SEAPA

Southeast Alaska Power Agency

SEIRP Technical Conference

Integrating a Proposed Hydro Project into a 3 (5) City System
April 20 , 2011

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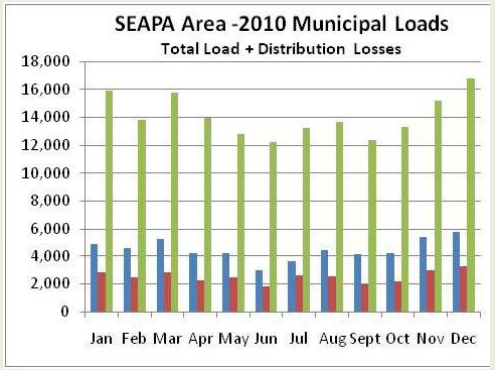
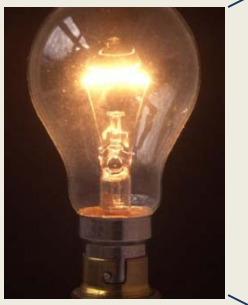
Southeast Alaska Power Agency



SEAPA Generation



Power
1-100 Watt bulb

Energy
100 Watts for 24 hrs= 2400 Wh- energy
100 Watts for 24 hrs = 2.4 kWh (kiloWatt hours)
100 Watts for 24 hours = .0024 MWh (MegaWatt hr)

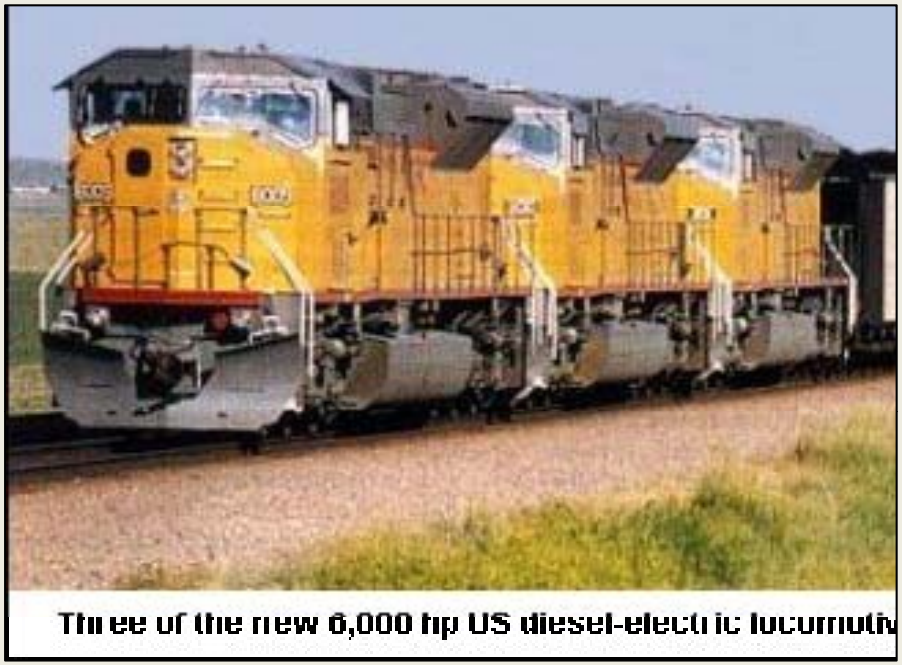
10,000 X

Power
10,000 bulbs = 1 MW

Energy
10, 000 bulbs for 24 hours = 24 MWh
or
417 100 W bulbs for 24 hrs = 1 MWh

1 Tyee Turbine = 12.5 MW

Tyee Plant (2 turbines) ≅ 6 Locomotives

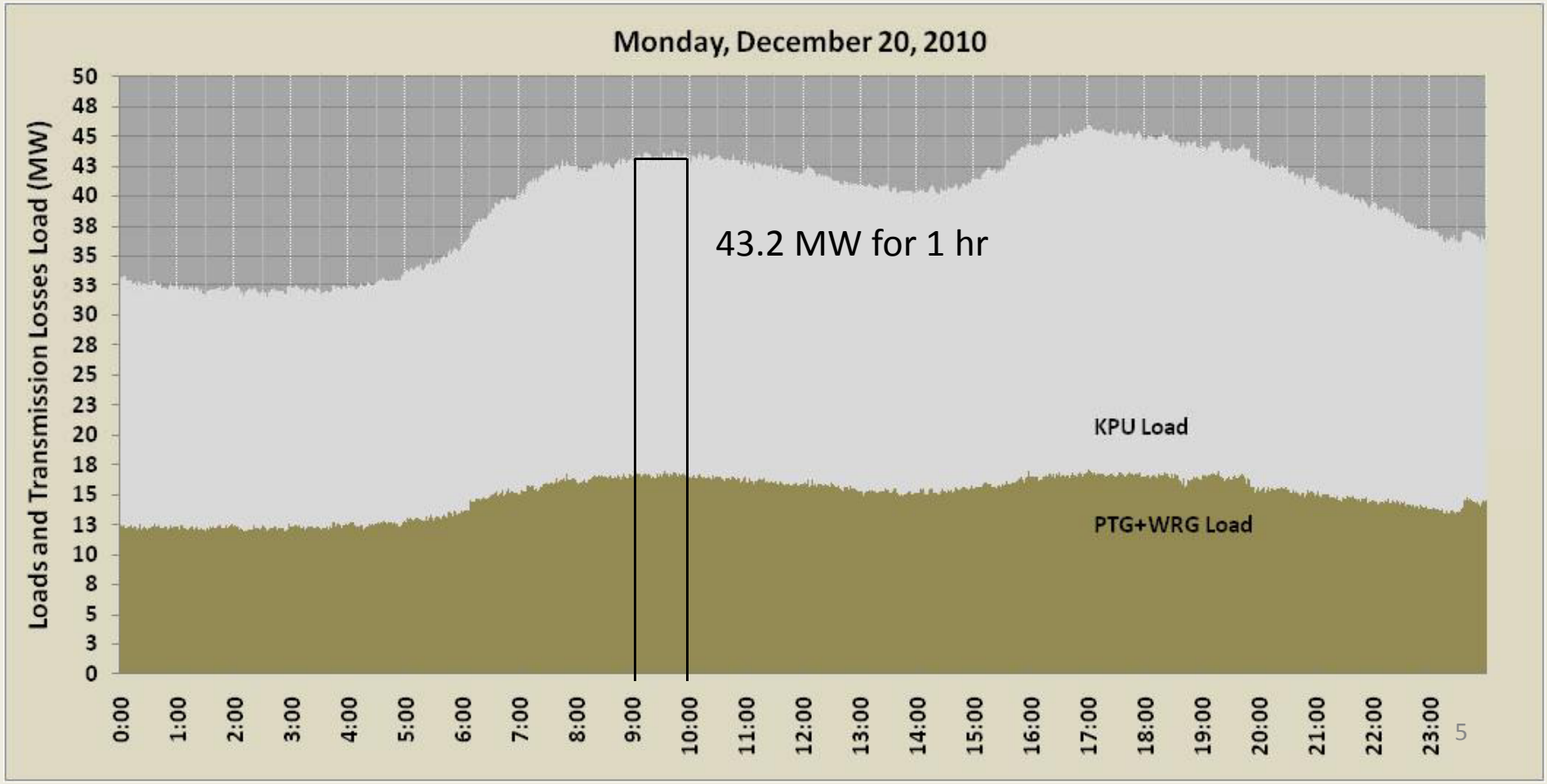


1 Locomotive = 6000 hp or 4.4 MW

3 Locomotives = 13.2 MW

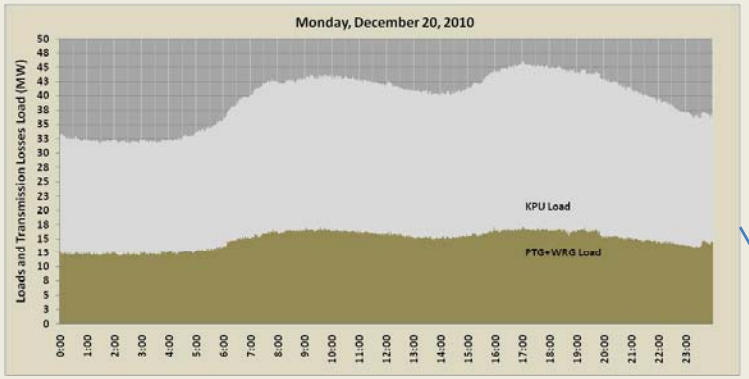
In Ketchikan 1 MW can serve 800 homes using 900 kWh/month flat demand rate. In the winter 1 MW can meet the peak demands of approximately 650 homes . In summer 1 MW can serve approximately 1000 homes.

PSG – WRG – KTN Daily Loads - how they vary hour by hour
The morning peak was 43 MW for the hour 8am to 9am
The total load for the day is the area under the curve (MW x hr) = 936 MWh



$\sum$

365days



If you add up the area under each days curve, and sum all the days of the year, this is the regions total energy demand in MWh.

