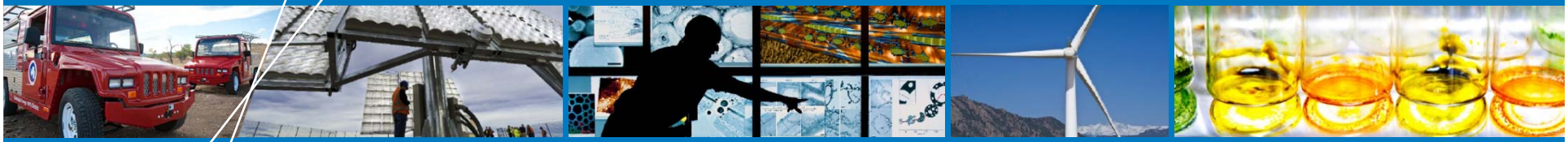
NREL
NATIONAL RENEWABLE ENERGY LABORATORY



WWSIS2 TRC Sept meeting

9/12/12

Topics

- Data inputs
- Transmission database
- Preliminary Results
- New schedule
- New GE and APTECH work

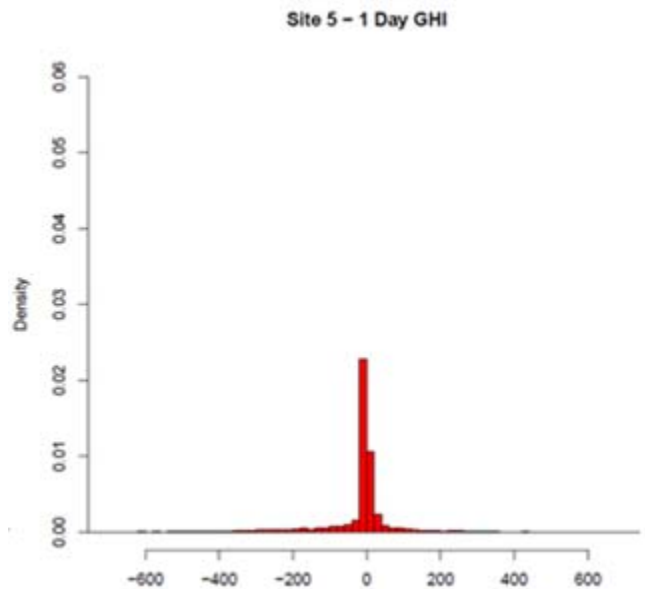
Data inputs

- **Wind forecasts have slight bias**
- **Solar forecasts have greater bias**

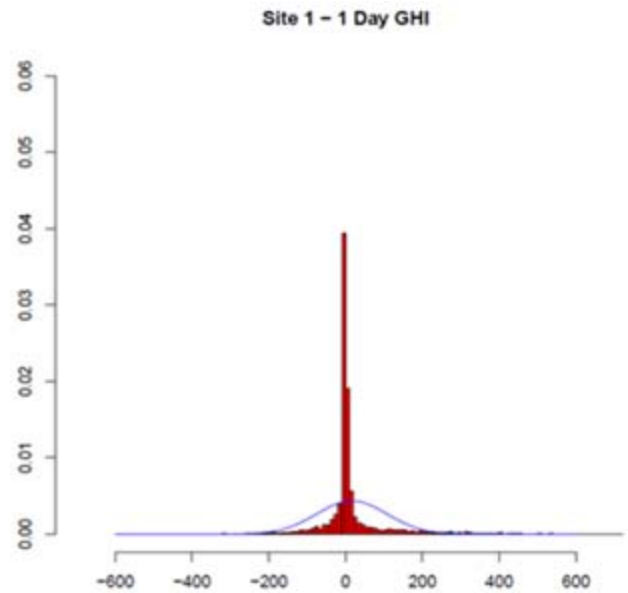
Over-forecasting bias ((forecast – wind)/wind):

	High-Solar Scenario		High-Wind Scenario	
	Wind	Solar	Wind	Solar
CA	7.5%	5.6%	7.4%	6.0%
CG	3.4%	14.5%	3.2%	14.5%
NTTG	3.1%	7.9%	4.5%	5.5%
WC	4.3%	5.9%	4.6%	6.3%
US WI	4.4%	6.1%	4.7%	6.6%

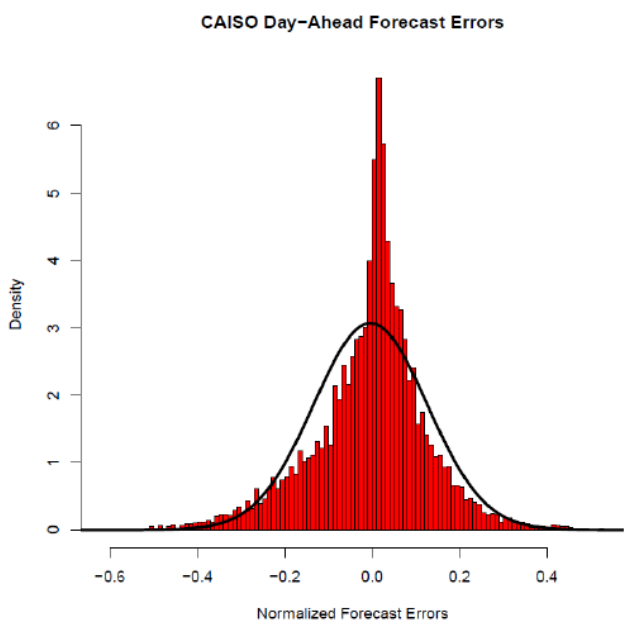
Solar NDFD Forecasts Mean Bias: 19.63 W/m^2



Solar GEM Forecasts Mean Bias: 16.21 W/m^2

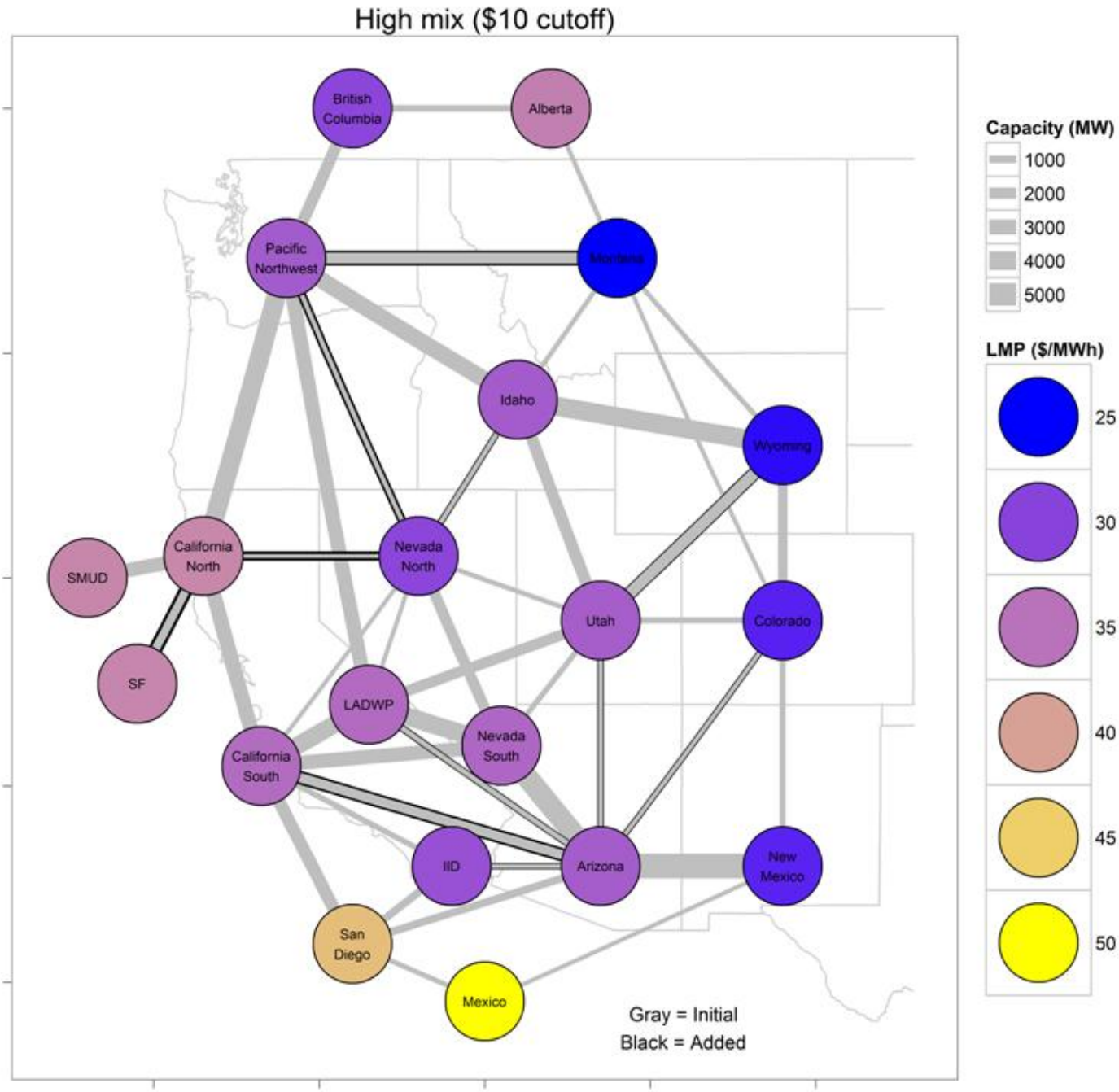


CAISO Wind DA Forecasts Mean Bias: 4% of installed capacity



Transmission database

- About 1500 transmission lines should not be in the database of 20,000+ lines
- Because our runs are zonal with interface limits defined between zones, this affects our runs, but not as severely as otherwise. May be responsible for loop flow seen in southwest
- Should we eliminate the 1500 extra lines?


