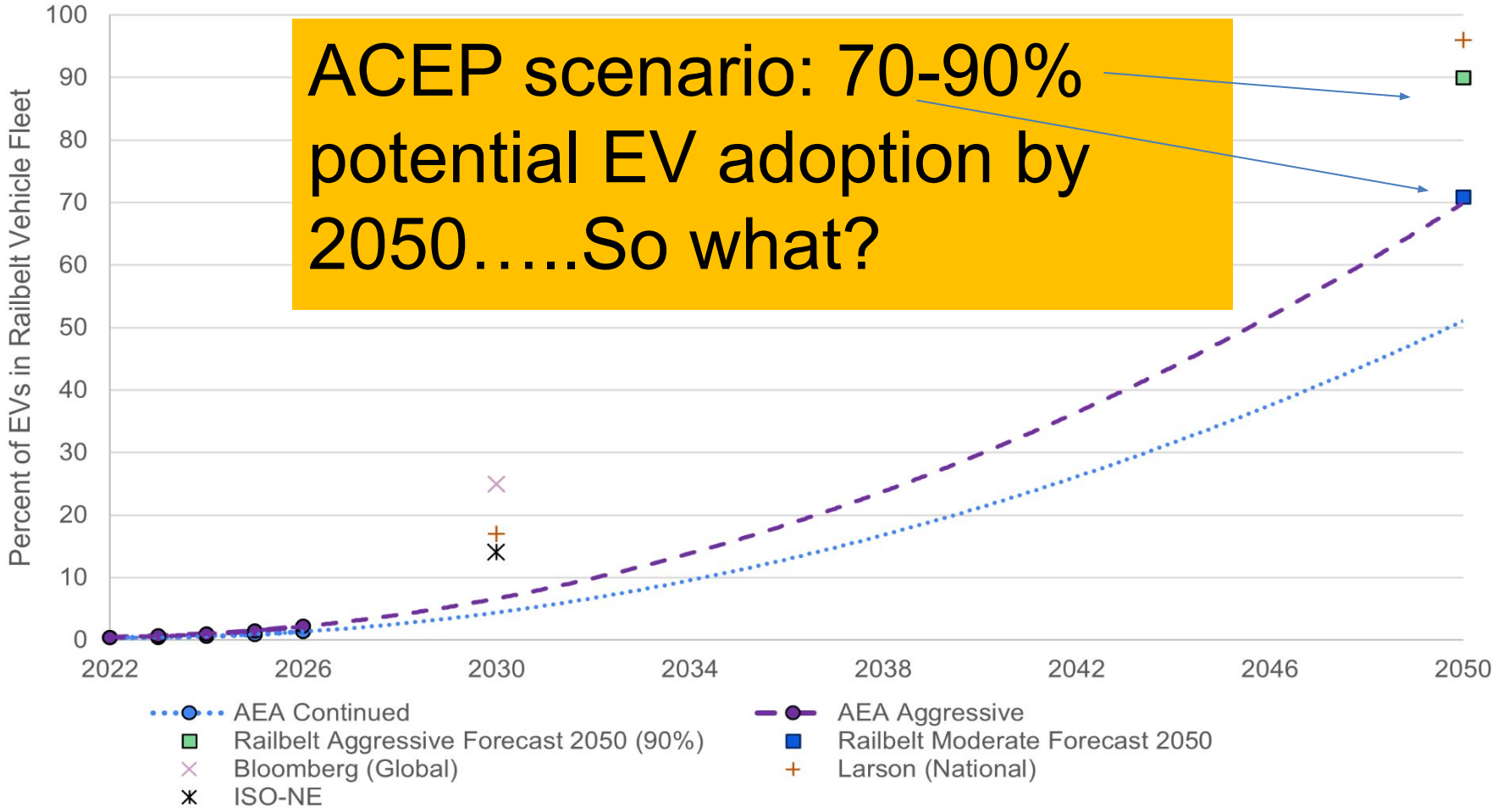
Q: Where did this chart come from?