Table of Daily Energy

1-Jan	795.6
1-May	400
9-Aug	600
20-Dec	936
31-Dec	912
Total	252,737

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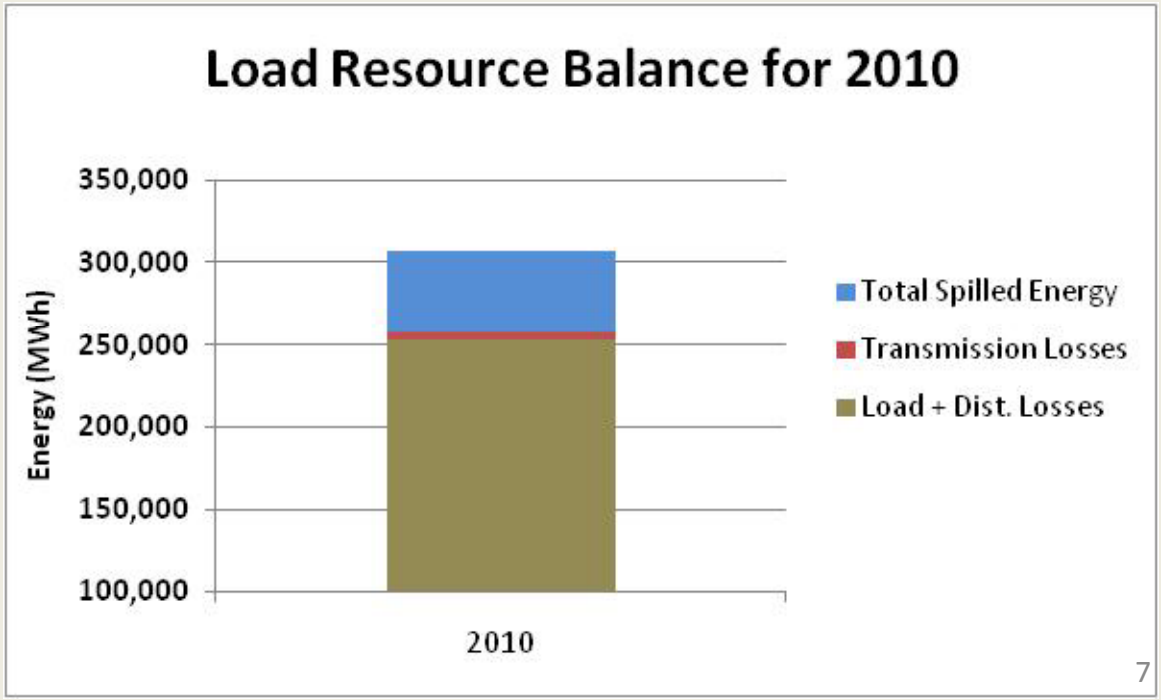
252,737 MWh

2010 Actual Load and Resource Values

Table of PSG-WRG-KTN Loads and Resources	MWh
PSG + WRG + KTN Load + Distribution Losses	252,737
Transmission Losses	5,406
Total Load	258,143
Tyee spilled energy	42,800
Swan Lake Spilled Energy	6,500
Total Spilled Energy	49,300
Total Hydro Capability for 2010	307,443

Region is long by nearly 50,000 MW-hr;
Tyee spilled for 5 months!
Swan Lake spilled for 1 month

All hydro and diesel generation inside the brown region, diesel in 2010 was limited to maintenance efforts



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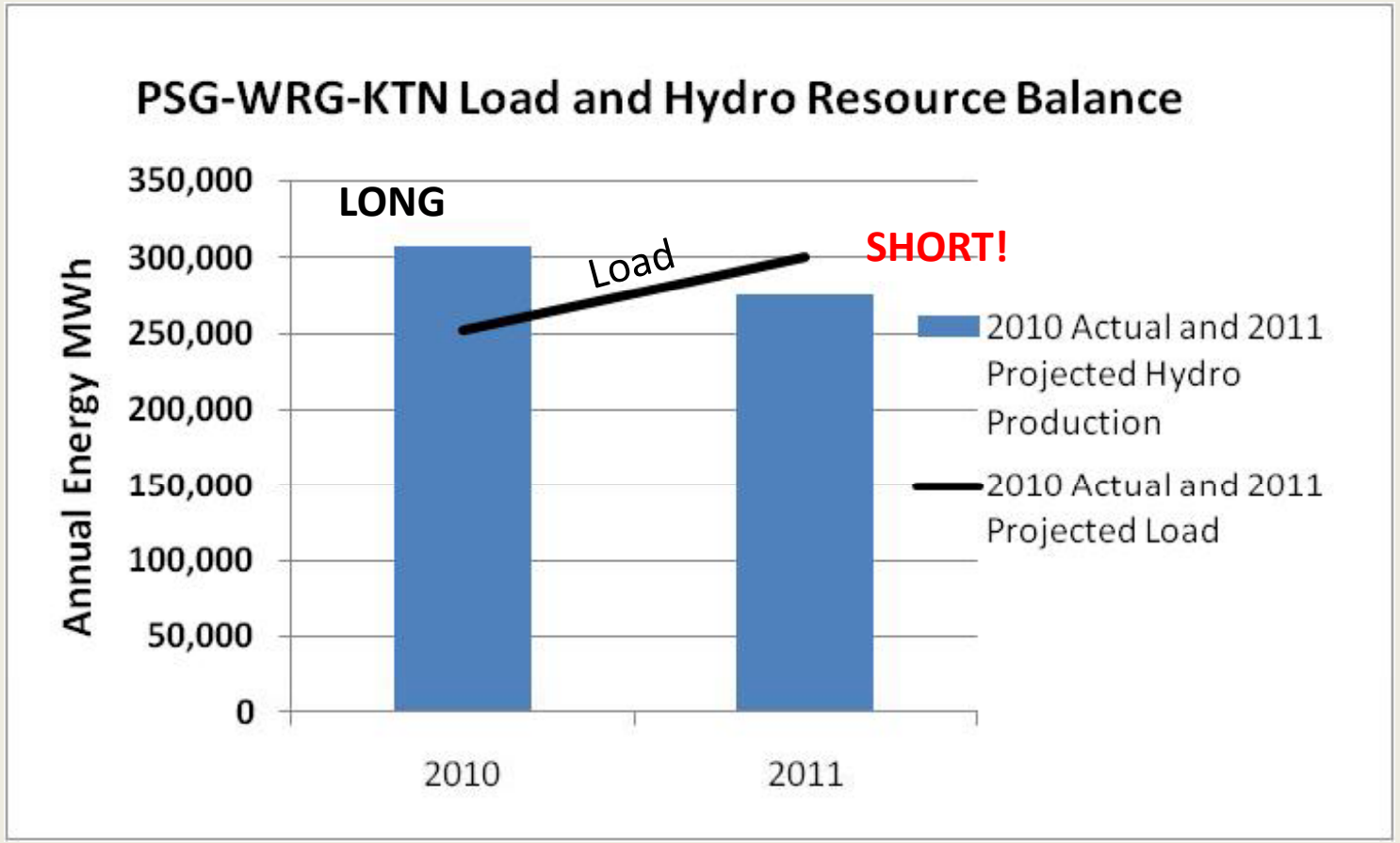
Too big a water year is problematic!

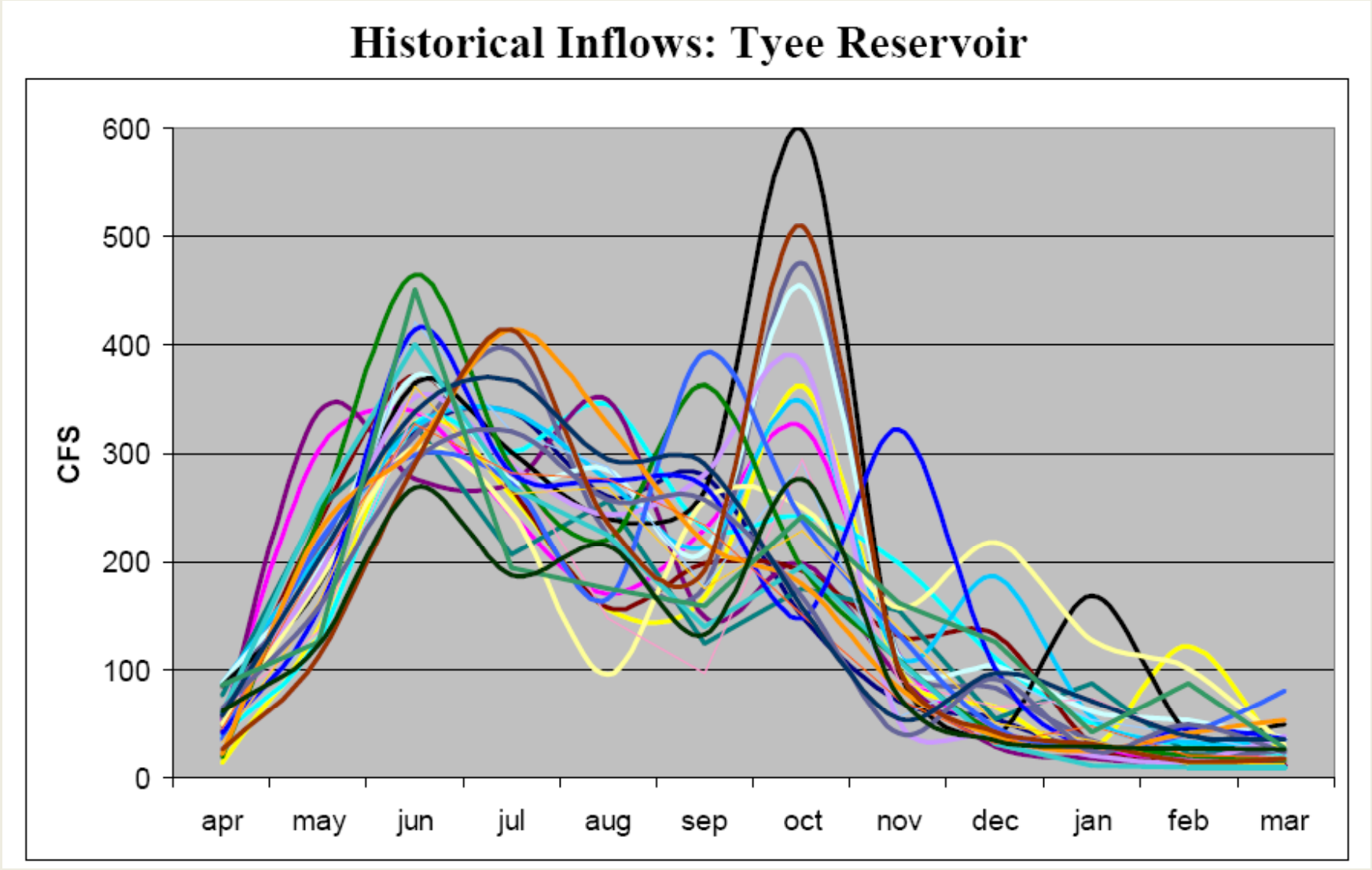
The majority of spilled energy of 2010 occurred From late October through November. While SEAPA allows for storage increases to occur at Swan Lake and Tyee during this period, we don't assume extremely high events will occur. These events are problematic for two other reasons.

