Accuracy Discussion

Load Analysis Subcommittee
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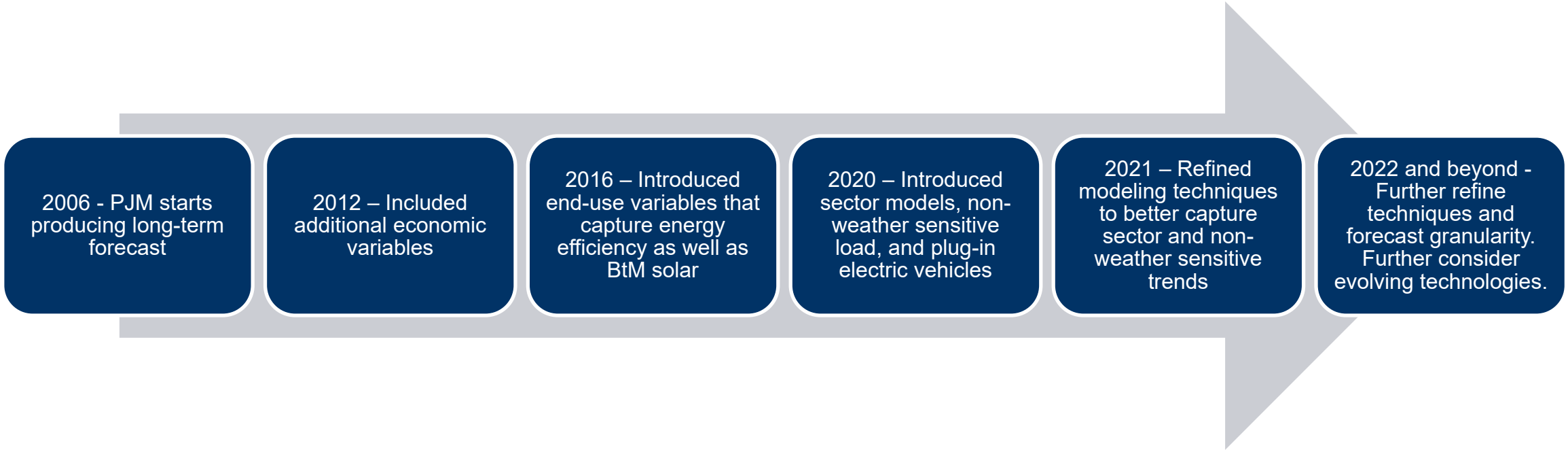
Overview

- Each year PJM publishes a report we refer to as “Model Accuracy”.
  - https://www.pjm.com/-/media/planning/res-adeq/load-forecast/model-accuracy.ashx

- The goal is to answer the question: If the model knew what we know now regarding input assumptions (i.e. economics, end-use, solar), what load would it expect to occur?
  - This is not the same as asking about total error. Total error includes error from those input assumptions.

Overview (continued)

- "Model Accuracy" reports are always based on the model in place at the time the analysis is conducted, not the model(s) that had been in place in prior years.

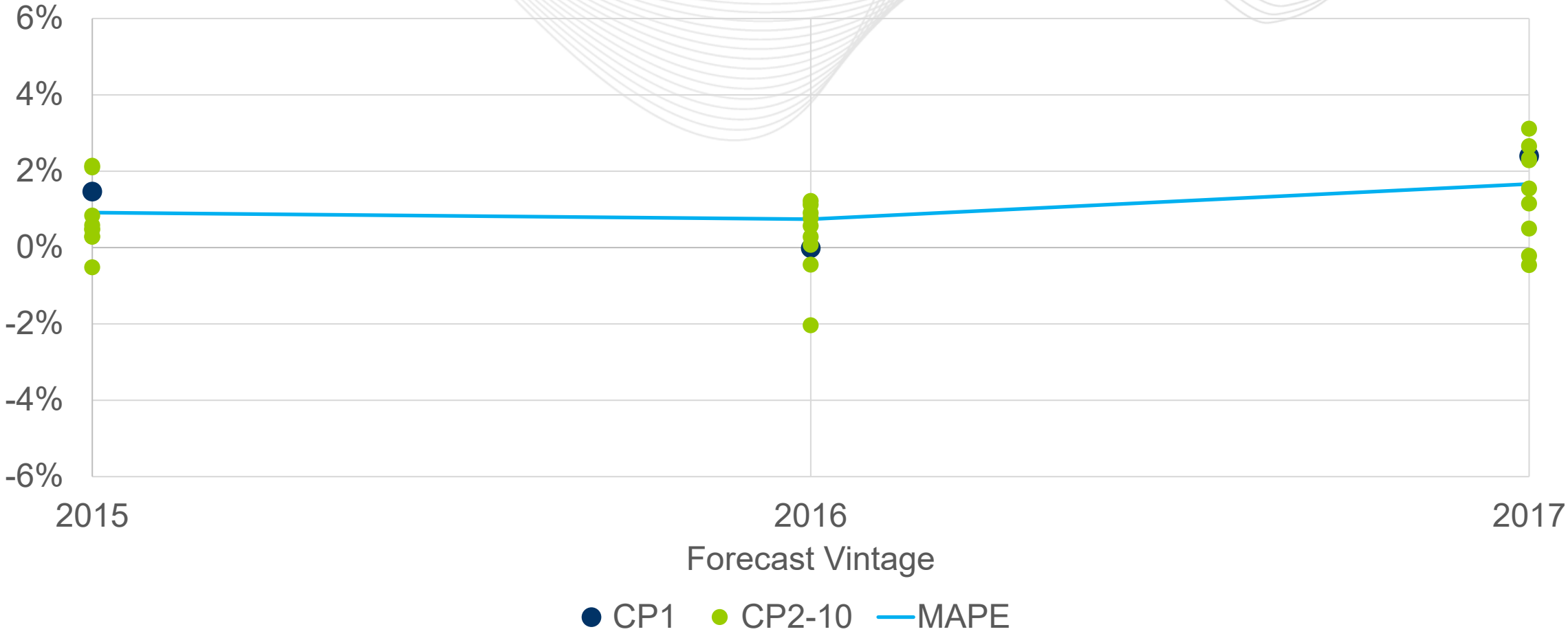


Model Accuracy Testing Plan

- The “Model Accuracy” report accompanying the 2021 Load Forecast uses that forecast’s methodology and incorporates input data from Moody’s Analytics September 2020 forecast vintage and the 2020 Itron end-use inputs (consistent with the EIA 2020 Annual Energy Outlook).