High mix ($10 cutoff)
British Columbia
Alberta
Pacific Northwest
Montana
Idaho
Wyoming
California North
Nevada North
SMUD
SF
Utah
Colorado
LADWP
Nevada South
California South
IID
Arizona
New Mexico
San Diego
Mexico
Gray = Initial
Black = Added
Capacity (MW)
1000
2000
3000
4000
5000
LMP ($/MWh)
25
30
35
40
45
50

Unit commitment and dispatch sequence

DA commitment
Commit long-start generators
Hourly resolution
48 hr UC window
Run every 24 hrs

→ ~4 days

↓

4HA commitment
Commit medium-start generators
Hourly resolution
8 hr UC window
Run every 4 hrs

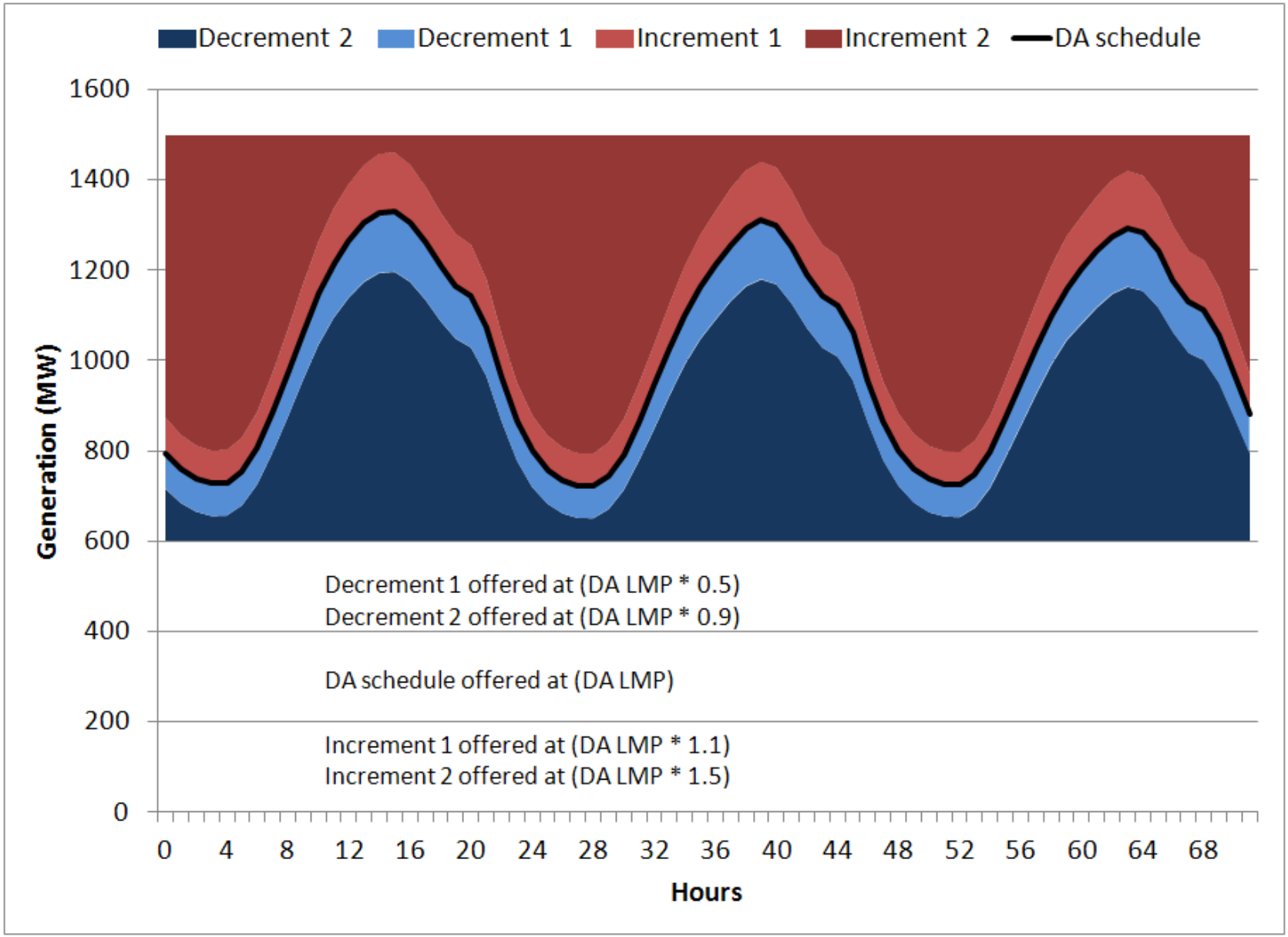
→ < 1 day

↓

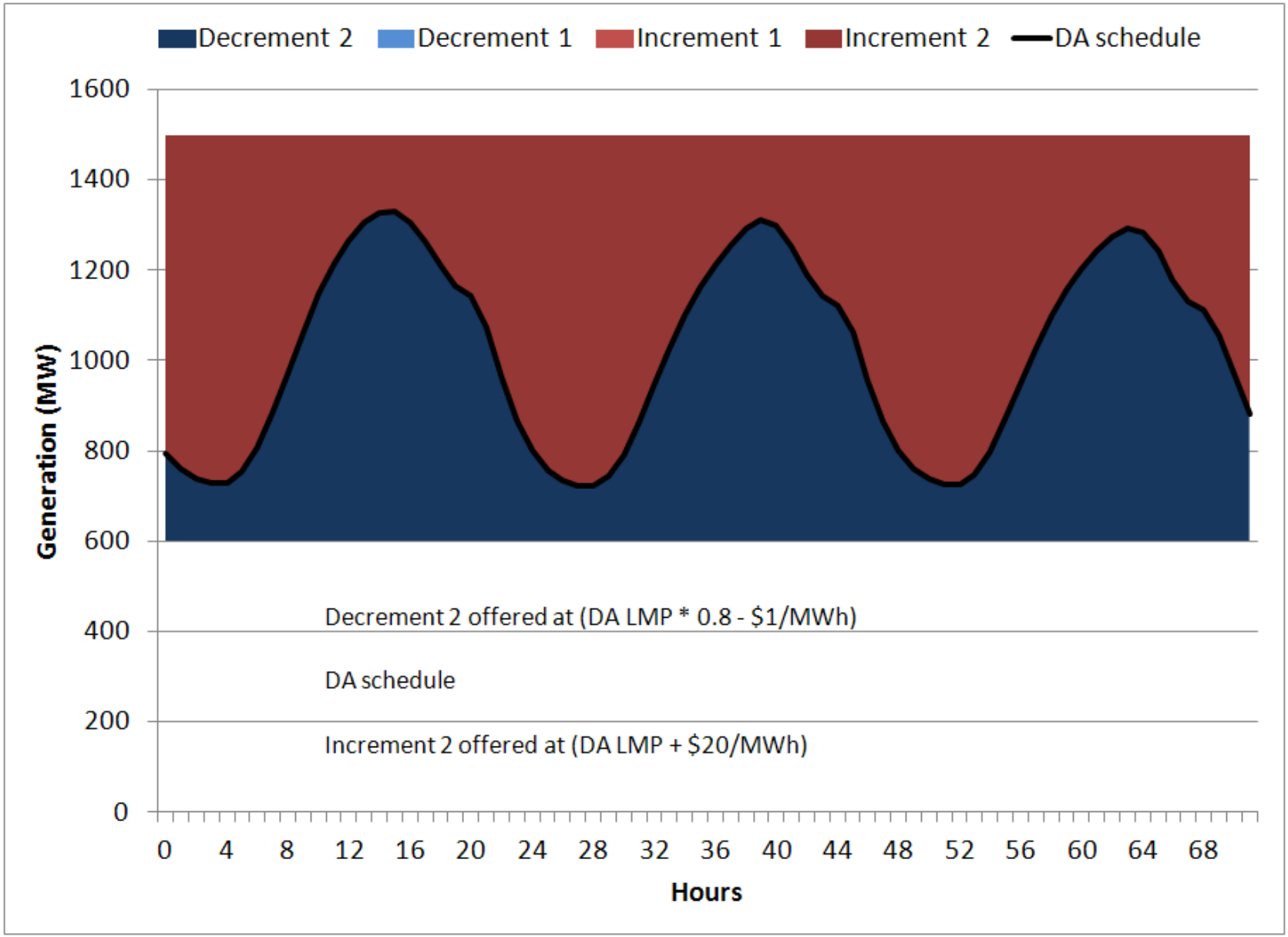
RT dispatch
Commit fast-start generators
5-minute resolution
Run every ? minutes (test)

→ 3-4 days

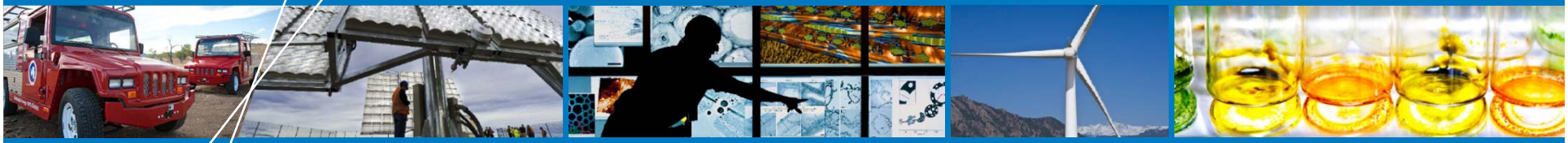
Hydro adjustment between DA, 4HA, RT



Hydro adjustment between DA, 4HA, RT

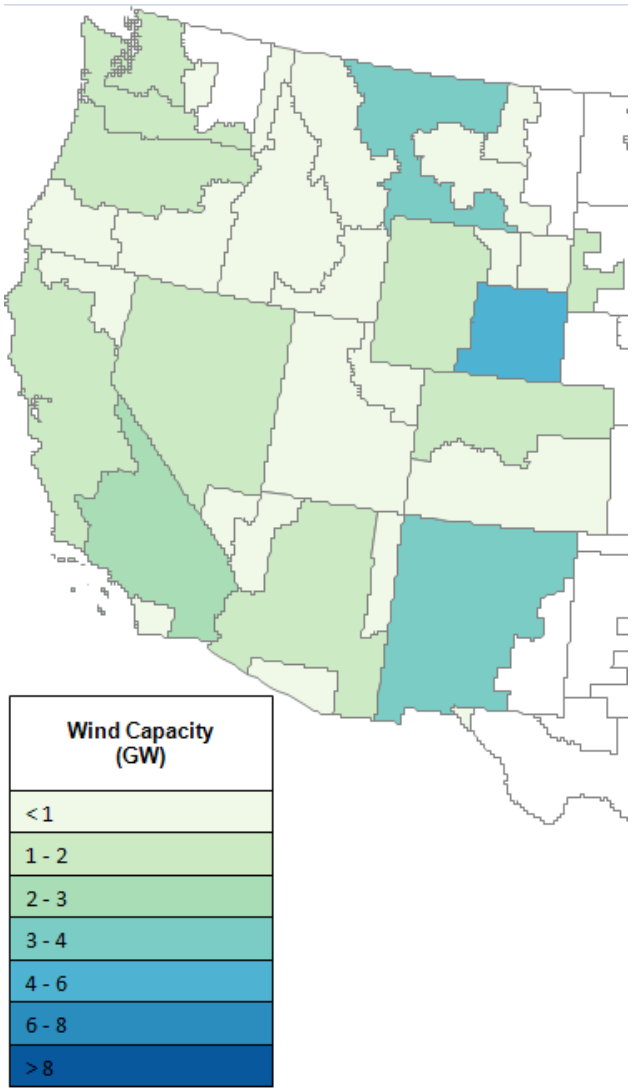


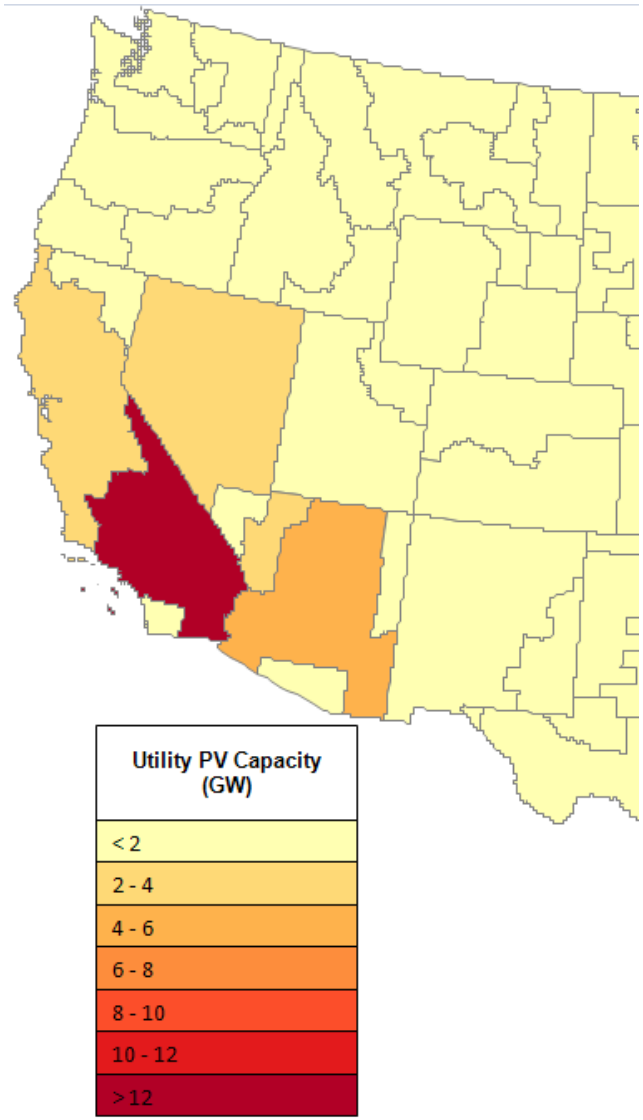
NREL
NATIONAL RENEWABLE ENERGY LABORATORY