1)Loads decrease because of the warm weather, and loads decrease because these strong storms cause outages. It's hard to ramp up hydro units to avoid spill if your line is out.

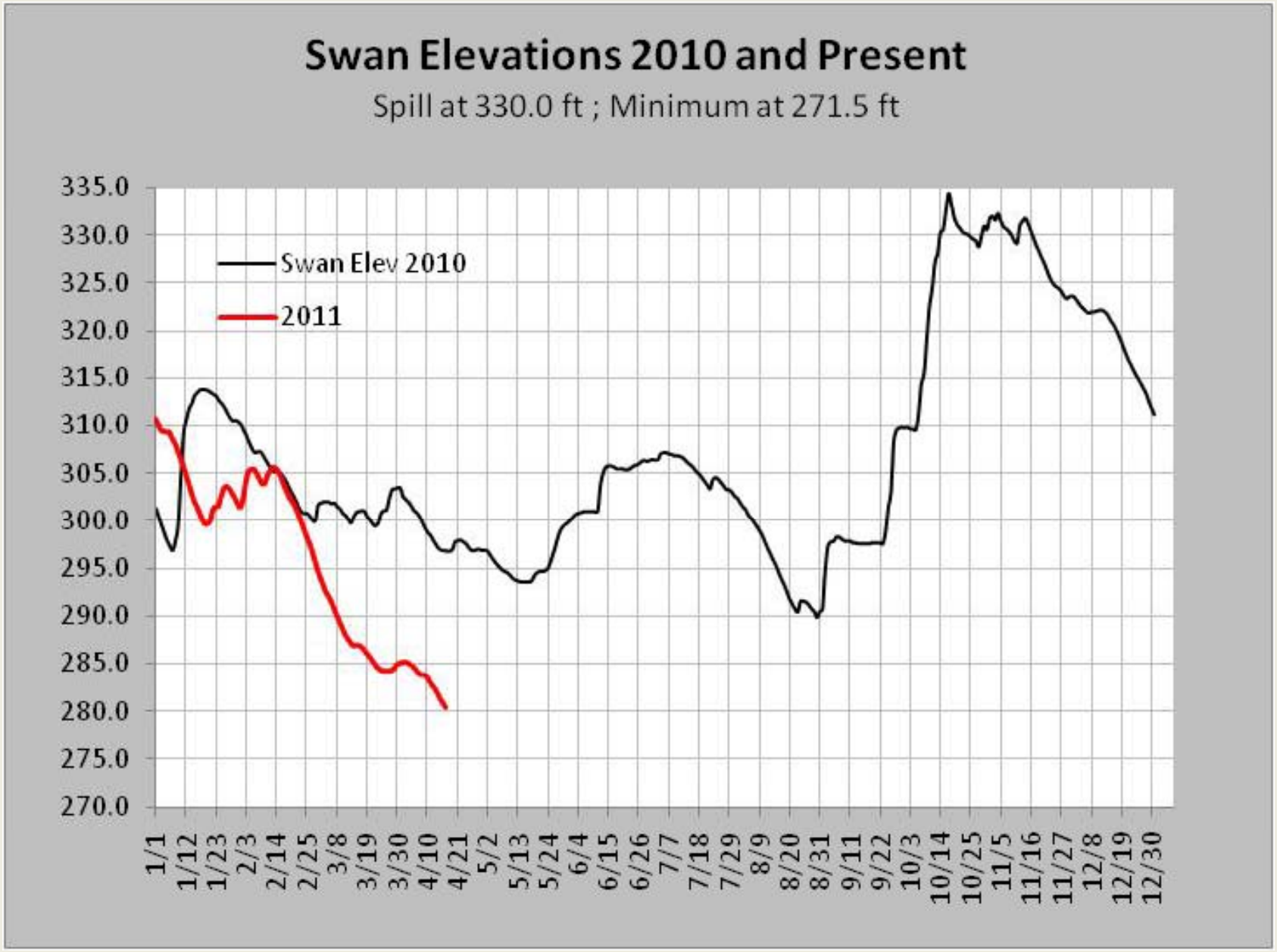
2) Our member utilities dislike spill just as much as we do. Their generation increases which further reduces loads to SEAPA.

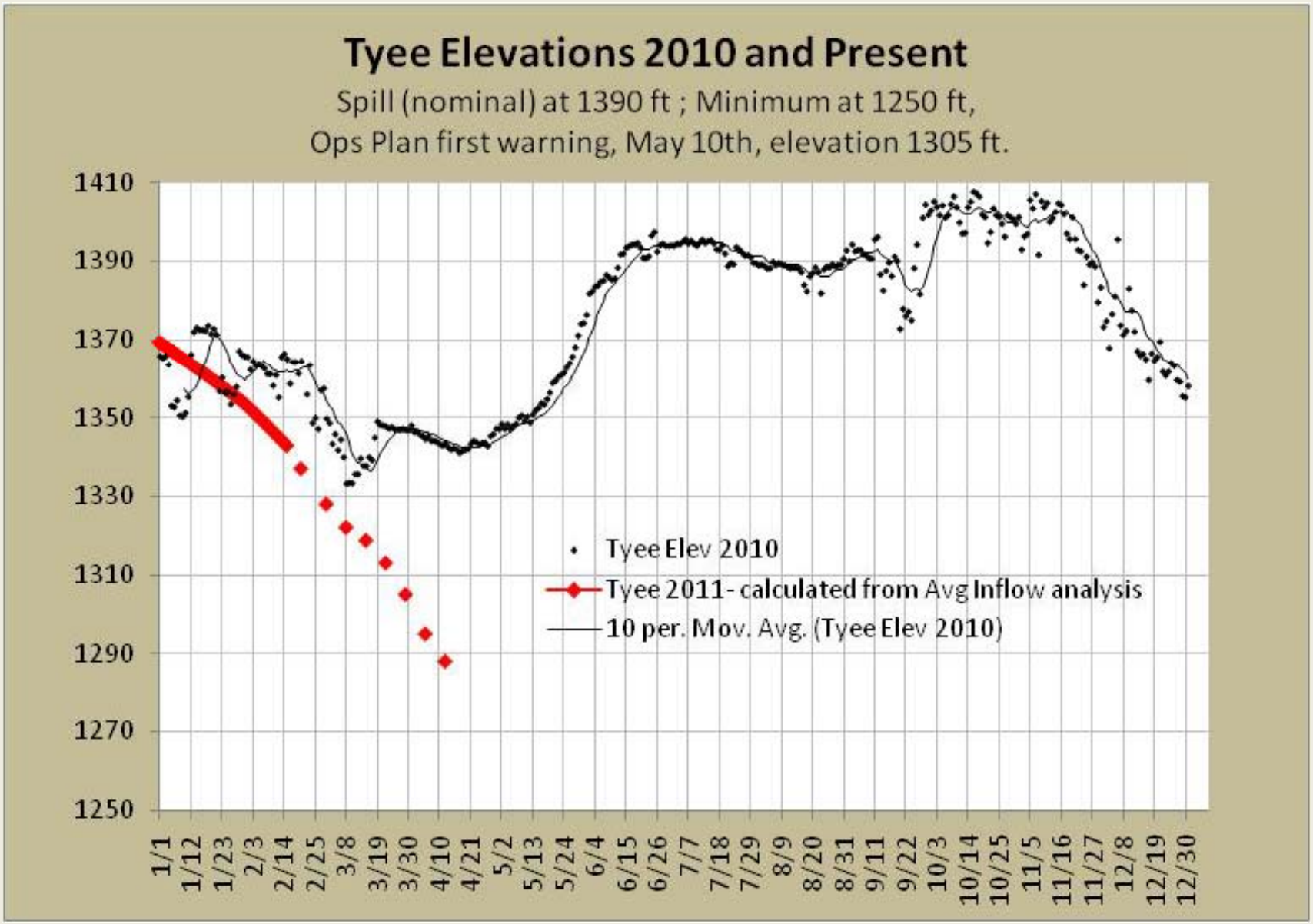
That's right, in one year we go from way long to significantly short. In SE Alaska a 100% hydro system is feast or famine. As we discuss resource balance today, KPU's Bailey Plant is generating with diesel engines! February loads were an astounding 46% above February 2010 Loads, Jan, March and April were also significantly above our projections which included provisions for the boiler conversion program. Cold weather has reduced inflows to near zero, storage is seriously depleted. Diesel generation (9-14 MW) is expected to last for 2-4 weeks depending on what else ?.....WEATHER.