A: The good folks at Chugach Electric

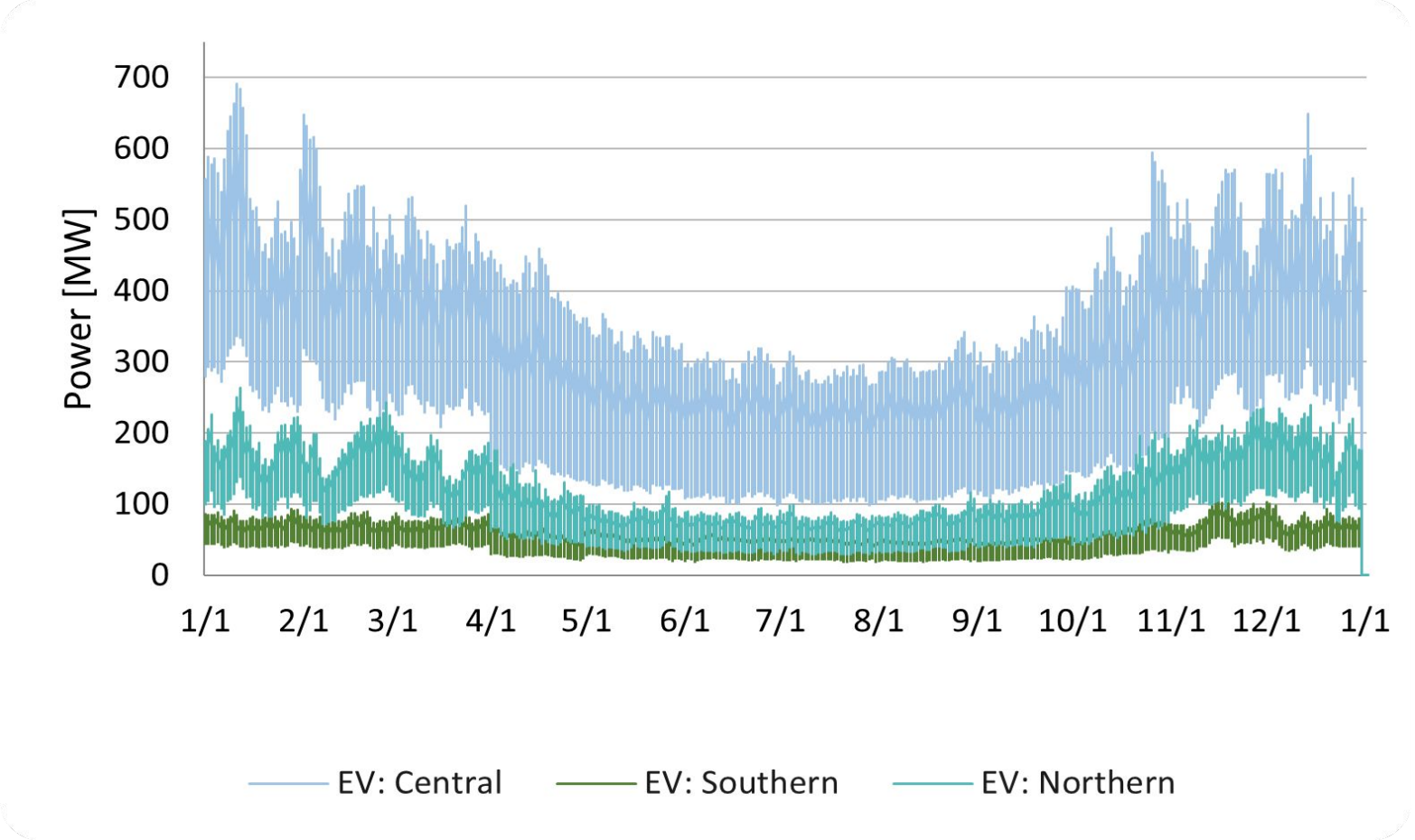
Final view from the Trenches

How might EV and Heat Pump load increase total Railbelt electricity demand?