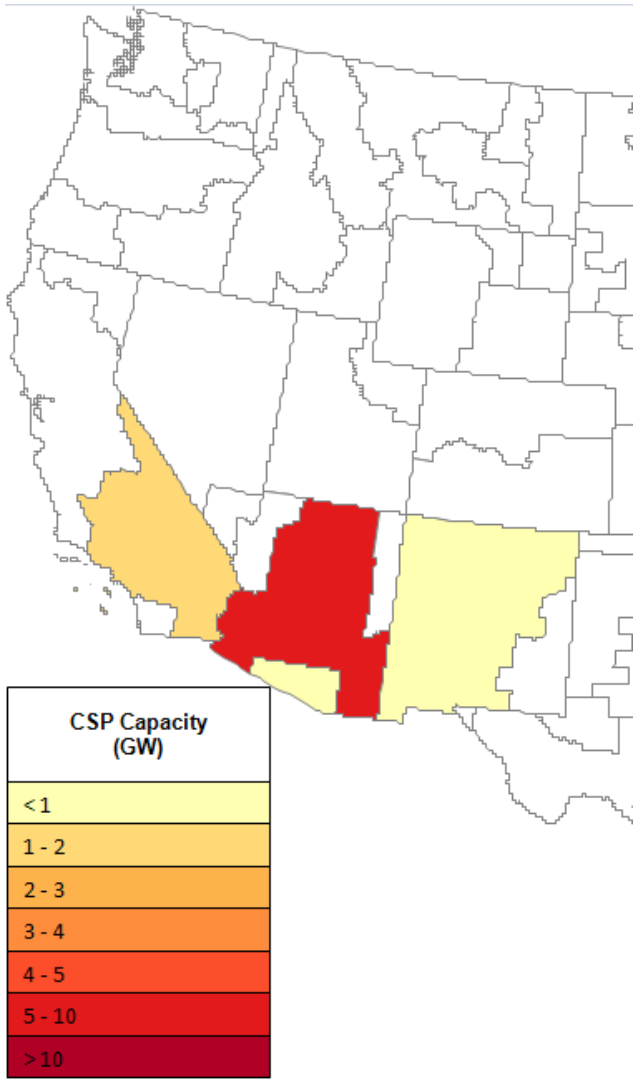


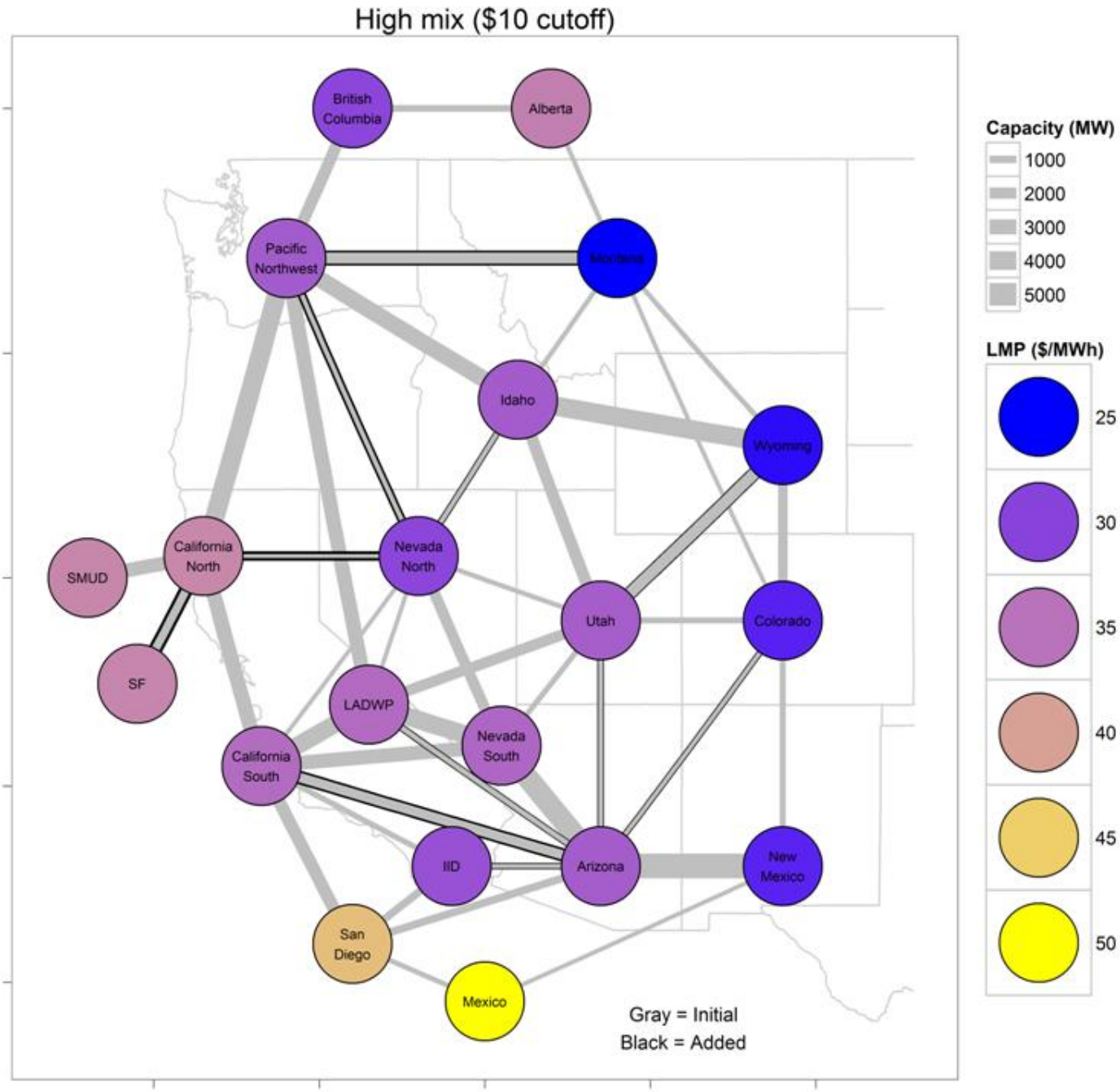
Preliminary results for base case, high mix case, for RT model in July

HiMix (16.5% wind, 9.9% PV, 6.6% CSP)








High mix ($10 cutoff)
British Columbia
Alberta
Pacific Northwest
Montana
Idaho
Wyoming
California North
Nevada North
SMUD
SF
Utah
Colorado
LADWP
Nevada South
California South
IID
Arizona
New Mexico
San Diego
Mexico
Gray = Initial
Black = Added
Capacity (MW)
1000
2000
3000
4000
5000
LMP ($/MWh)
25
30
35
40
45
50

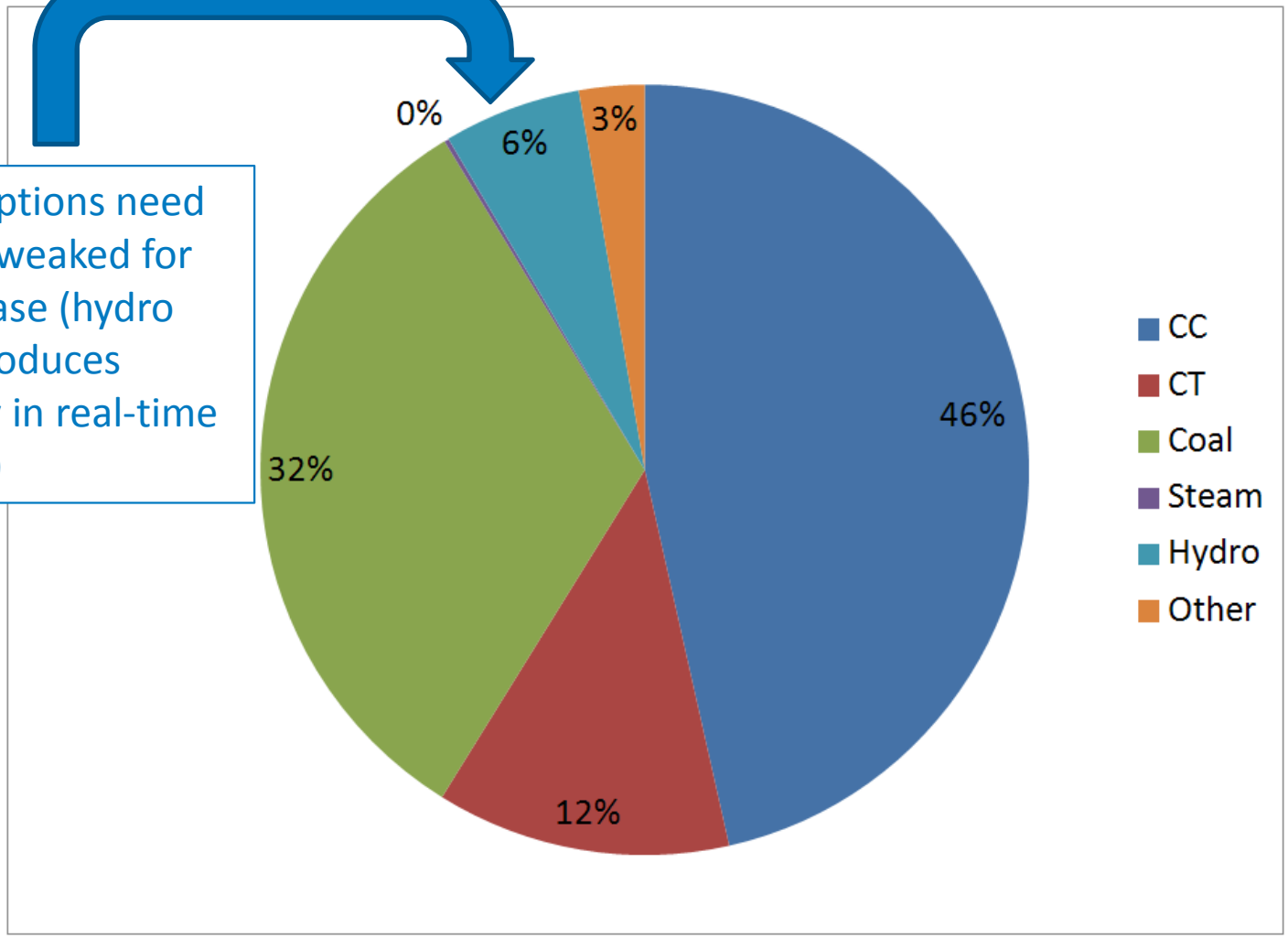
System adequacy in July

	Base	HiMix
Unserved Load (GWh)	0 GWh	0 GWh
Unserved Regulating Reserves (GWh)	0 GWh	0 GWh
Unserved Contigency Reserves (GWh)	0.83 GWh	0.68 GWh
Unserved Contingency Reserves (% of requirement)	0.03%	0.02%