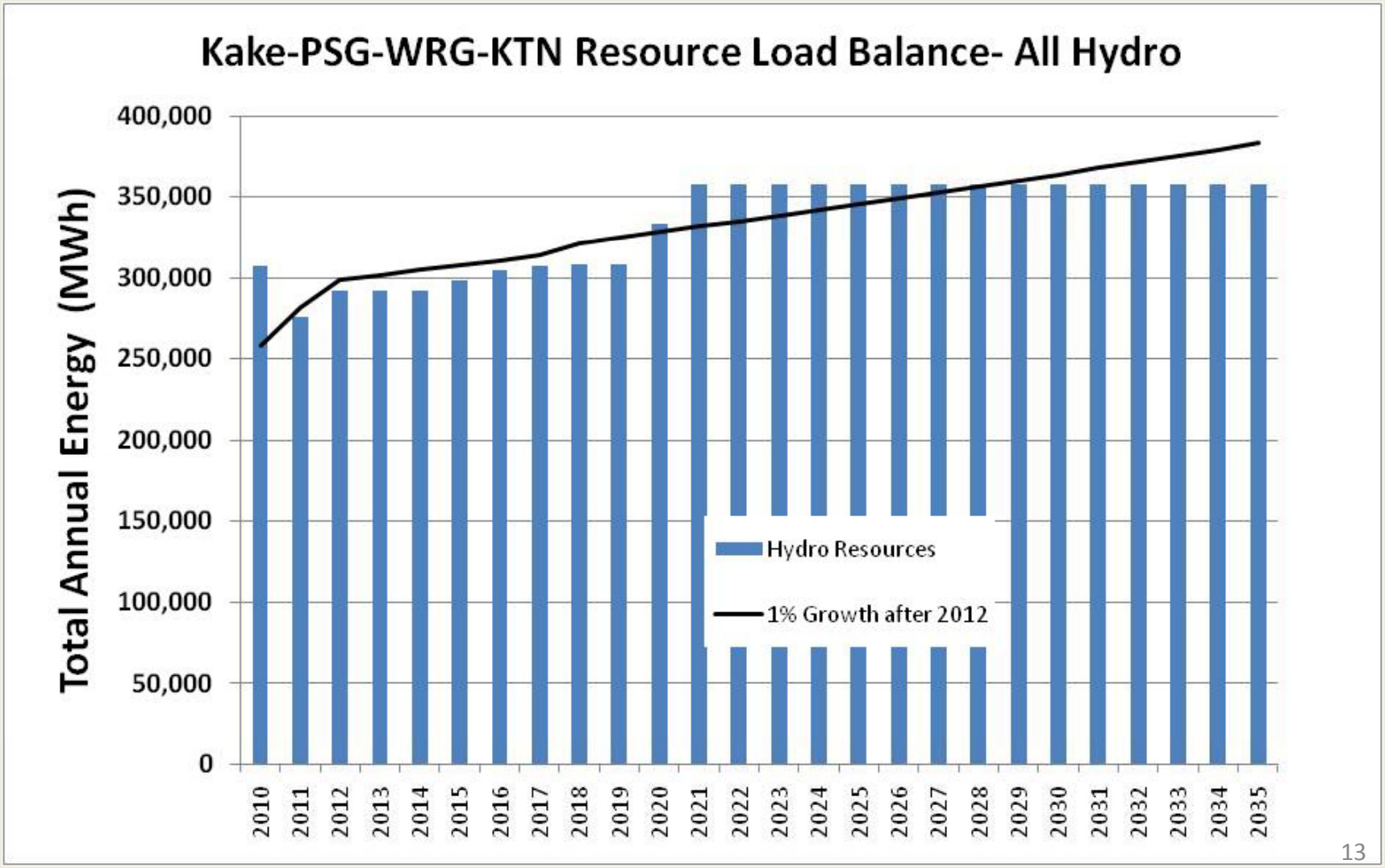


Huge annual fluctuations in fuel lead to large fluctuations in hydro output.

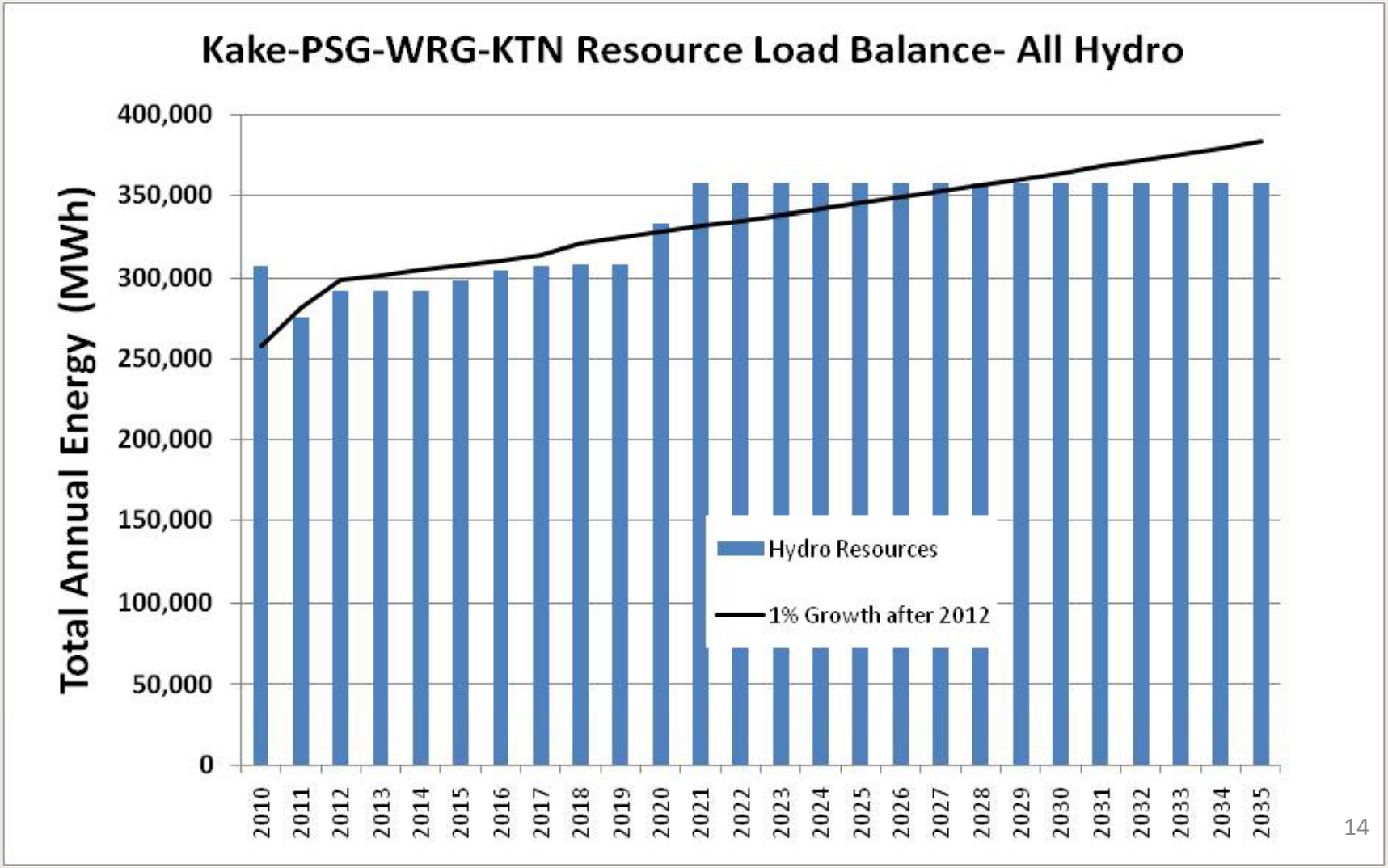

Swan Elevations 2010 and Present
Spill at 330.0 ft ; Minimum at 271.5 ft
Swan Elev 2010
2011
335.0
330.0
325.0
320.0
315.0
310.0
305.0
300.0
295.0
290.0
285.0
280.0
275.0
270.0
1/1
1/12
1/23
2/3
2/14
2/25
3/8
3/19
3/30
4/10
4/21
5/2
5/13
5/24
6/4
6/15
6/26
7/7
7/18
7/29
8/9
8/20
8/31
9/11
9/22
10/3
10/14
10/25
11/5
11/16
11/27
12/8
12/19
12/30


Tyee Elevations 2010 and Present
Spill (nominal) at 1390 ft ; Minimum at 1250 ft,
Ops Plan first warning, May 10th, elevation 1305 ft.
1410
1390
1370
1350
1330
1310
1290
1270
1250
1/1
1/12
1/23
2/3
2/14
2/25
3/8
3/19
3/30
4/10
4/21
5/2
5/13
5/24
6/4
6/15
6/26
7/7
7/18
7/29
8/9
8/20
8/31
9/11
9/22
10/3
10/14
10/25
11/5
11/16
11/27
12/8
12/19
12/30
Tyee Elev 2010
Tyee 2011- calculated from Avg Inflow analysis
10 per. Mov. Avg. (Tyee Elev 2010)

This is exactly why we are here today, a short year after completion of a new project makes you think of planning! What is the long term load and resource balance for the Region?



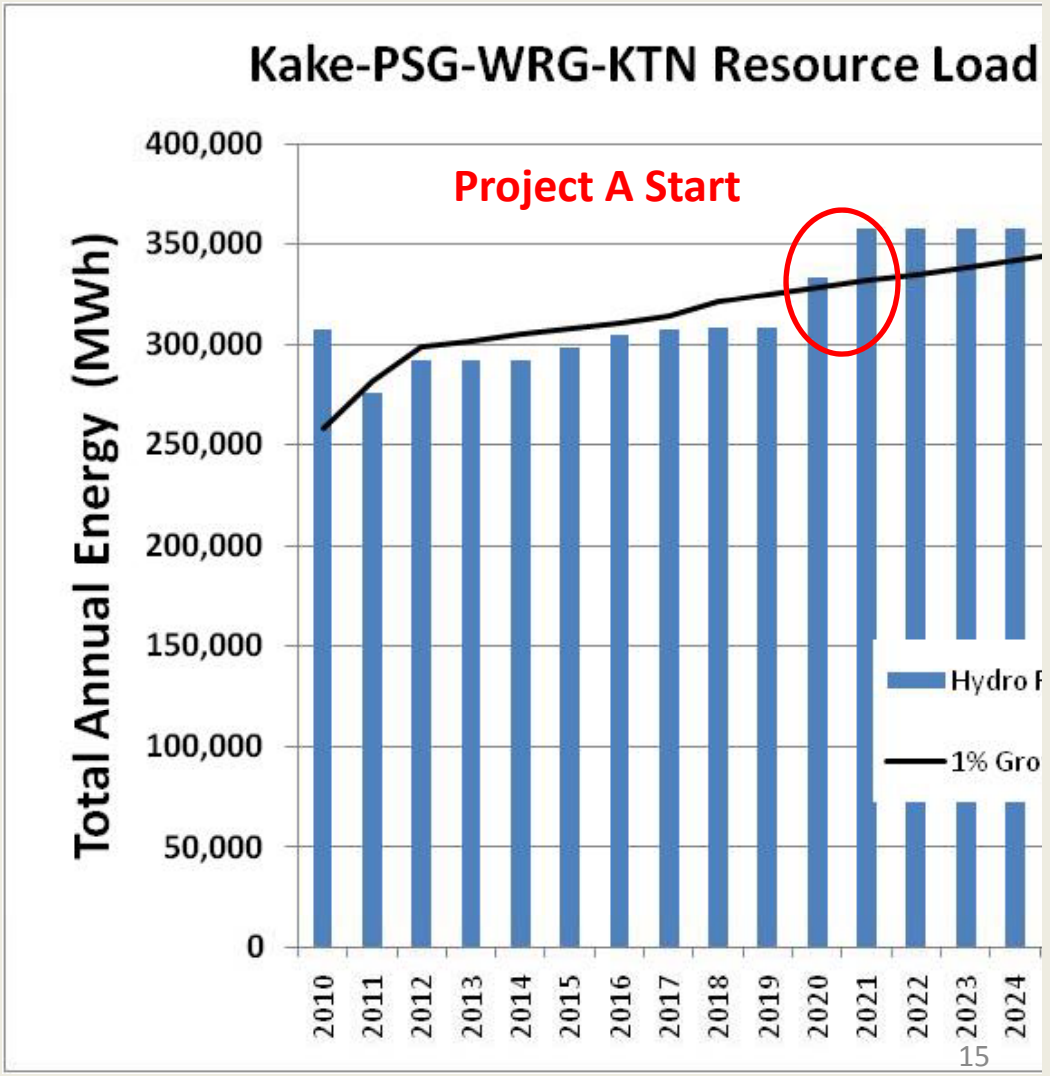
2012 to 2015- use historical average hydro generation
2015 Whitman 800 KW, next near full project complete
2018 Kake Intertie commissioned, Metlakatla on a future analysis
2020 Project A commissioned



Before Project A can be estimated as a reliable contribution, the FERC application is reviewed. As the majority provider to our member communities we have a responsibility to verify the proposed project will be financially viable.