	Estimation Period		
Forecast Vintage	Sector Models (Annual)	Non-Weather Sensitive Model	Final Forecast Model
2015	1998-2013	1/1/1998-8/31/2014	1/1/2005-8/31/2014
2016	1998-2014	1/1/1998-8/31/2015	1/1/2006-8/31/2015
2017	1998-2015	1/1/1998-8/31/2016	1/1/2007-8/31/2016
2018	1998-2016	1/1/1998-8/31/2017	1/1/2008-8/31/2017
2019	1998-2017	1/1/1998-8/31/2018	1/1/2009-8/31/2018
2020	1998-2018	1/1/1998-8/31/2019	1/1/2010-8/31/2019

Summer Model Accuracy – Three Year Forecast Horizon



***MAPE is Mean absolute percent error**

Model Accuracy Example Calculations

2016 Vintage Model Accuracy Calculations

Horizon	Forecast Vintage	Date	Year	Gross Load	Rank	Gross Forecast	Pct Error	Abs % Error
3	2016	2-Jul-19	2019	140,363	10	142,073	1.2%	1.2%
3	2016	10-Jul-19	2019	143,326	4	142,682	-0.4%	0.4%
3	2016	15-Jul-19	2019	140,412	9	141,492	0.8%	0.8%
3	2016	16-Jul-19	2019	141,203	8	142,786	1.1%	1.1%
3	2016	17-Jul-19	2019	145,039	3	146,345	0.9%	0.9%
3	2016	19-Jul-19	2019	152,988	1	152,965	0.0%	0.0%
3	2016	20-Jul-19	2019	151,736	2	148,645	-2.0%	2.0%
3	2016	21-Jul-19	2019	141,849	7	142,245	0.3%	0.3%
3	2016	29-Jul-19	2019	142,245	6	143,052	0.6%	0.6%
3	2016	19-Aug-19	2019	143,117	5	143,215	0.1%	0.1%

Horizon: Years out from forecast start

Forecast Vintage: Year in which the forecast would have been effective.

Date: Date of actual load and weather input into forecast model

Year: Year under study

Gross Load: Unrestricted load plus solar estimates

Rank: Rank of the daily load for that given Summer

Gross Forecast: Forecast vintage model solved with actual weather conditions (not reduced by solar).

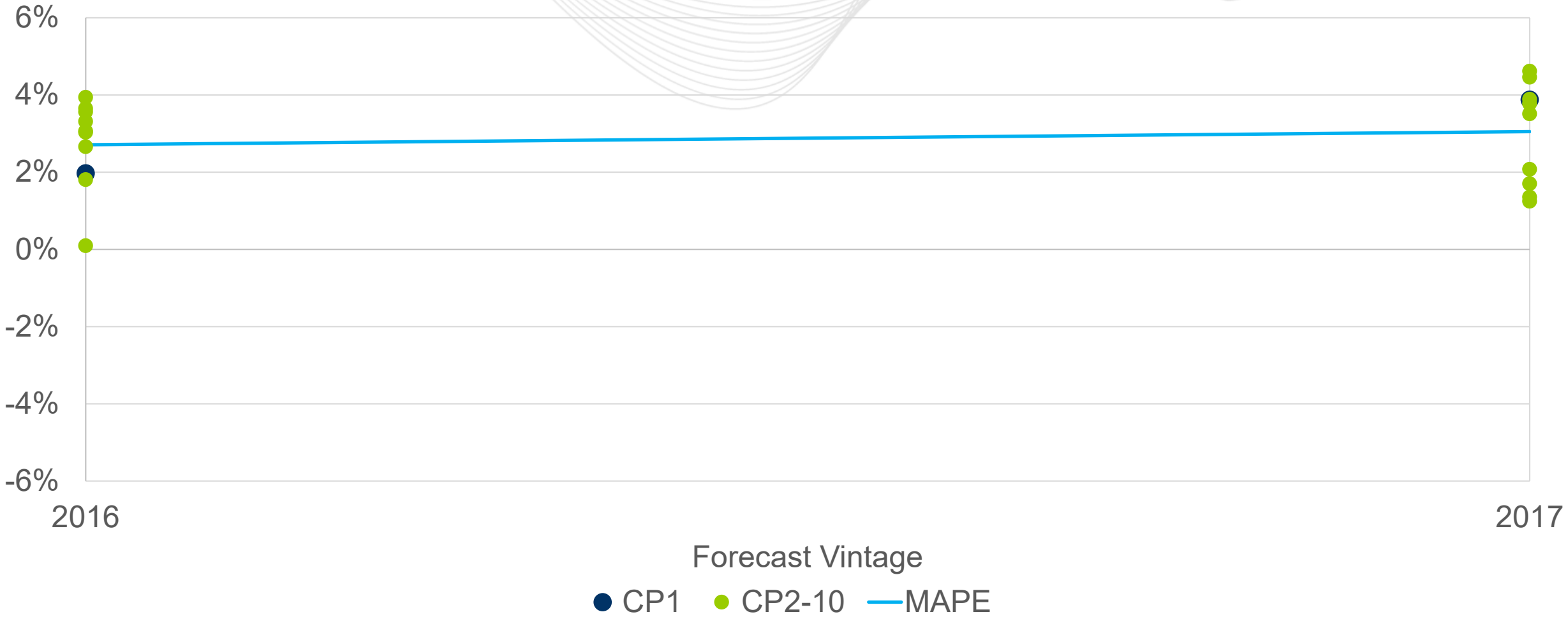
% Error: (Forecast - Actual)/Actual, expressed as a percent

Abs % Error: Absolute value of % Error

Total Error or Total Accuracy

- Similar to “Model Accuracy” except that values for input assumptions are those that would have been available at the time of the forecast.
  - For instance, in producing Total Error metrics for a 2016 Forecast, we would use the September 2015 economics vintage, the 2015 Itron/EIA data on end-uses, and the 2016 IHS Markit solar capacity forecast.