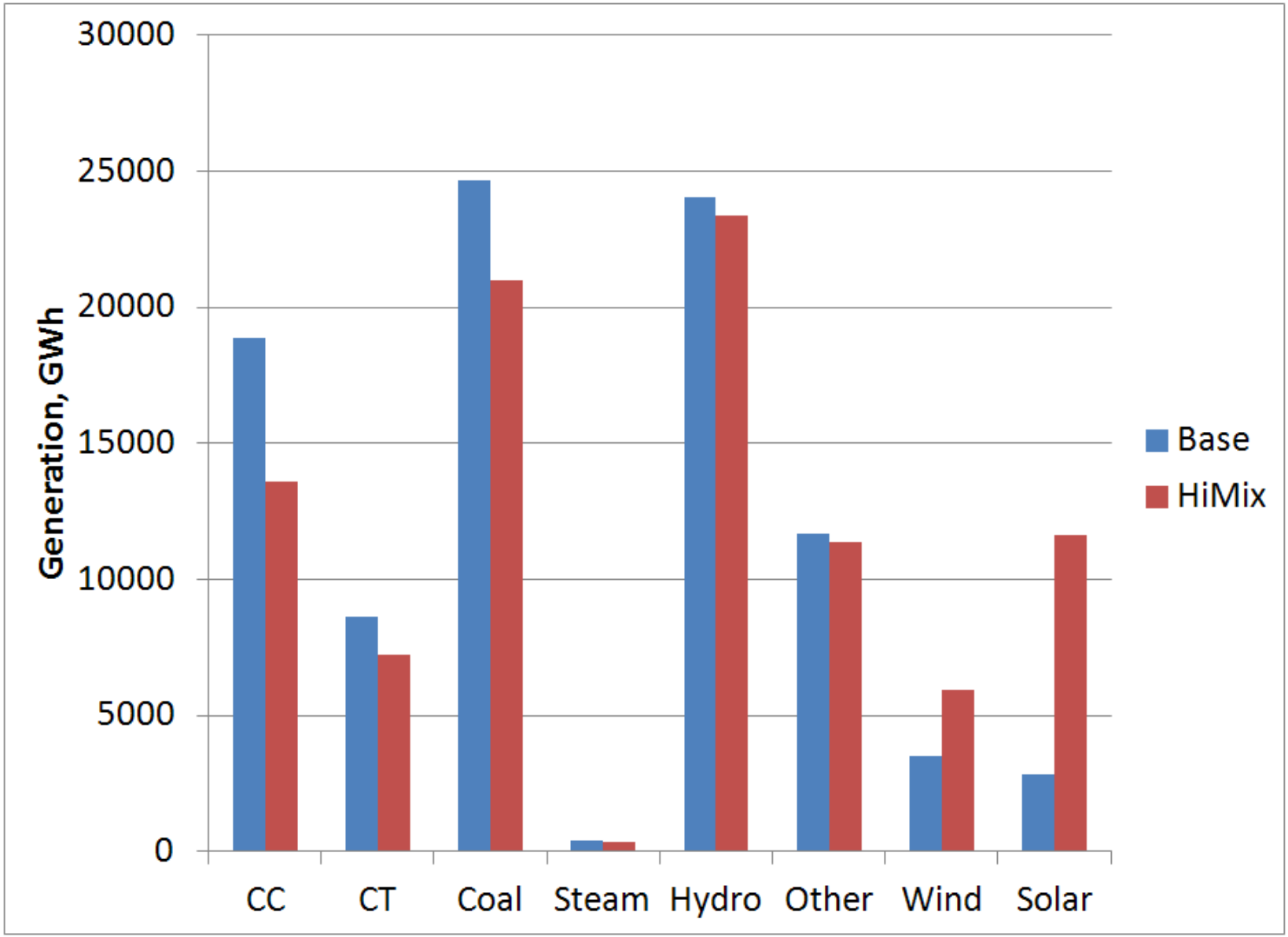
Compare to 47 GWh in WWSIS1

Reductions from adding wind and solar (July)

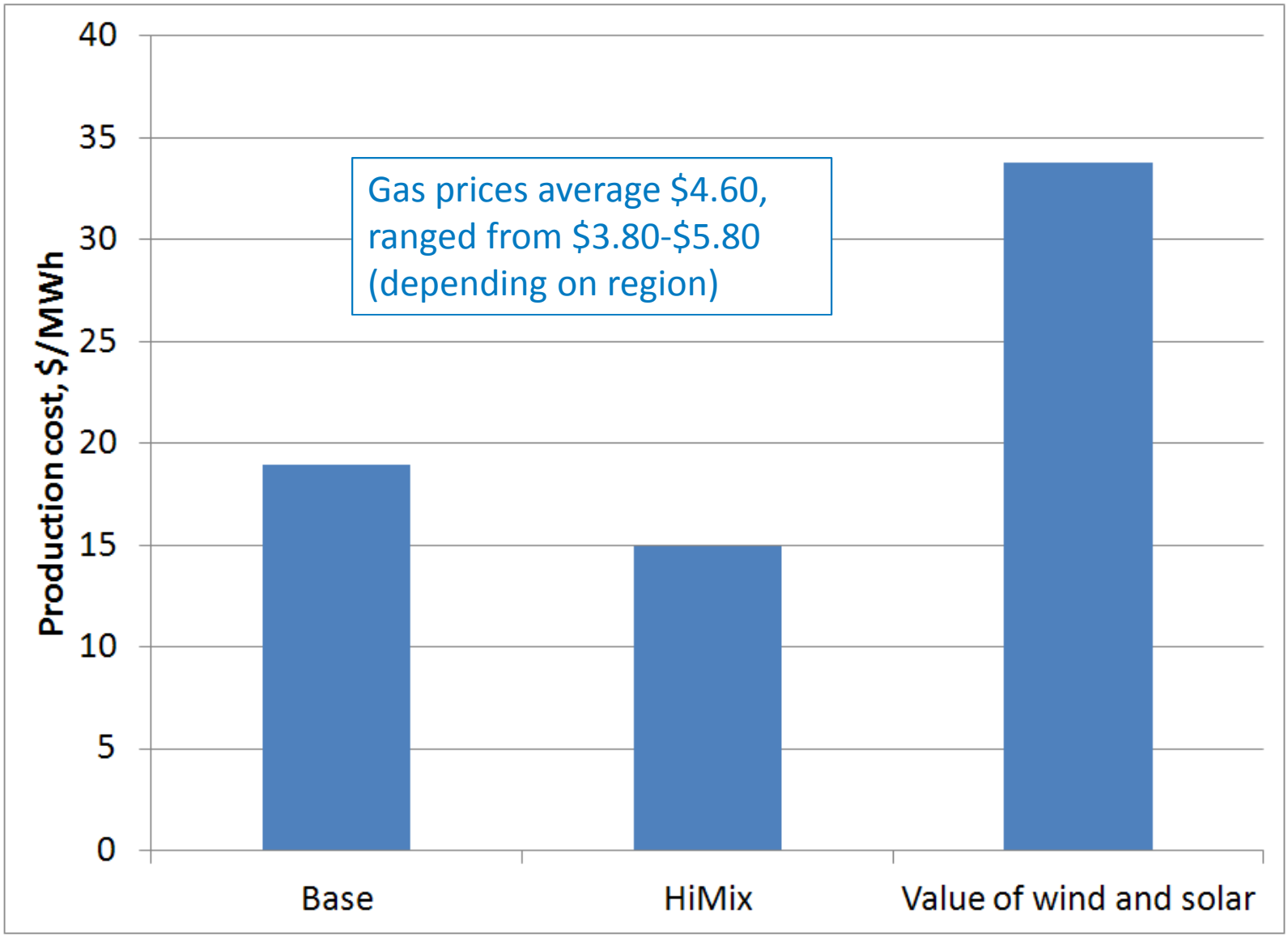
Assumptions need to be tweaked for base case (hydro overproduces slightly in real-time model)



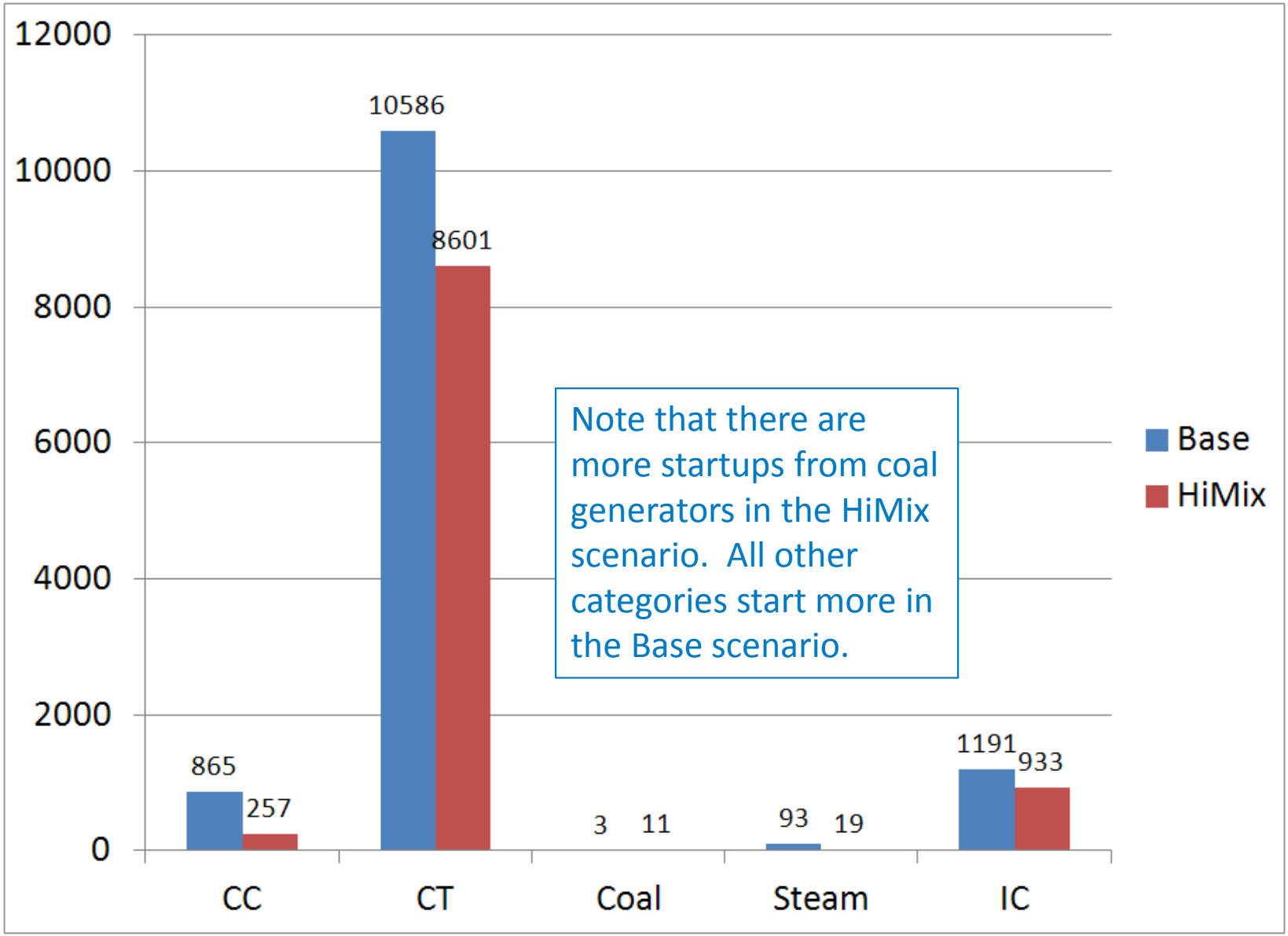
Generation by type (July)