Are you sure that project will integrate into the system and provide the stated energy?

1) Verify hydrology
2) Verify hydraulics
3) Plant operation proposal consistent with system operation?, will it integrate well or will significant inefficiencies result



Verify basin hydrology

•Basin productivity reasonable- cfs/sq. mi consistent with like basins?

•Stream gage information available? Data intact or sporadic? If sporadic what were correcting assumptions?

•Stream gage corrected back to reservoir using appropriate methods for elevation change and tributary areas

Verify project hydraulics

•Flow rates and net head consistent, tunnels, penstock sized appropriately?

• Is there daily, weekly, monthly or seasonal storage?

•Plant output restricted by ramp rates?

•Plant output restricted by reservoir limits or reservoir rate change limits?

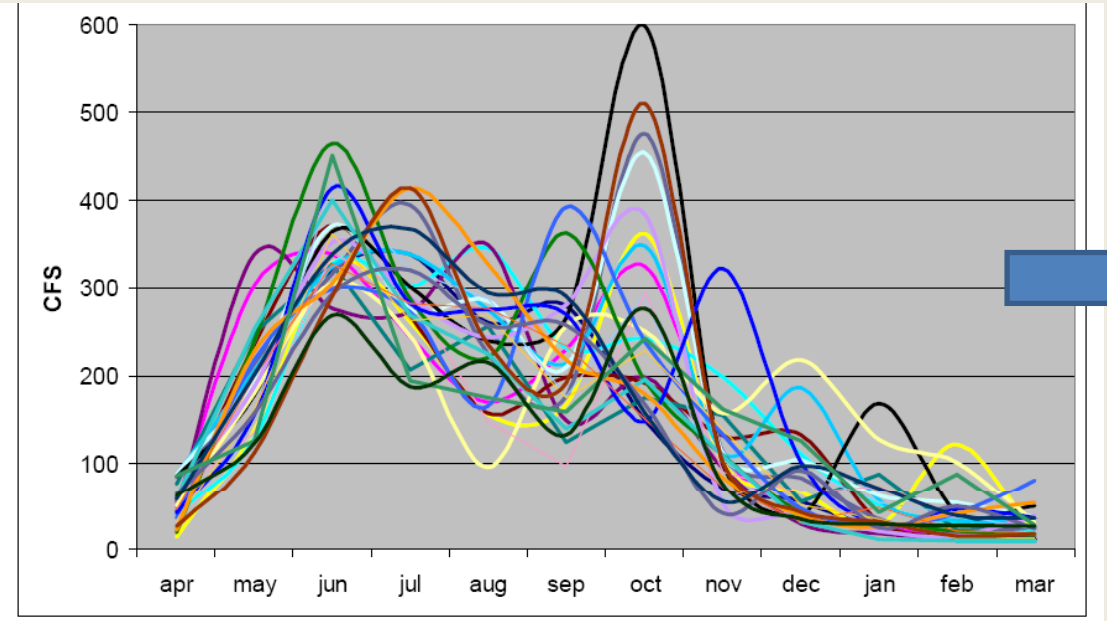
•How were annual and monthly capacity and energy values derived?

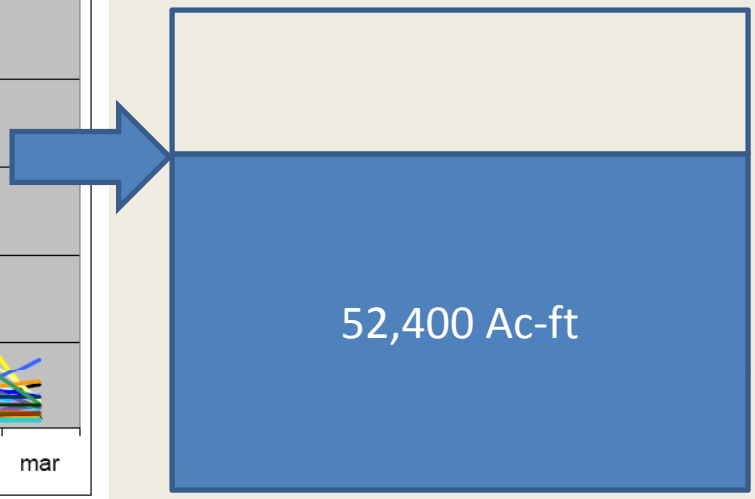
- •**Never Average inflow**, you won't get average generation
- •See tail end of presentation for details

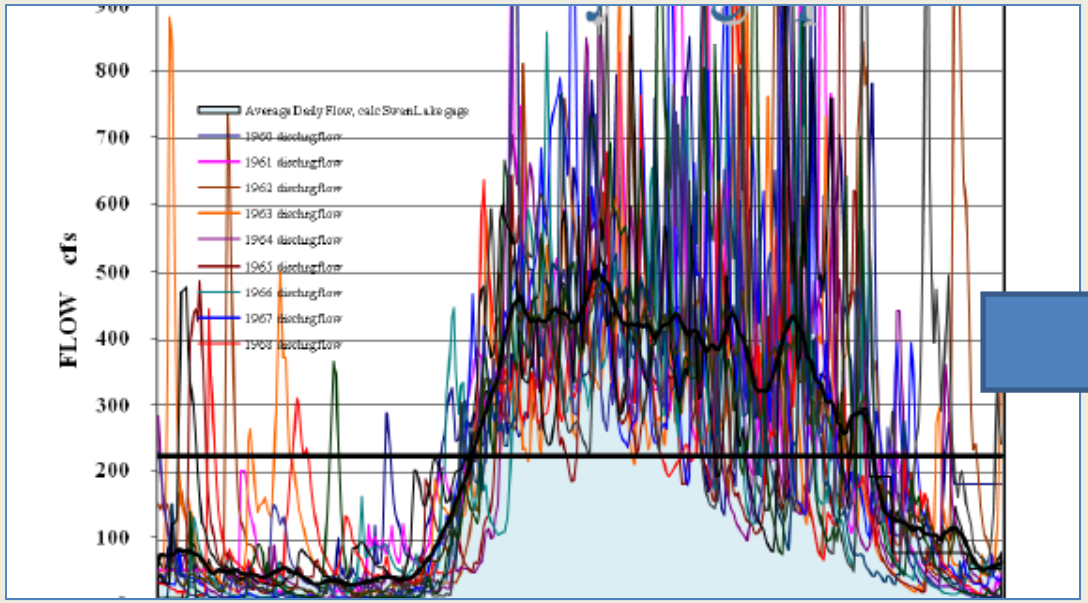
A word concerning Storage

	Storage	Plant Pwr	Plant Hydr	# days
Project	Ac ft	Cap MW	Cap cfs	storage
KPU Ktn Lks	13,600	4.2	127	54
KPU Silvis	38,000	2.5	80	241
KPU BVR Falls	8,052	7	87	47
SEAPA Swan lake	86,000	22	921	64
SEAPA Tyee	52,400	24	200	132
PMP&L Blind Sl.	4,875	2	16	152
Mahoney Lake	4,000	9.6	58	35
Cascade Swan Lake	3,474	70	670	3
Ruth	2,200	20.1	152	7
Ruth with Dam	3,900	40	305	6

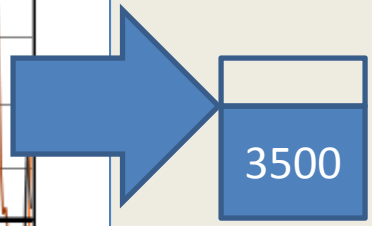
High altitude reservoirs require storage to assist with winter loads!
High altitude reservoirs with little storage are prone to spill in summer when loads are low