Summer Total Accuracy – Three Year Forecast Horizon



***MAPE is Mean absolute percent error**

Total Accuracy Example Calculations

2016 Vintage Total Accuracy Calculations								
Horizon	Forecast Vintage	Date	Year	Actual	Rank	Forecast	% Error	Abs % Error
3	2016	2-Jul-19	2019	138,403	10	143,854	3.9%	3.9%
3	2016	10-Jul-19	2019	141,567	4	144,126	1.8%	1.8%
3	2016	15-Jul-19	2019	138,710	9	142,957	3.1%	3.1%
3	2016	16-Jul-19	2019	139,525	8	144,616	3.6%	3.6%
3	2016	17-Jul-19	2019	143,008	3	148,106	3.6%	3.6%
3	2016	19-Jul-19	2019	151,302	1	154,284	2.0%	2.0%
3	2016	20-Jul-19	2019	149,412	2	149,552	0.1%	0.1%
3	2016	21-Jul-19	2019	139,688	7	143,402	2.7%	2.7%
3	2016	29-Jul-19	2019	139,688	6	144,316	3.3%	3.3%
3	2016	19-Aug-19	2019	141,158	5	145,439	3.0%	3.0%

Horizon: Years out from forecast start

Forecast Vintage: Year in which the forecast would have been effective.

Date: Date of actual load and weather input into forecast model

Year: Year under study

Actual: Unrestricted load, has been reduced by solar

Rank: Rank of the daily load for that given Summer

Forecast: Forecast vintage model solved with actual weather conditions (reduced by solar).