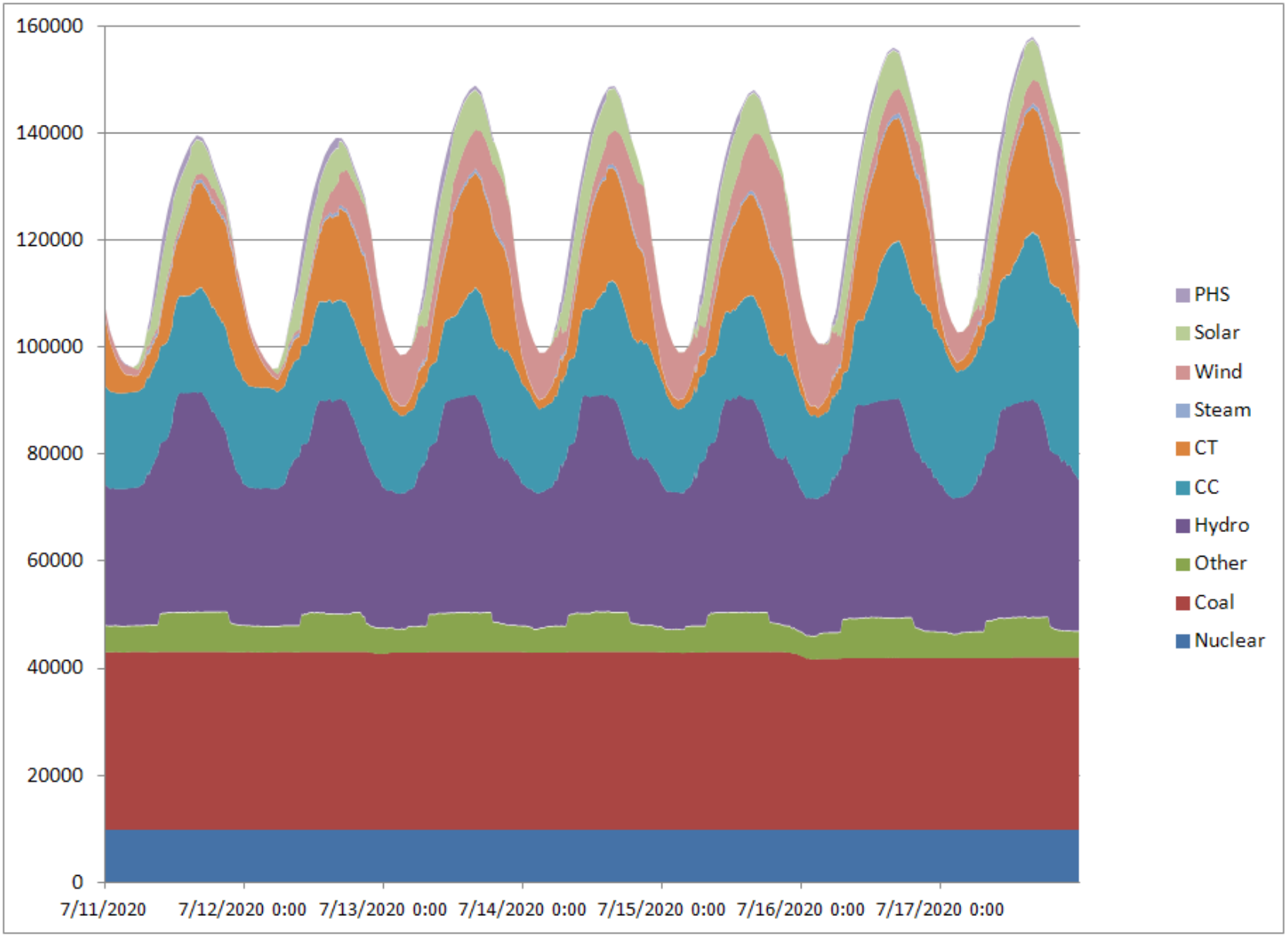
Average production cost (July)



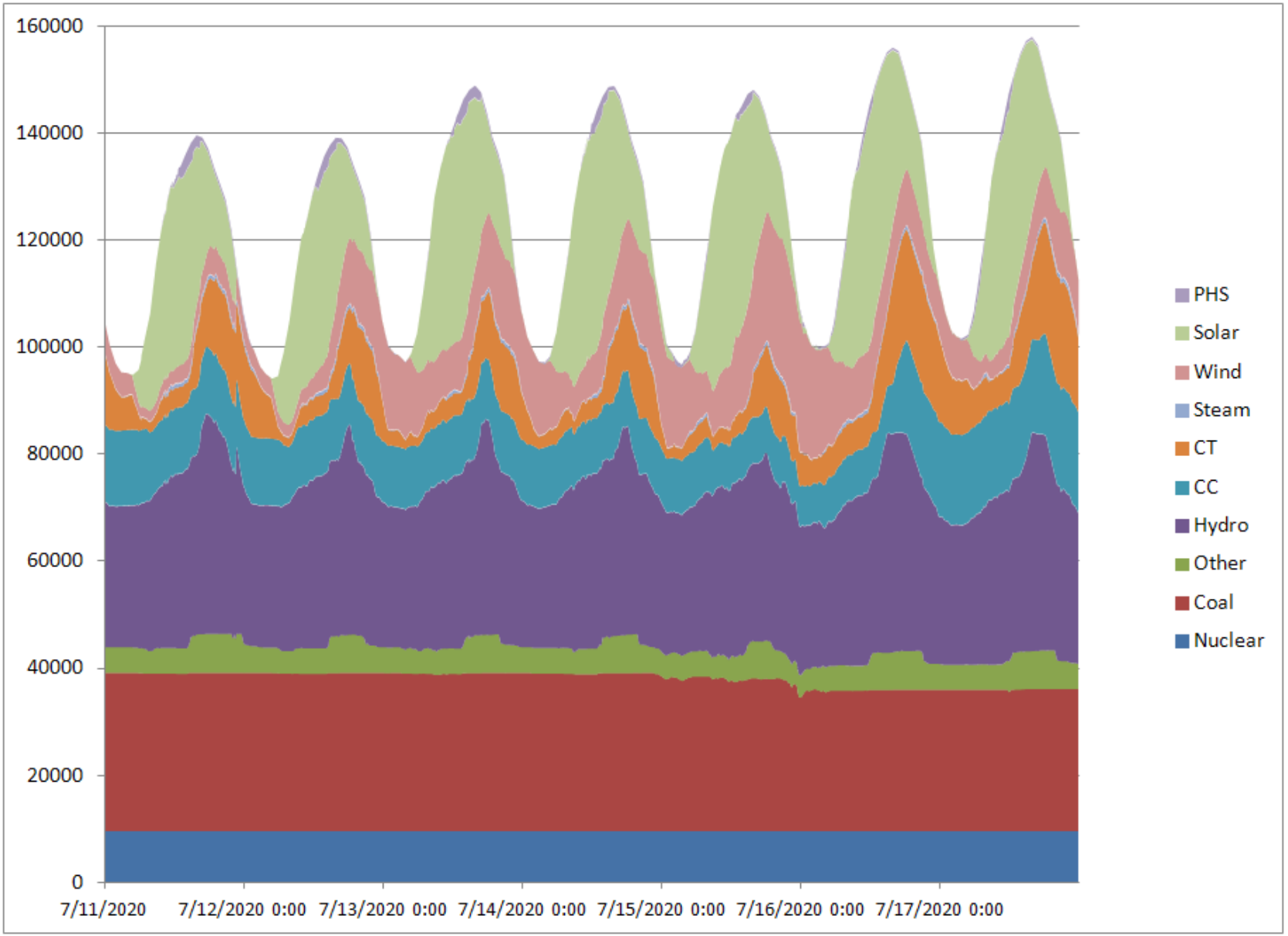
Number of startups during July



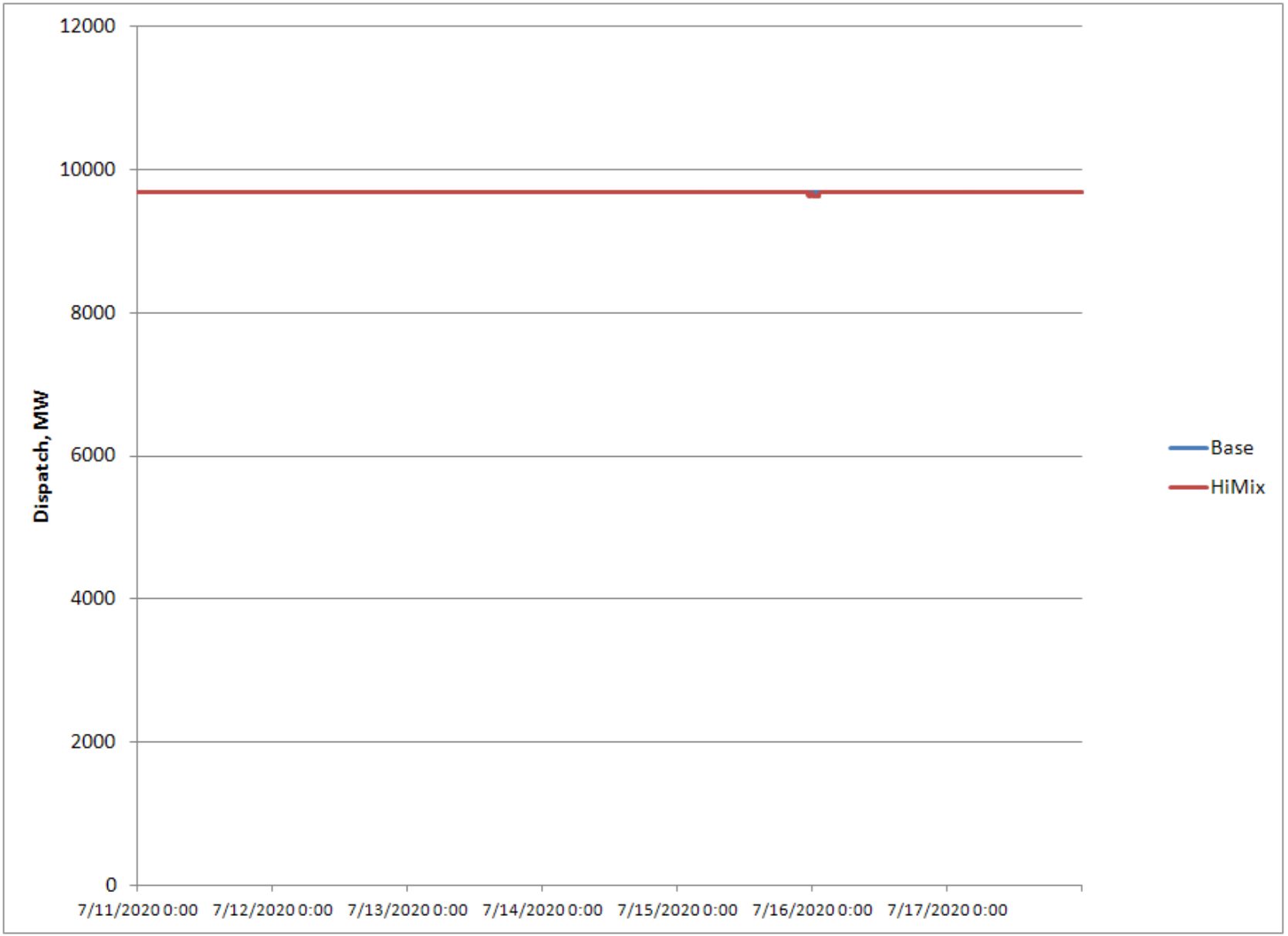
Base dispatch stack, 1 week (Sat-Fri)