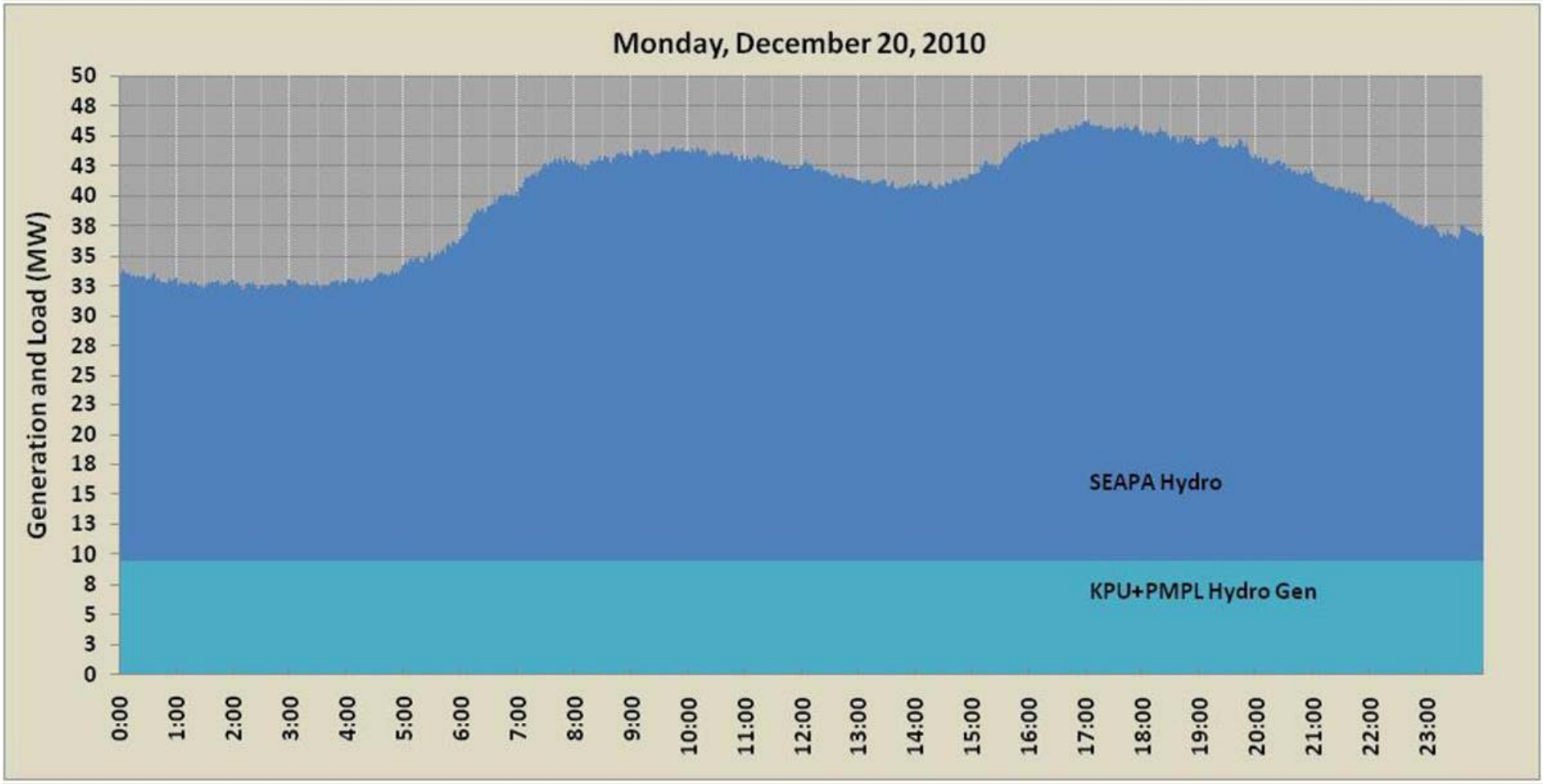






Which project do you think will waste less water?





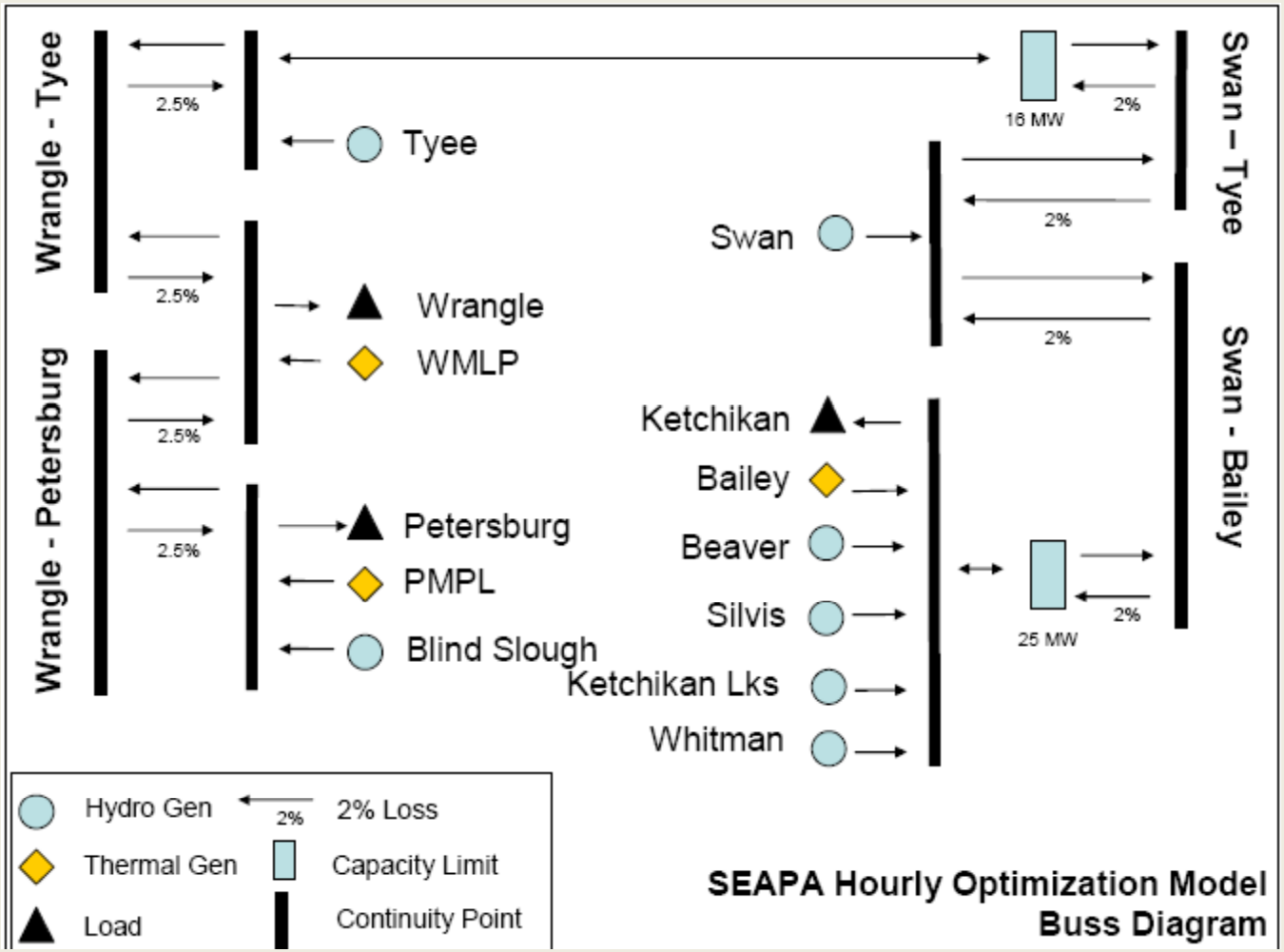
Ramp rate restrictions add more burden to hourly load following efforts!

Inputs

Add new plant to existing system
Hourly Loads
Daily Avg. Inflow sequence for a year
Reservoir Start
Spin Reserve Reqts.
Buss limitations
Reservoir limits

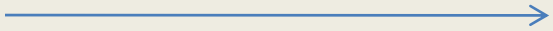
Outputs

System
Diesel Gen
Hydro Gen by plant
Spill by plant
End Reservoir Levels



Proposed Project
70,000 MWh, $110 M

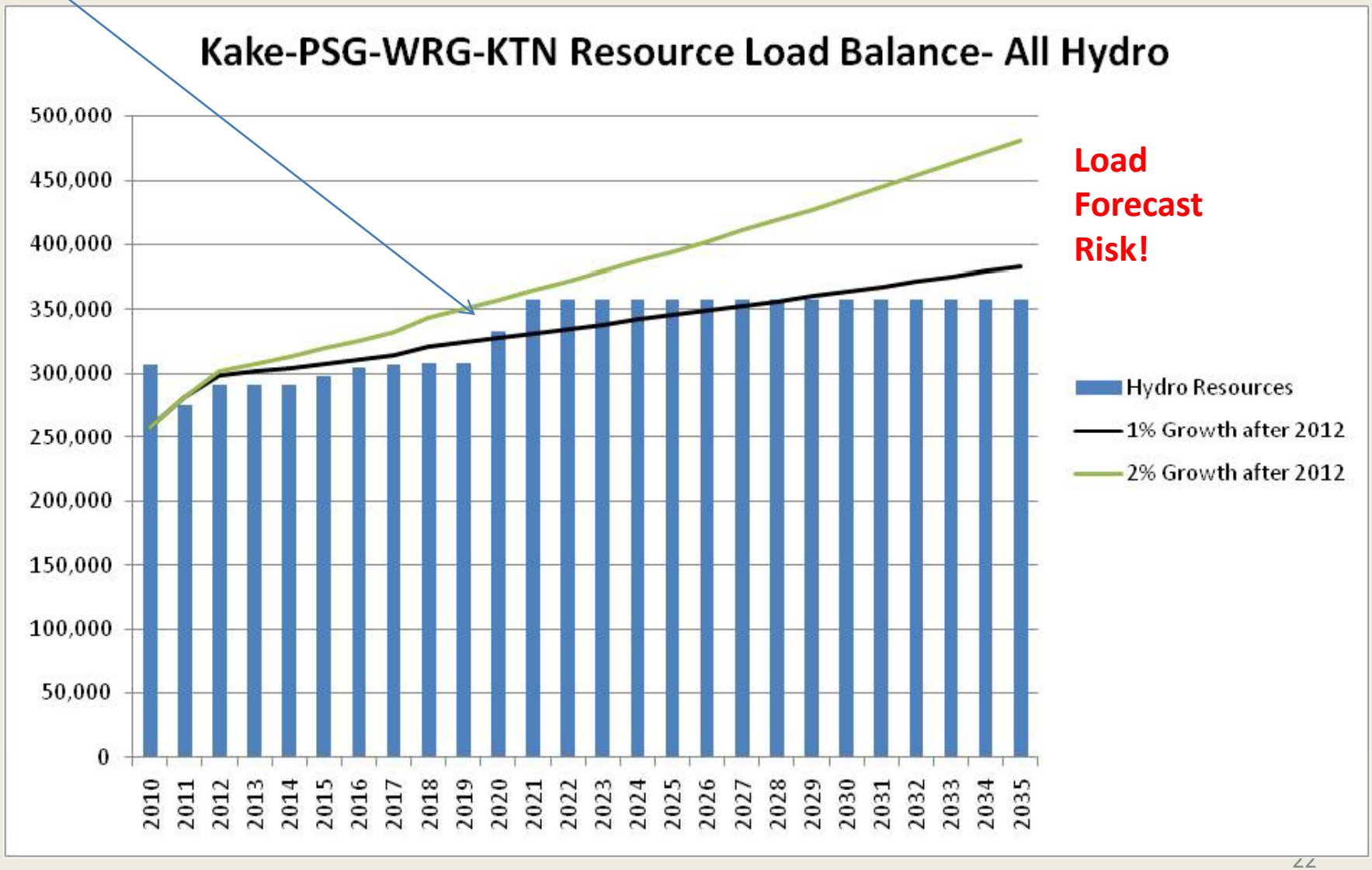
Project as proposed as stand alone benefit in FERC Application