% Error: (Forecast - Actual)/Actual, expressed as a percent

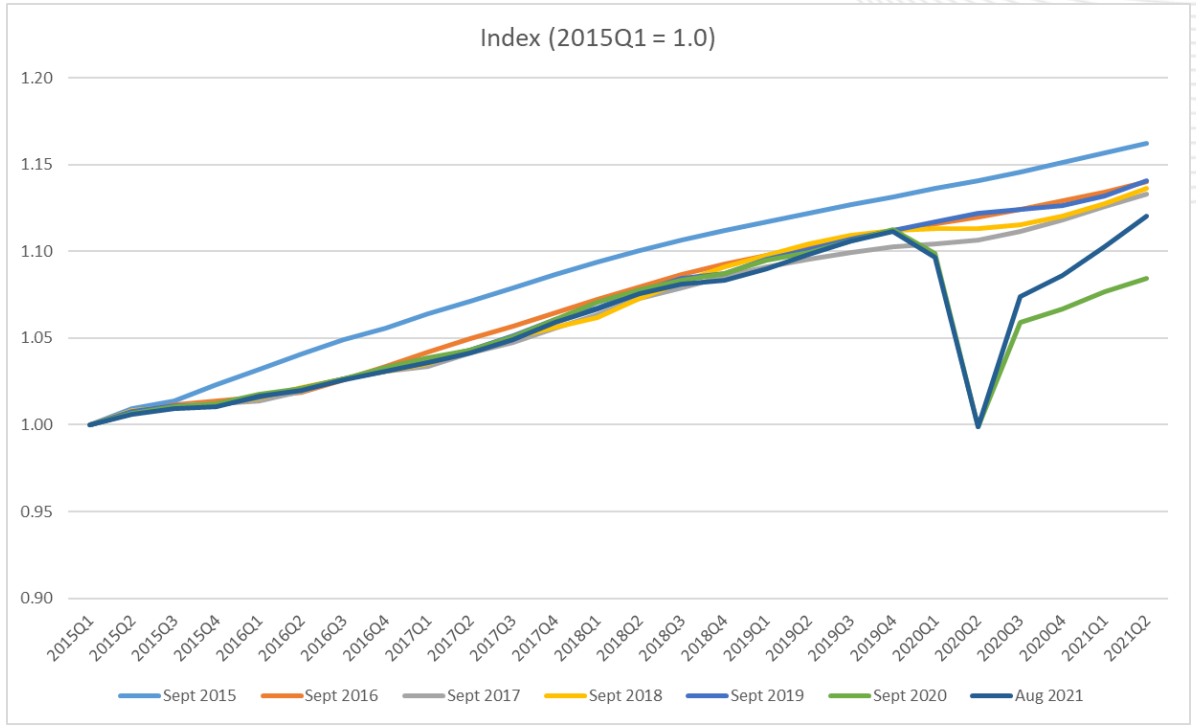
Abs % Error: Absolute value of % Error

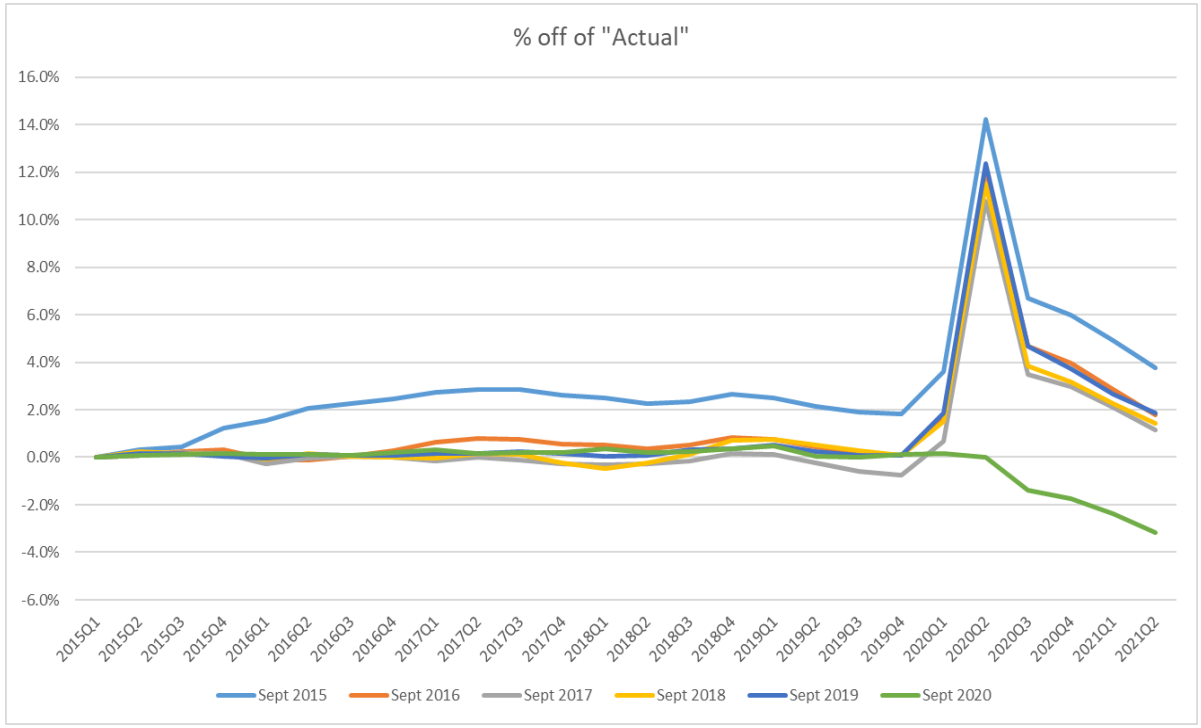
Input Variables

Economic Variables

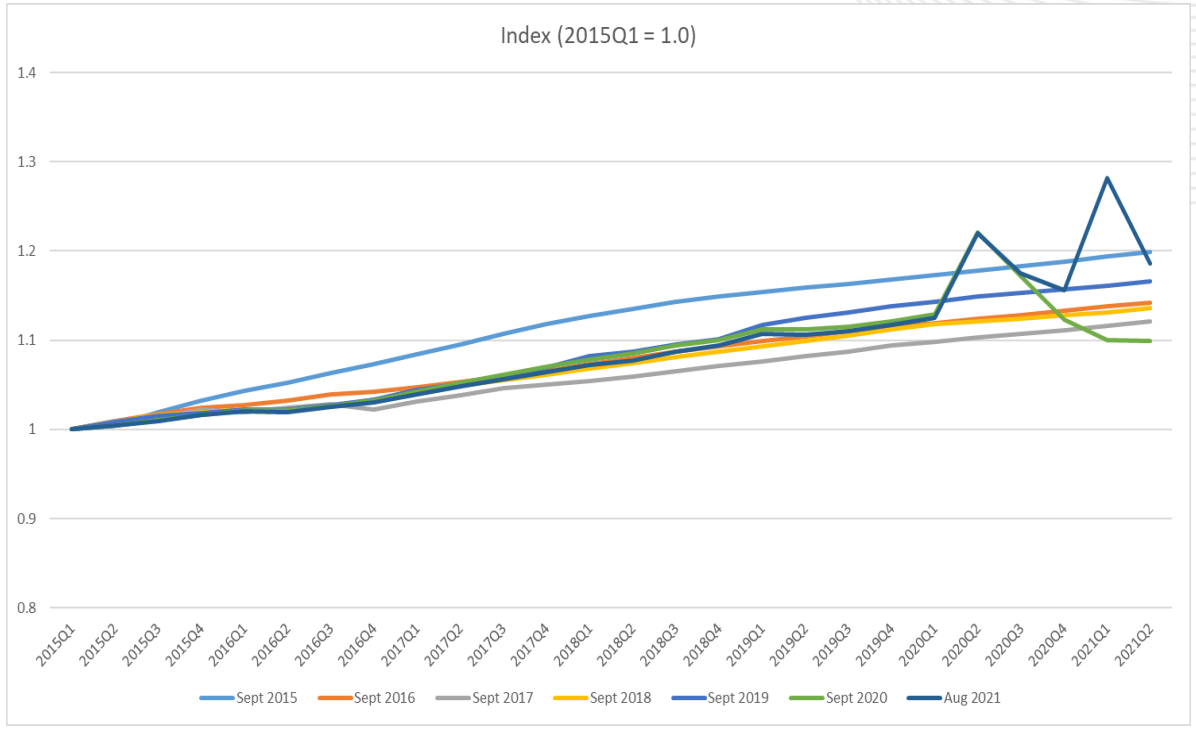
- Economic forecasts from Moody's Analytics are a key driver variable in the load forecast.
- Following slides examine some U.S. level variables to help understand degree of forecast error.
- Unlike load, we may never know "actual". Different concepts undergo varying degrees of restatement.
  - For purposes of this exercise, we will treat the most recent vintage (August 2021) as "actual".