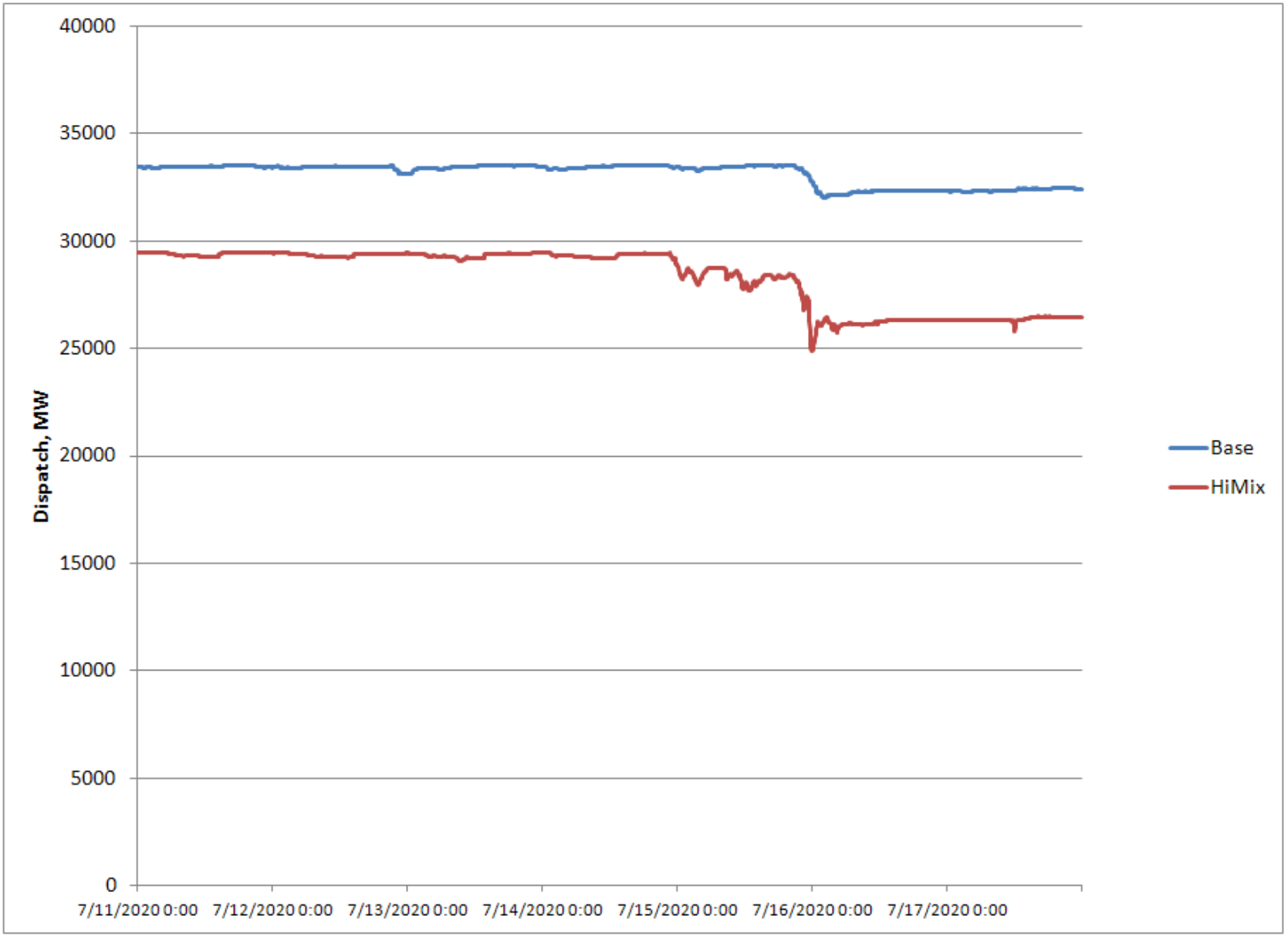
HiMix dispatch stack, 1 week (Sat-Fri)