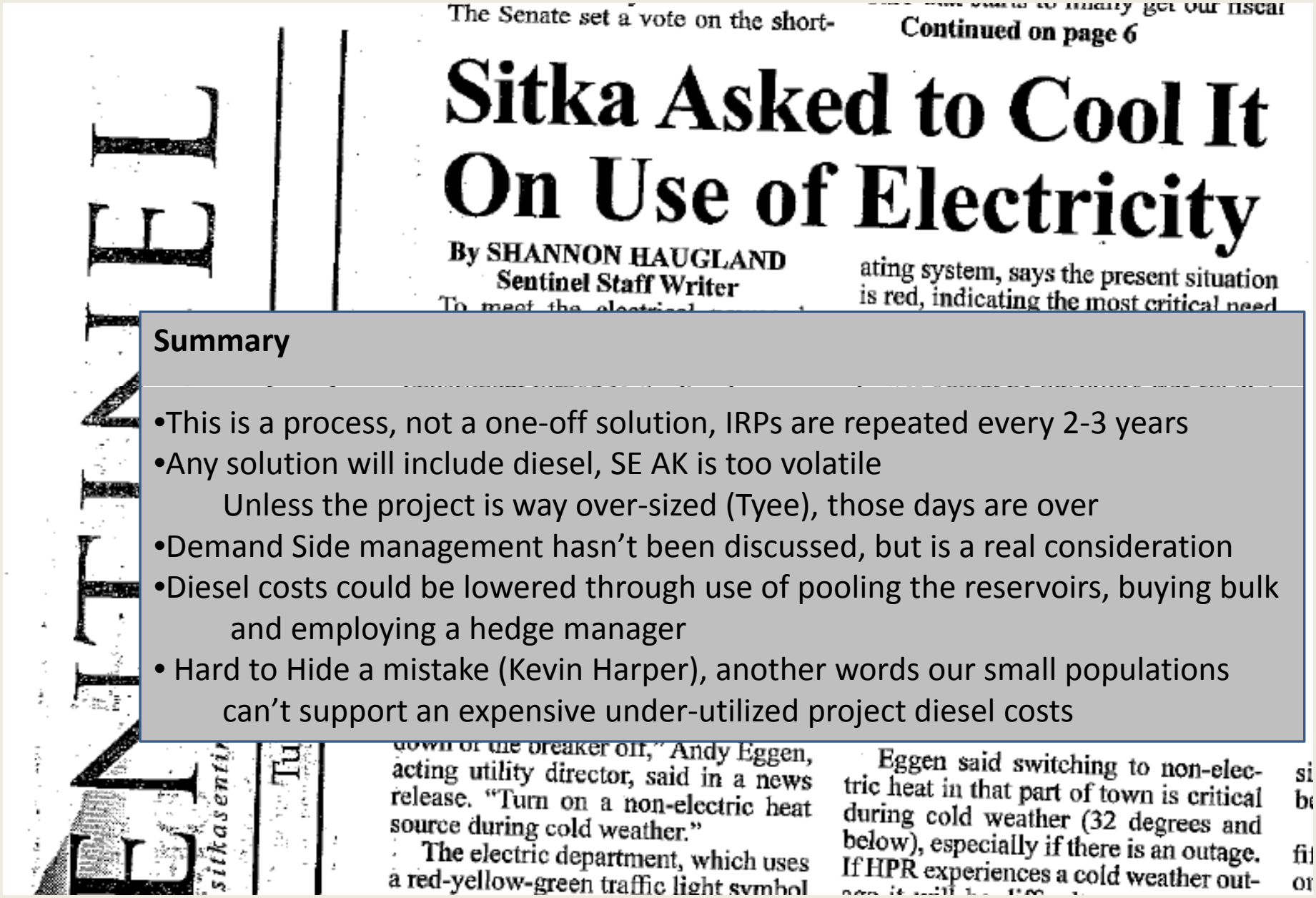


Actual Expectation
50,000 MWh, $140M

Actual dispatched energy to system and updated costs. This project gets evaluated in Dave's Finance Model

Now you can add the 50,000 MWh of system generation, you have high confidence it will be produced when needed and sold to help pay the bankers!





The Senate set a vote on the short-

Continued on page 6

Sitka Asked to Cool It On Use of Electricity

By SHANNON HAUGLAND
Sentinel Staff Writer

ating system, says the present situation is red, indicating the most critical need

down of the breaker off," Andy Eggen, acting utility director, said in a news release. "Turn on a non-electric heat source during cold weather."

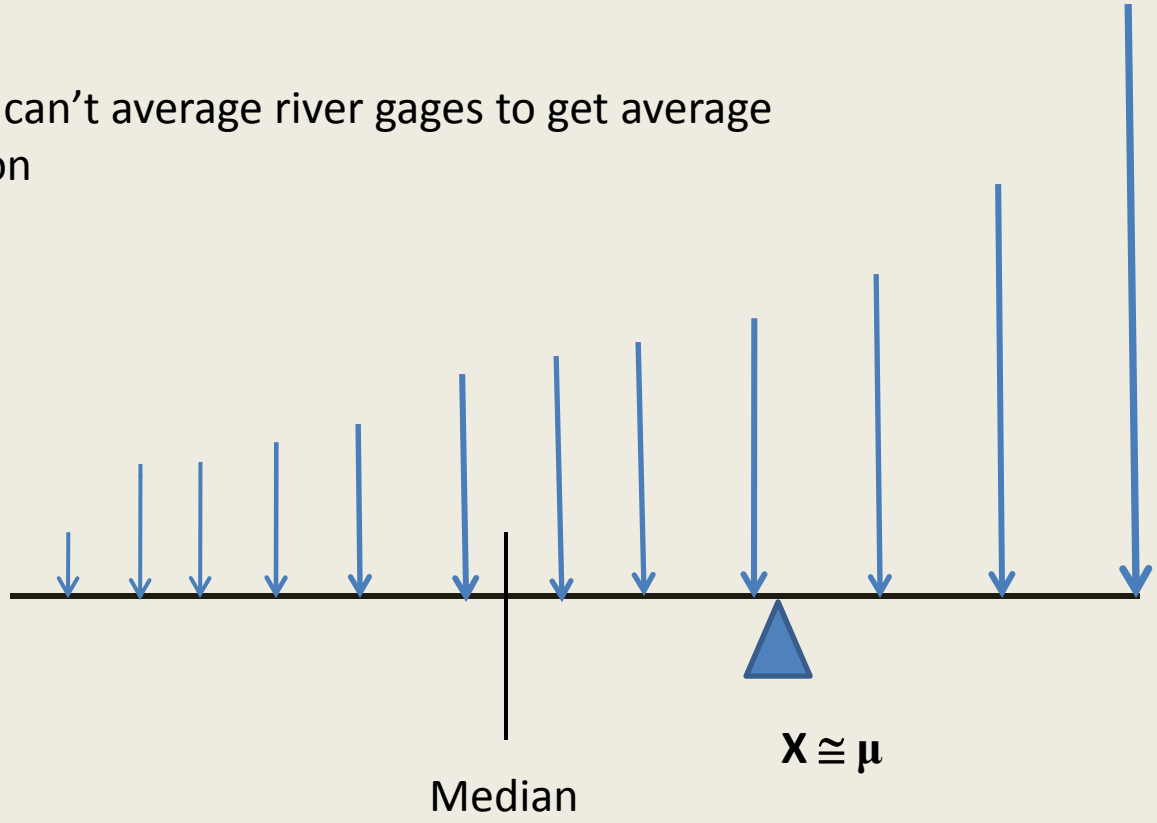
The electric department, which uses a red-yellow-green traffic light symbol

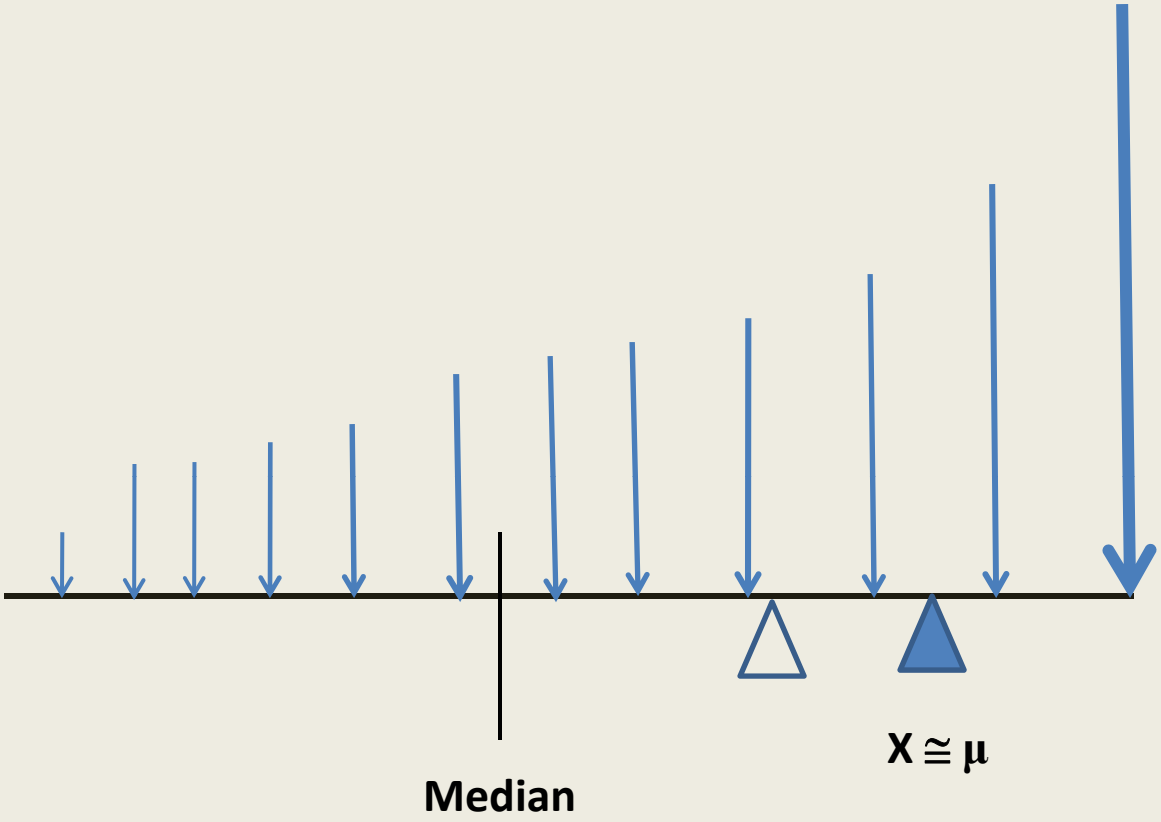
Eggen said switching to non-electric heat in that part of town is critical during cold weather (32 degrees and below), especially if there is an outage. If HPR experiences a cold weather out-