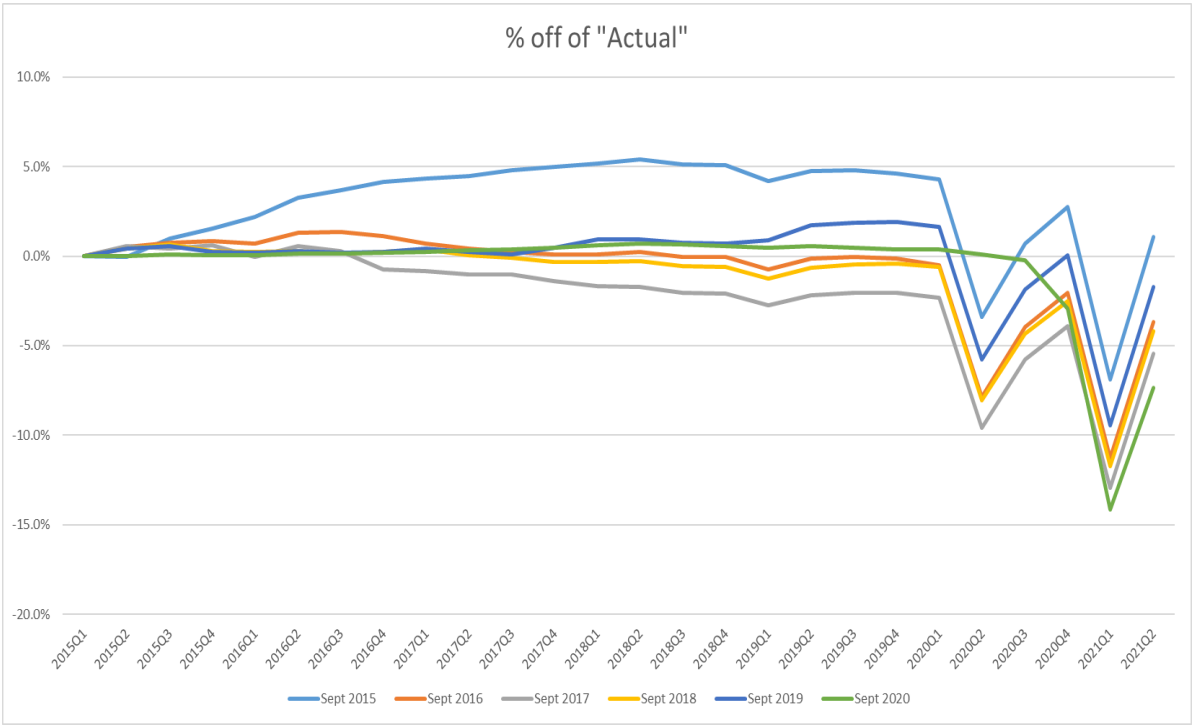
Real Gross Domestic Product



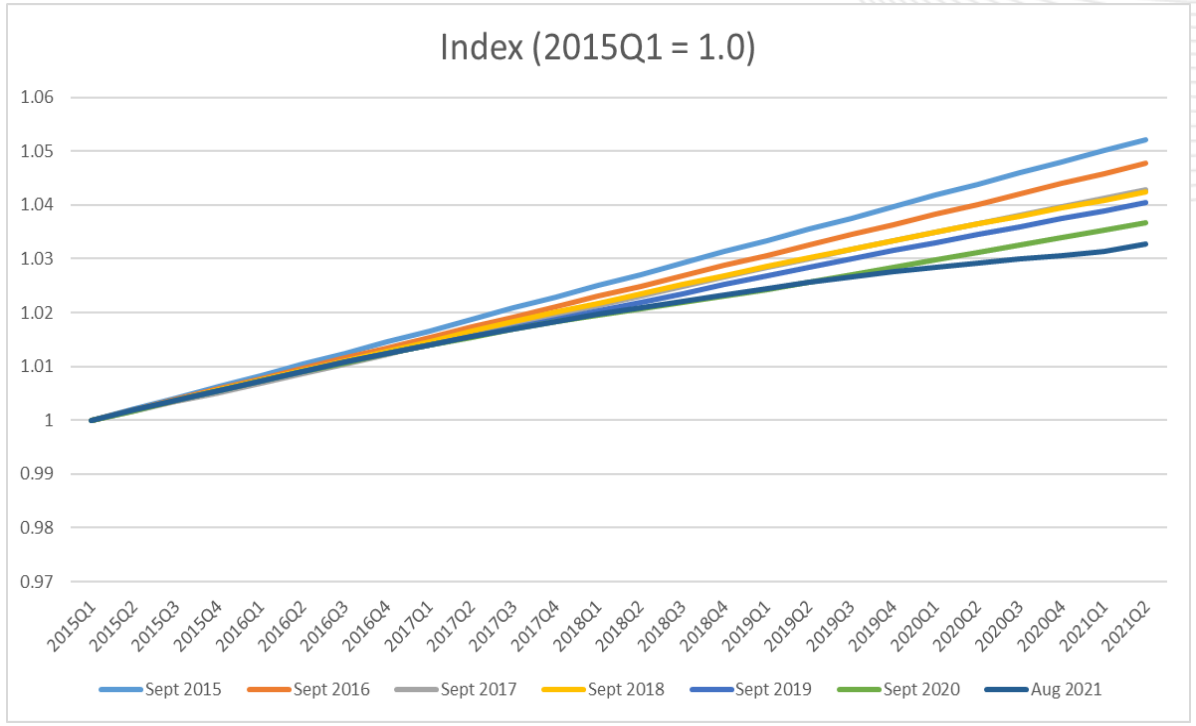


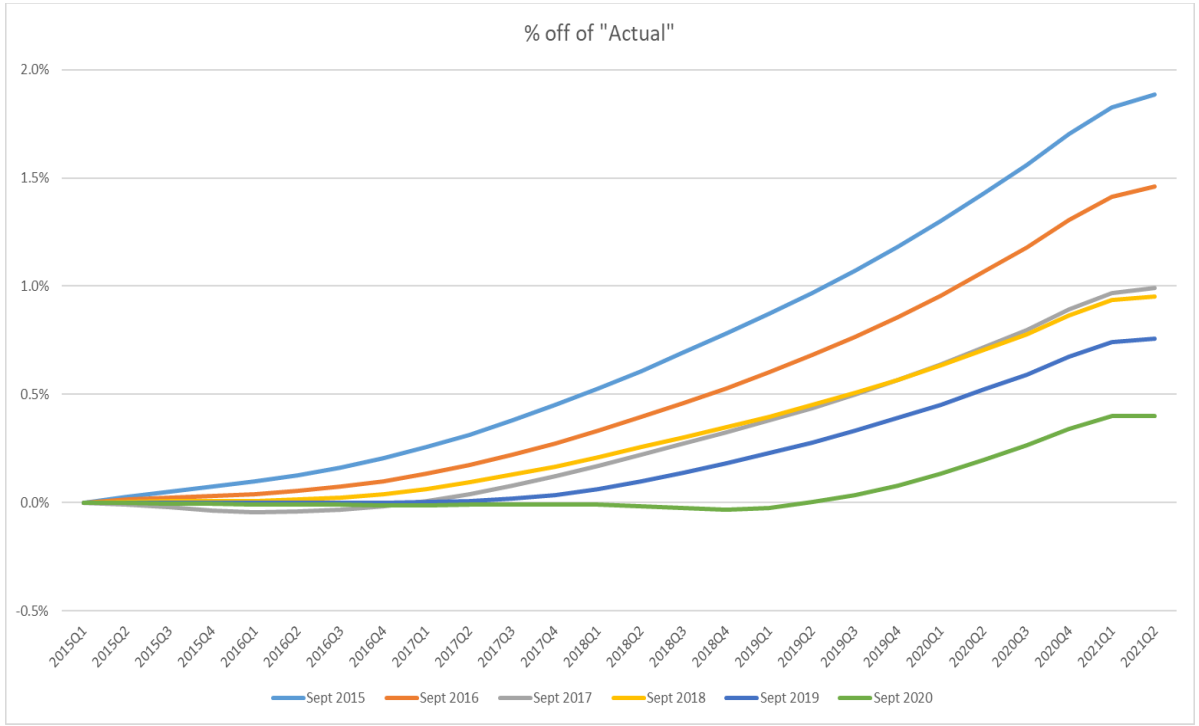
Real Personal Income



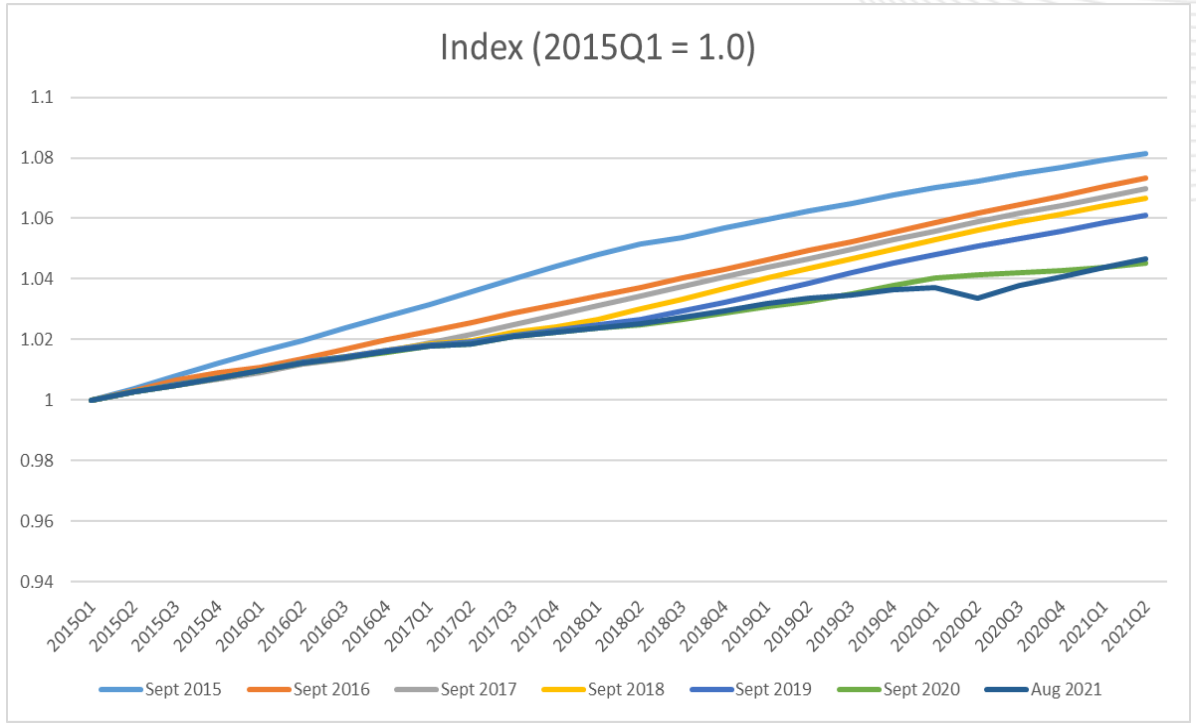