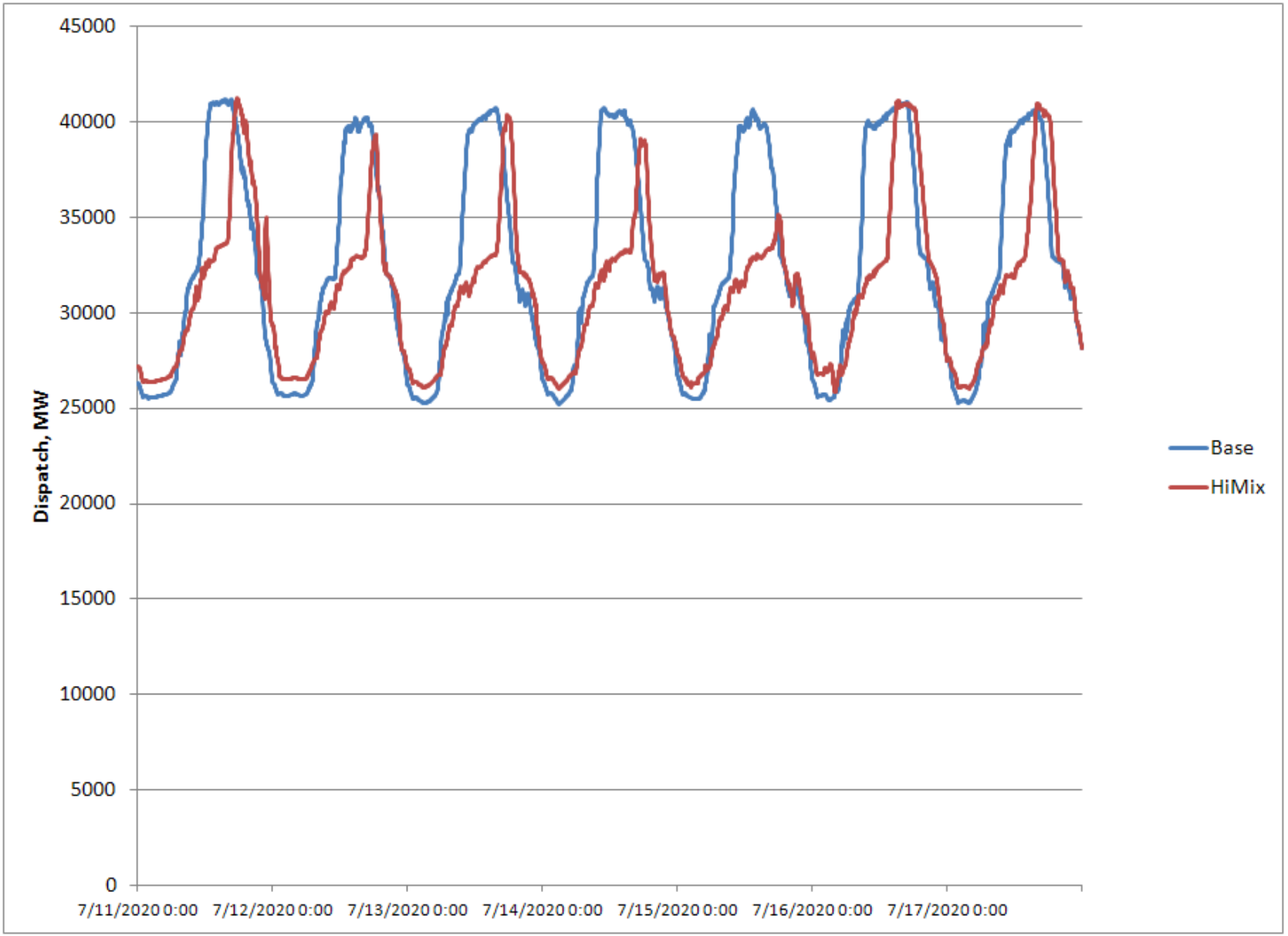
Nuclear dispatch



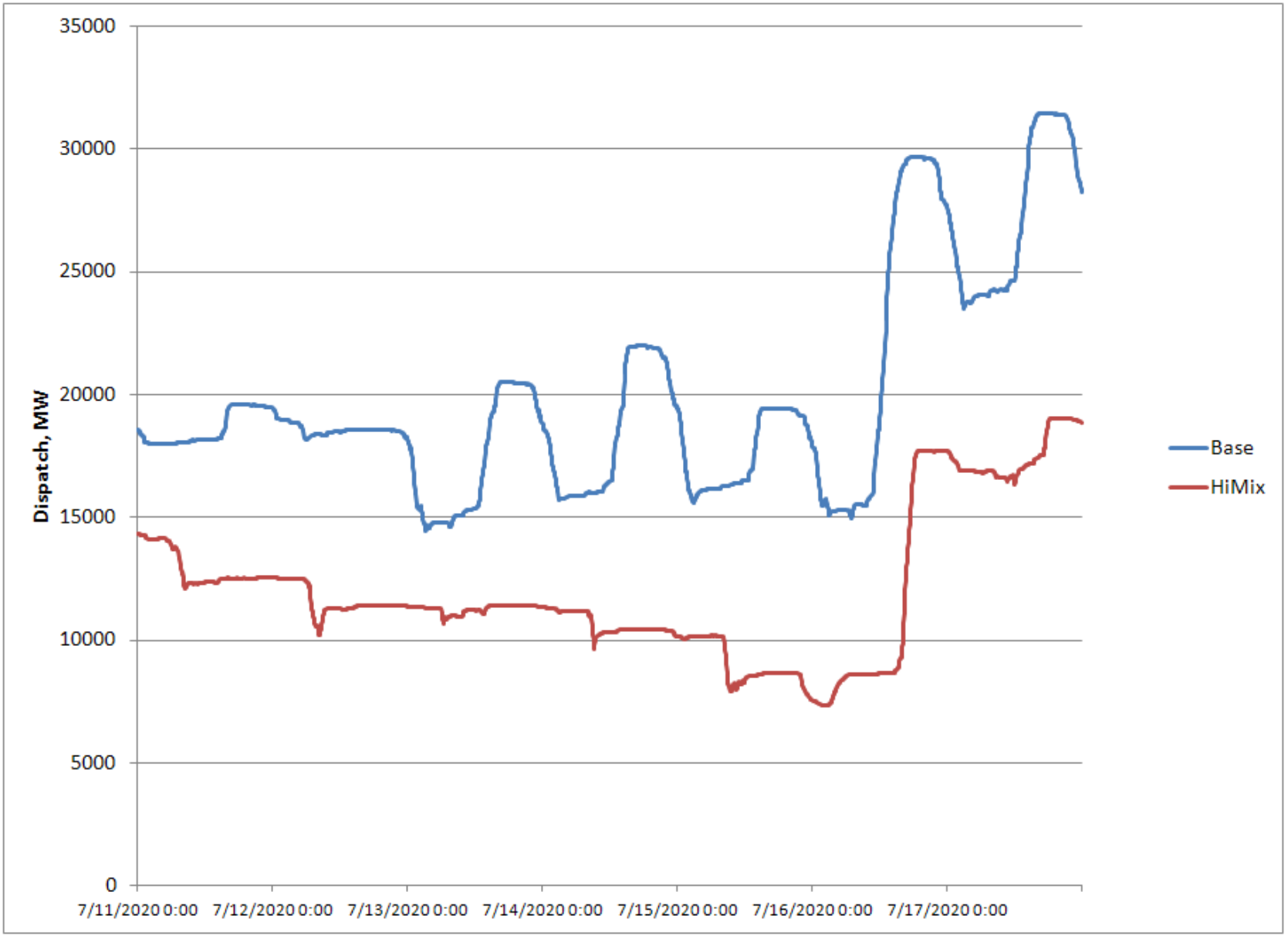
Coal dispatch



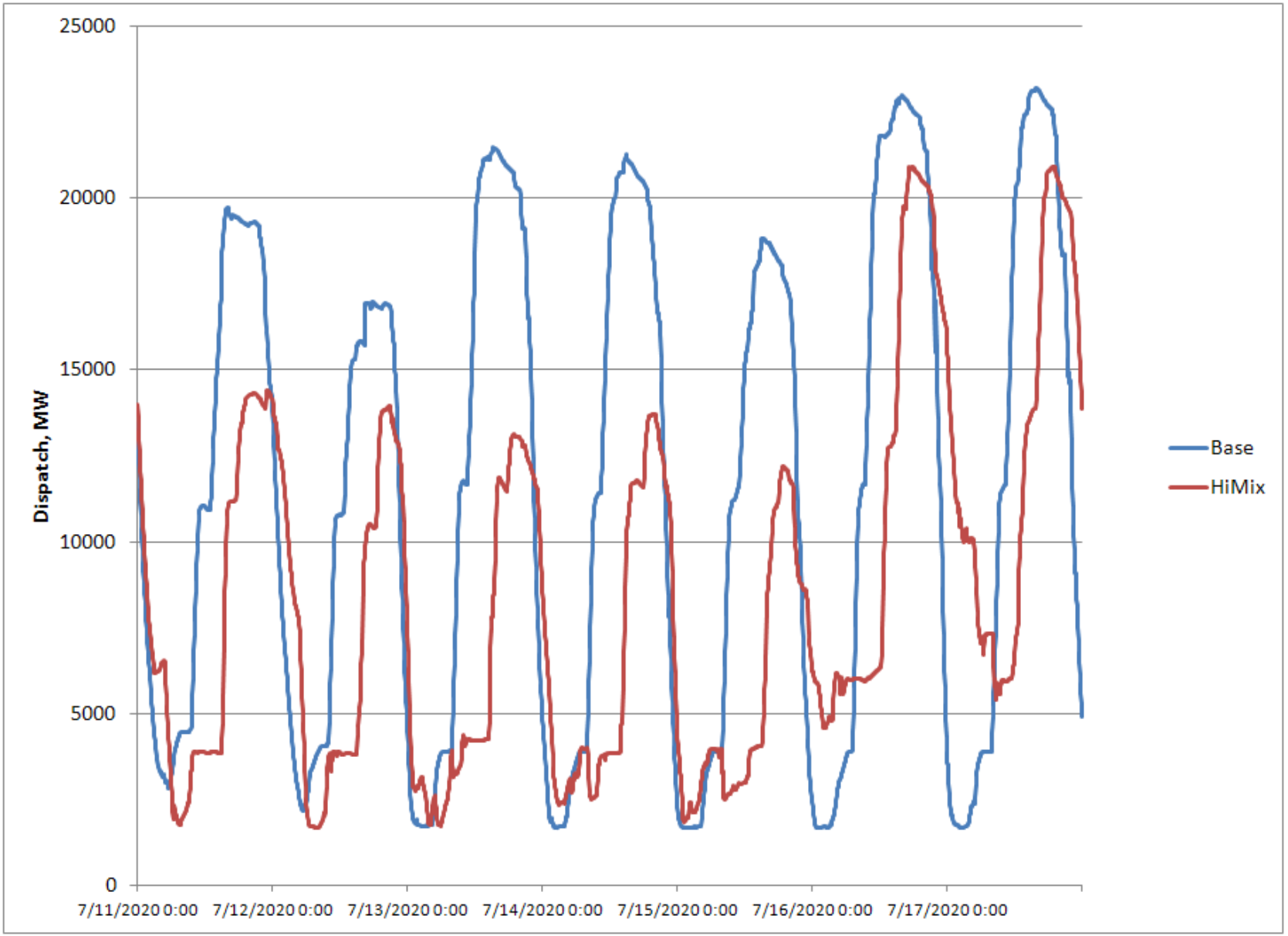
Hydro dispatch



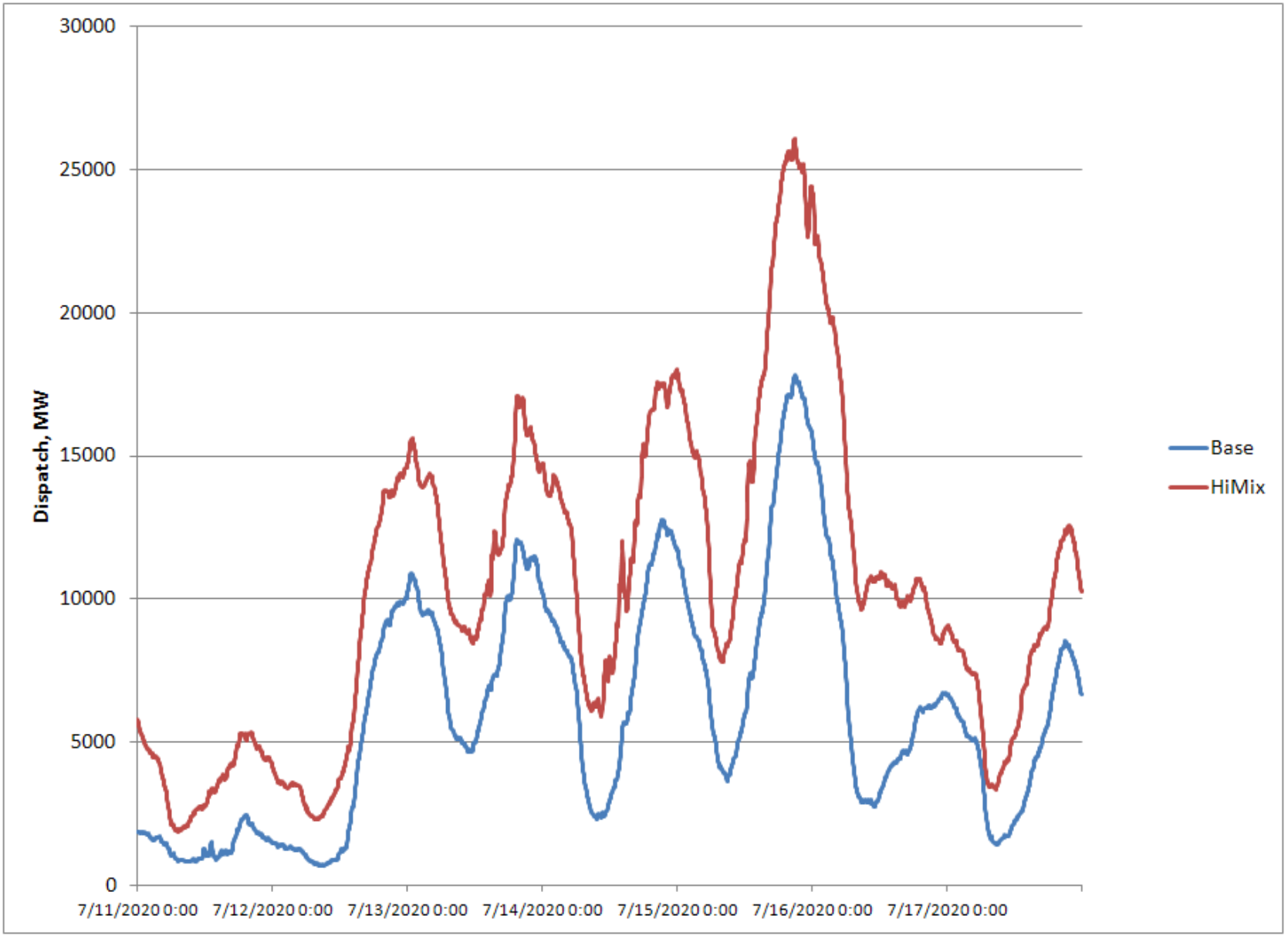
CC dispatch


35000
30000
25000
20000
15000
10000
5000
0
Dispatch, MW
7/11/2020 0:00
7/12/2020 0:00
7/13/2020 0:00
7/14/2020 0:00
7/15/2020 0:00
7/16/2020 0:00
7/17/2020 0:00
Base
HiMix