Summary

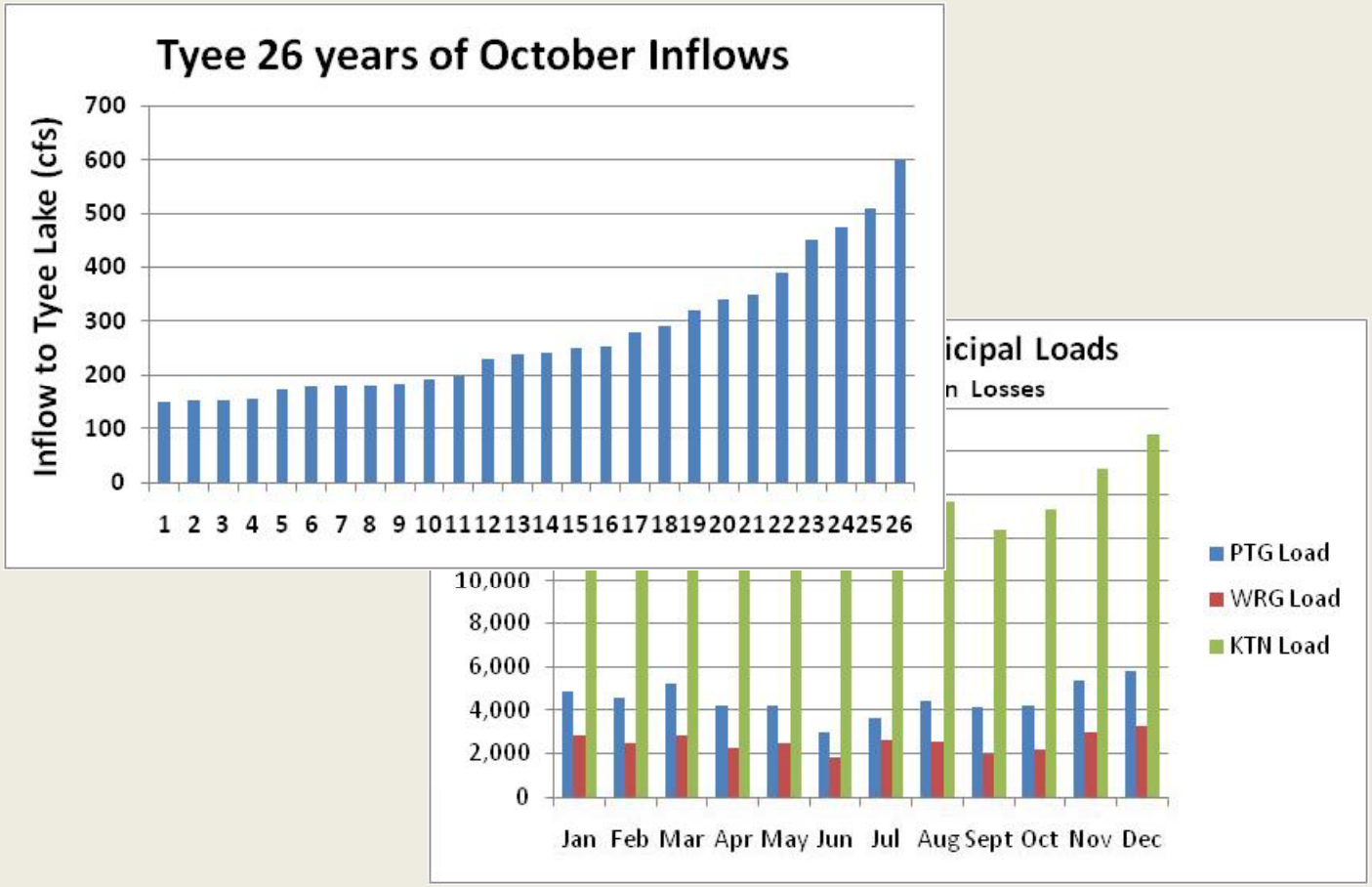
- This is a process, not a one-off solution, IRPs are repeated every 2-3 years
- Any solution will include diesel, SE AK is too volatile
  Unless the project is way over-sized (Tyee), those days are over
- Demand Side management hasn't been discussed, but is a real consideration
- Diesel costs could be lowered through use of pooling the reservoirs, buying bulk and employing a hedge manager
- Hard to Hide a mistake (Kevin Harper), another words our small populations can't support an expensive under-utilized project diesel costs

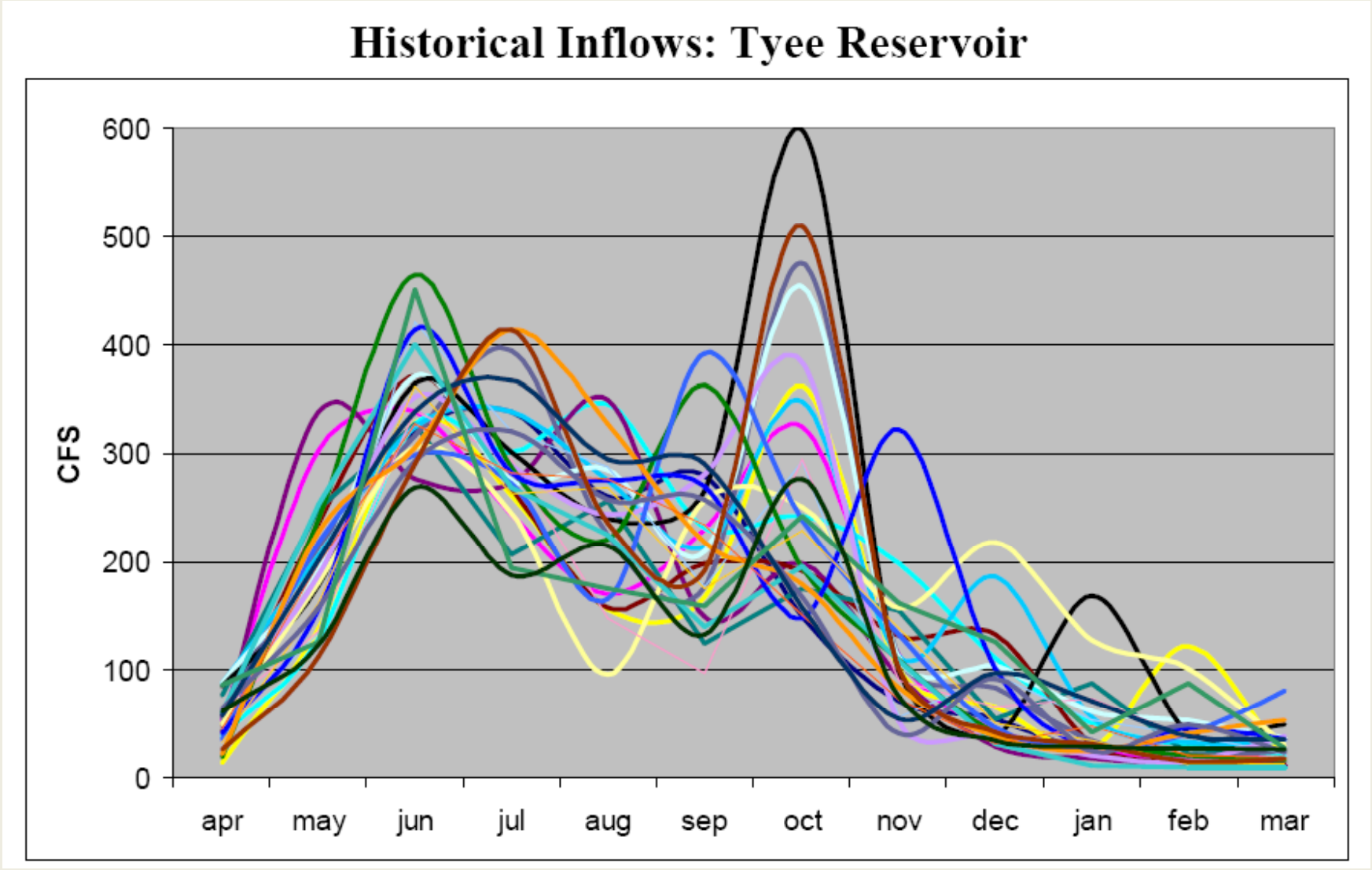
Why you can't average river gages to get average generation





If you replace the last large inflow with a really large inflow, the average must move, but the median stays the same. Plants with small to moderate storage sized for average spill. If you make the plant large enough to generate the average you will not recapture your investment..ever


Tyee 26 years of October Inflows
Inflow to Tyee Lake (cfs)
700
600
500
400
300
200
100
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
icipal Loads
n Losses
10,000
8,000
6,000
4,000
2,000
0
Jan Feb Mar Apr May Jun Jul Aug Sept Oct Nov Dec
PTG Load
WRG Load
KTN Load


Historical Inflows: Tyee Reservoir
CFS
600
500
400
300
200
100
0
apr
may
jun
jul
aug
sep
oct
nov
dec
jan
feb
mar