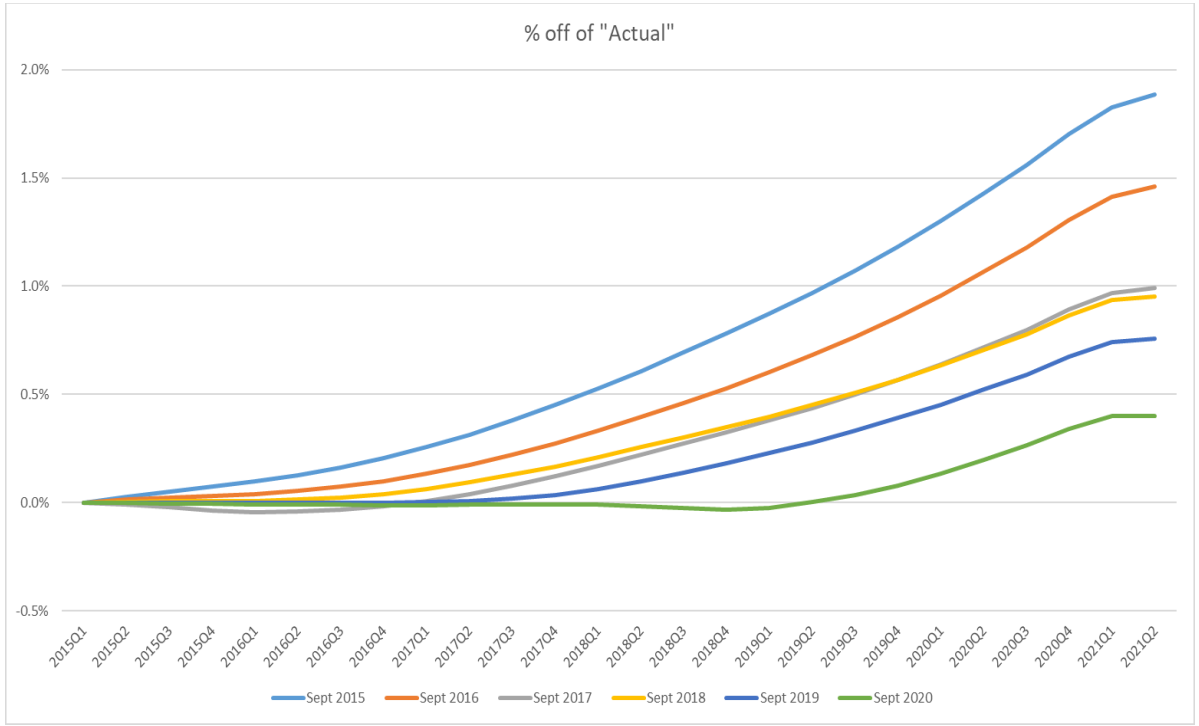
Population



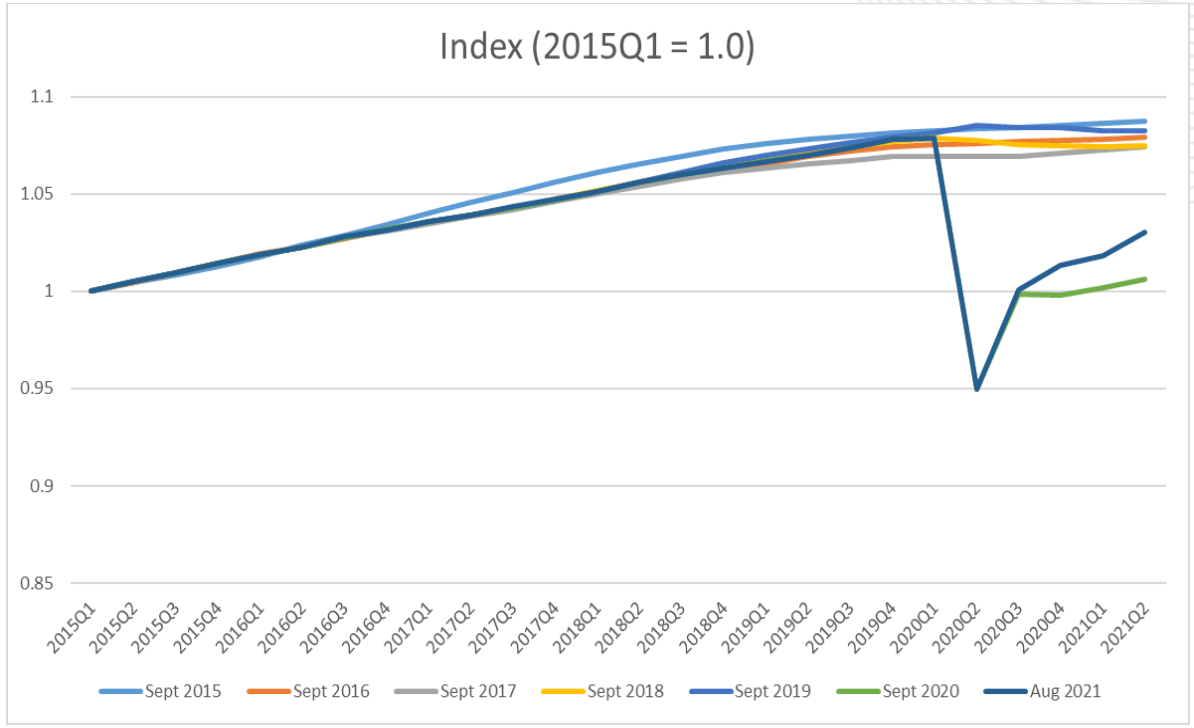


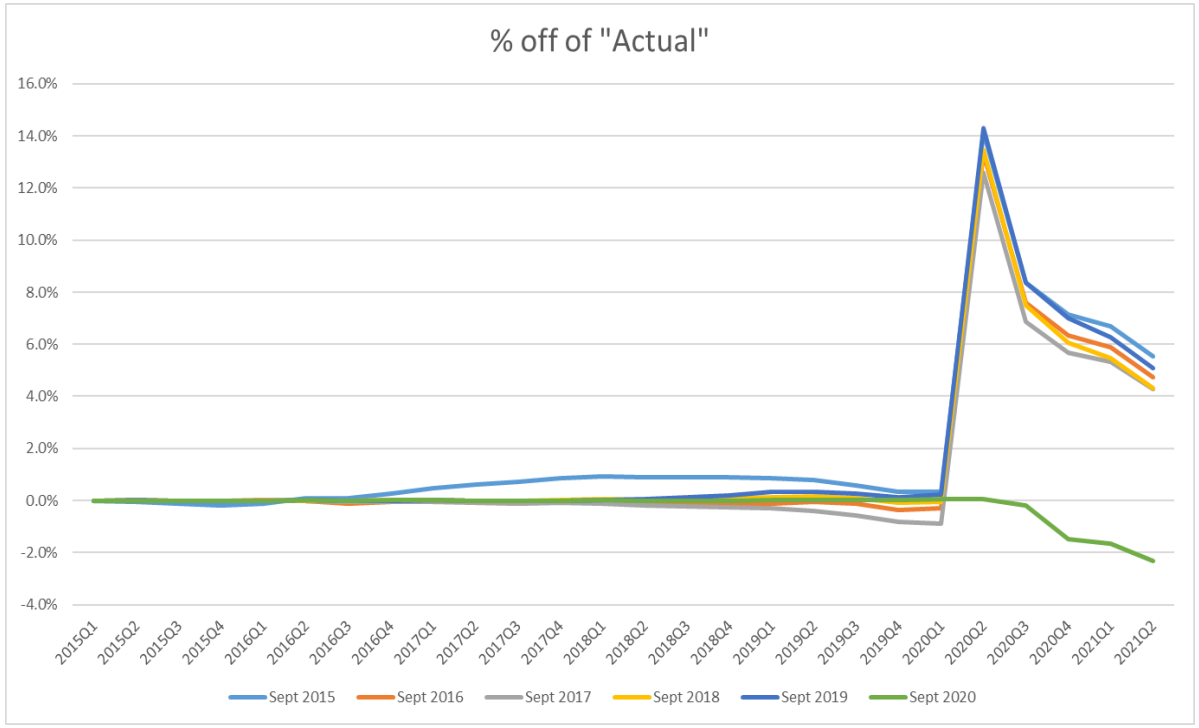
Households





Employment





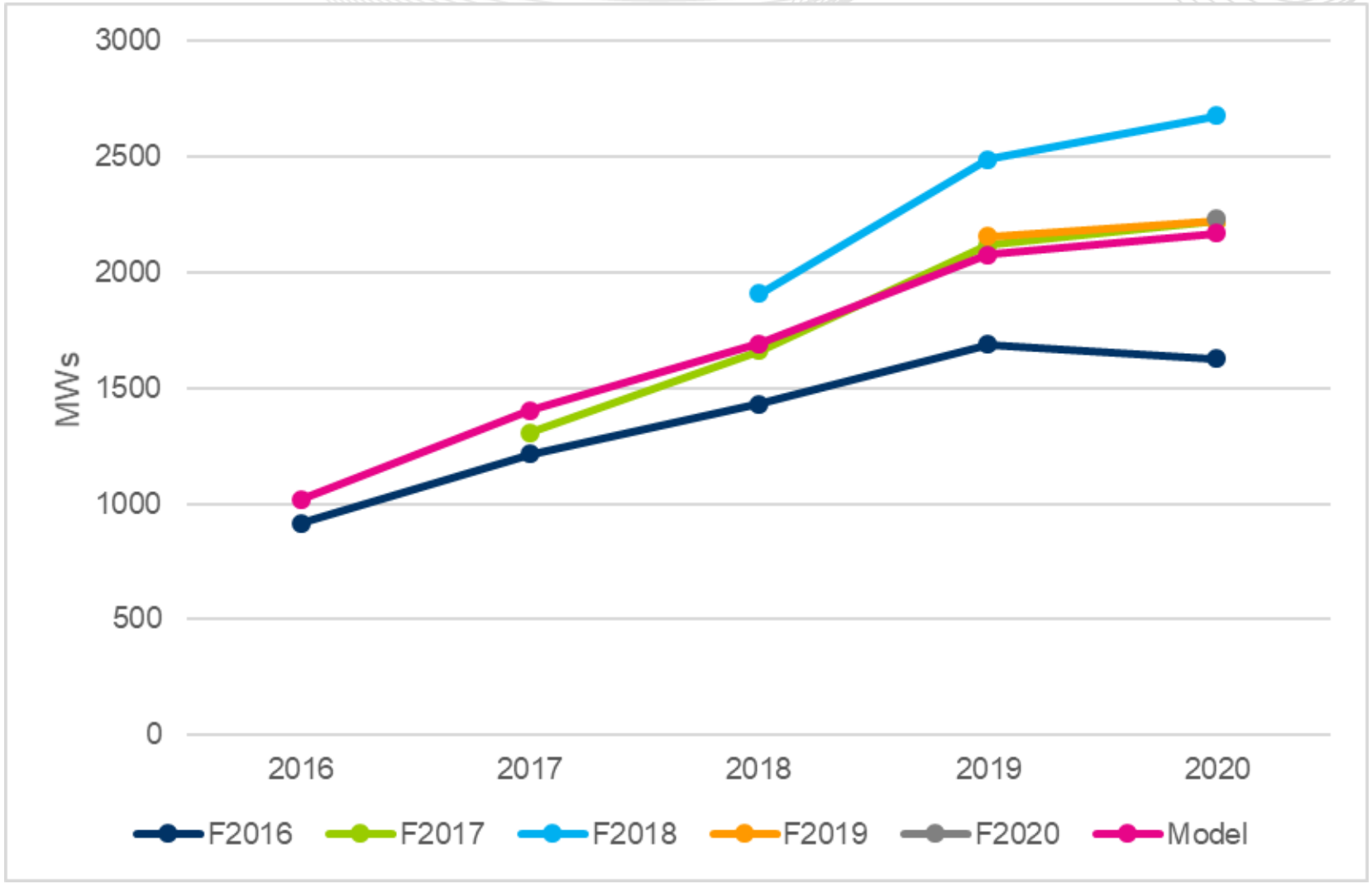
Behind-the-Meter Solar

- Since the 2016 Load Forecast, PJM has been obtaining a nameplate behind-the-meter solar capacity forecast from IHS Markit.

- PJM then pairs that capacity forecast with a capacity factor to impact the load forecast.

- The following slides compare vintage forecasts versus “Model”, which we perceive as *actual* for this exercise.

BtM Solar Impact on Peak Forecast (10CPs)



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