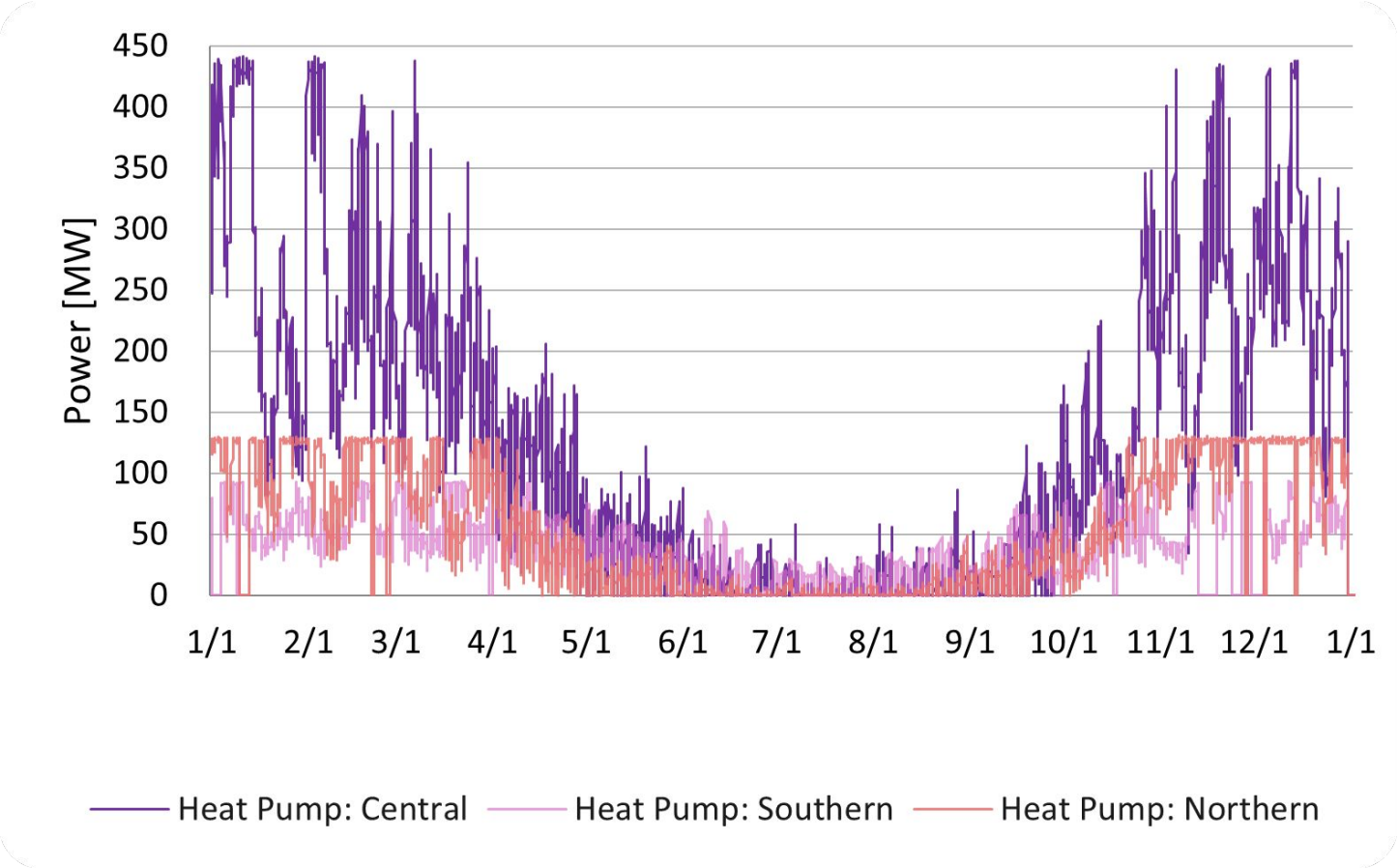


Cicilio et al. *Energies,* forthcoming. This slide from author.