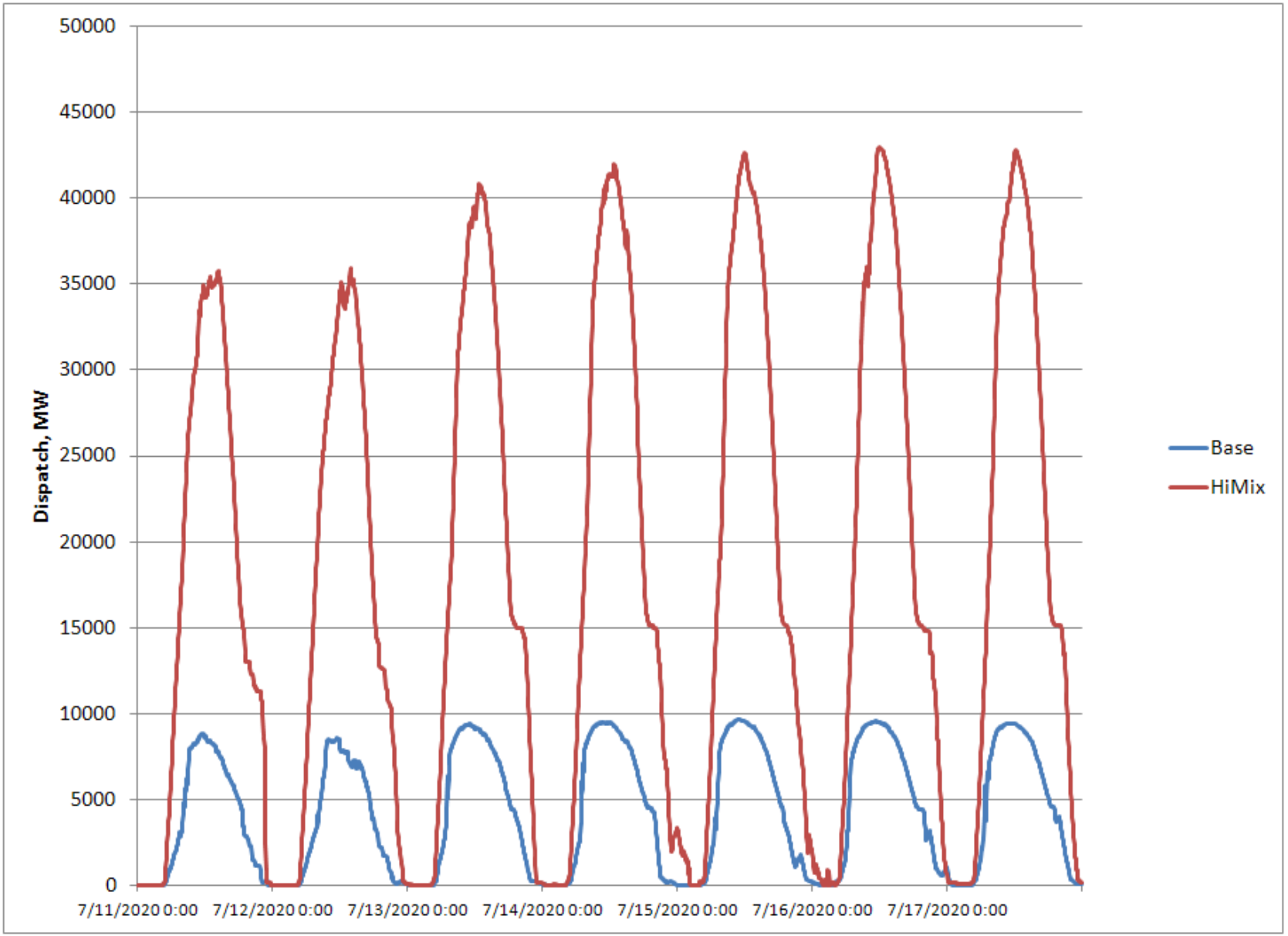
CT dispatch


25000
20000
15000
10000
5000
0
Dispatch, MW
7/11/2020 0:00
7/12/2020 0:00
7/13/2020 0:00
7/14/2020 0:00
7/15/2020 0:00
7/16/2020 0:00
7/17/2020 0:00
Base
HiMix

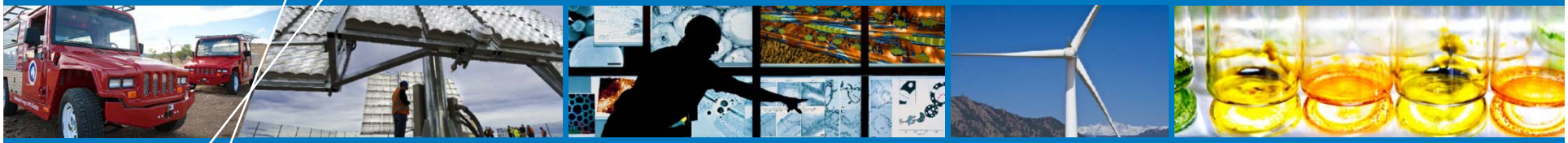
Wind dispatch



Solar dispatch

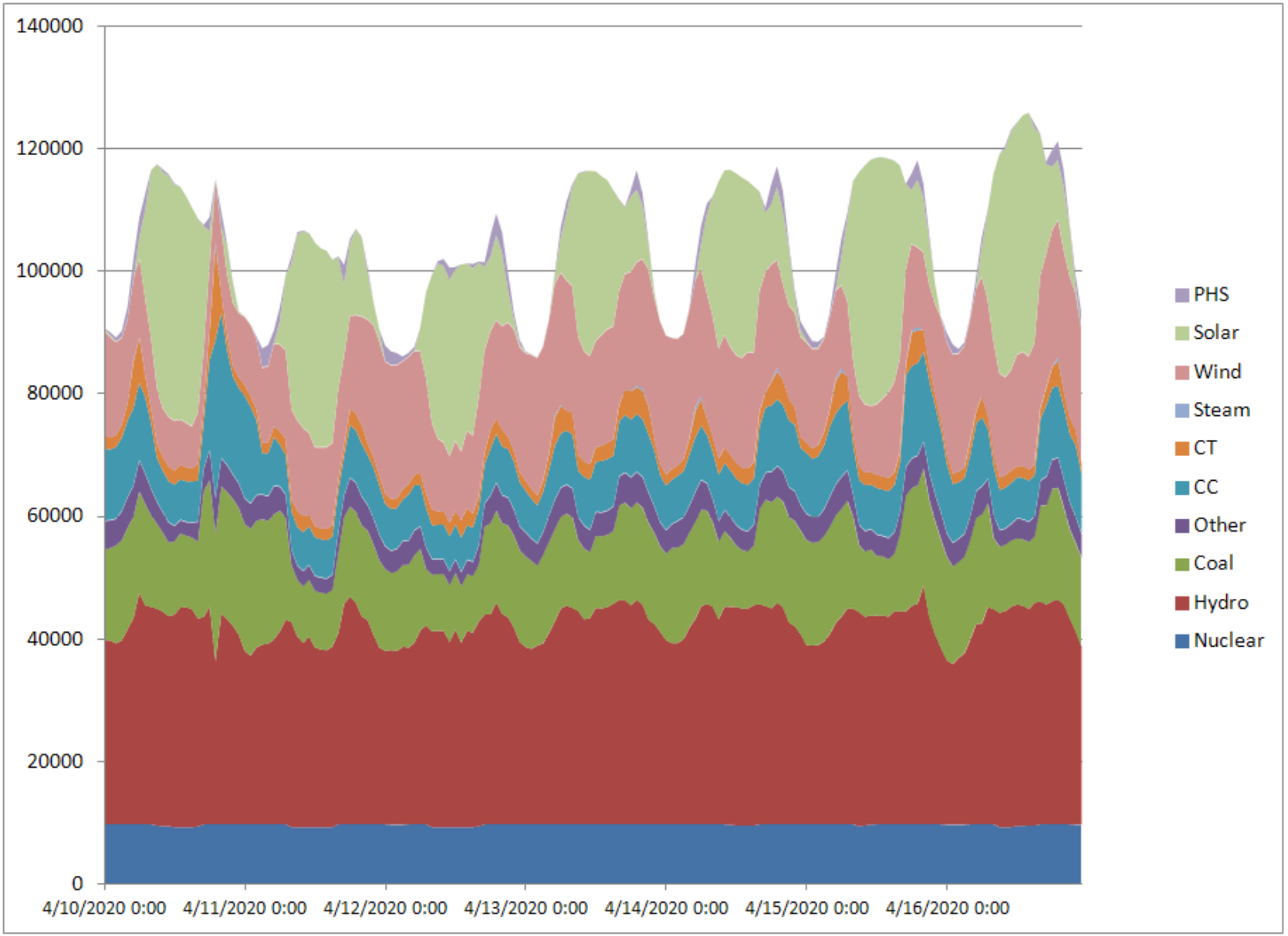


NREL
NATIONAL RENEWABLE ENERGY LABORATORY

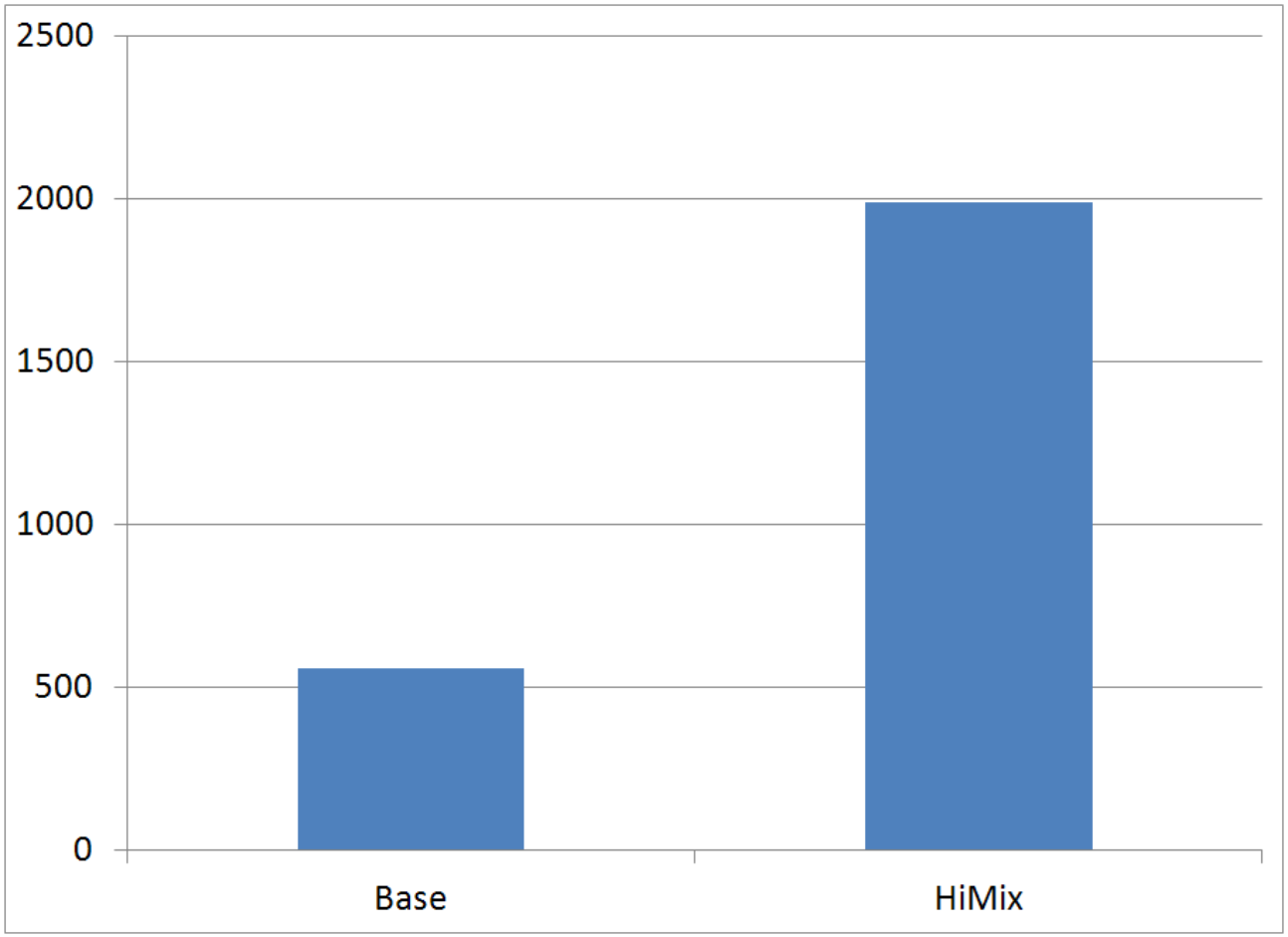


Preview: 4HA market results

HiMix dispatch stack, April week



Annual coal unit startups



Questions

- **How Canada/Mexico load and generation should be shown?**

New schedule for core scenarios

- Potentially revise and re-run all core scenarios. Complete core scenarios by end Sept.
- Oct – Analysis of core scenario results
- End Oct/early Nov – Draft report to TRC/DOE
- Nov – full day TRC meeting at NREL to present results and get feedback
- Dec – final report completed on core scenarios

New GE/APTECH work

- GE and APTECH are determining potential retrofits or operational strategies to increase flexibility of fossil fleet
- Develop new scenarios to run in Plexos
- Cost-benefit analysis of top strategies or retrofits

Questions?

- **Greg Brinkman**
  - 303-384-7390
  - gregory.brinkman@nrel.gov
- **Eduardo Ibanez**
  - 303-384-6926
  - eduardo.ibanez@nrel.gov
- **Debbie Lew**
  - 303-384-7037
  - debra.lew@nrel.gov