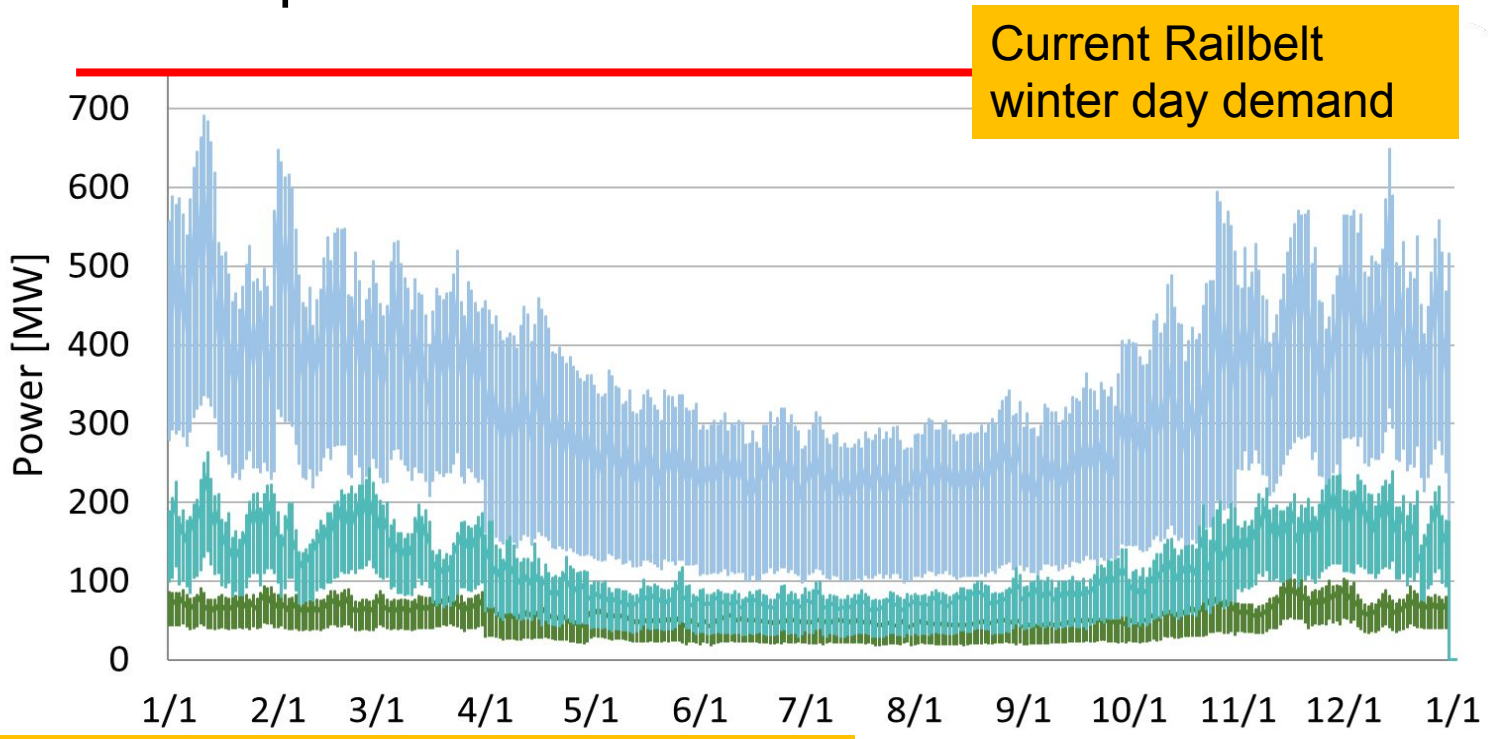
With 90% EV adoption in 2050…..



With 90% Heat Pump adoption in 2050…..



With 90% EV adoption in 2050…..



"You do the math…"
Load may double, or triple.
The Path to Cheap Power?

Final thoughts and a question

- This slide deck was messy because energy data is inherently messy
  - *Only people, applying sustained effort, can clean up messy energy data and make it accessible in useful formats*
- Our understanding of Alaska's energy picture is messy because much data is not collected
  - *Only people, working together and trusting one another, can collect, compile, and clean the heat and transportation data that will dominate policy choices during the next 20 years*
- GIGO
  - Bad raw data in □ [cleaning?] □ ??bad ??better ??good data out
  - Bad data in □ bad policy out
    - No data in □ ???
  - Bad policy in □ ???
- Is energy data a **useful byproduct** of program admin, or a **primary outcome**?
  - Can we live with data served up one pdf at a time?


Thank you for caring about energy data!
Questions/Discussion