

Cold Snaps and Pipeline Disruptions – Historical Data

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- At the May FSSTF, PJM presented the Risk Assessment Approach which included:
 - Identifying the Relevant Risks (this was covered at the June FSSTF meeting)
 - Identifying the potential realizations of each Relevant Risk.
 - To accomplish this, historical data on each Relevant Risk will be analyzed
- At today's FSSTF, PJM will present historical data on two such Relevant Risks: Cold Snap and Pipeline Disruptions
- At the August FSSTF, PJM will present historical data on the remaining Relevant Risks as well as the impact of the Relevant Risks on PJM generation



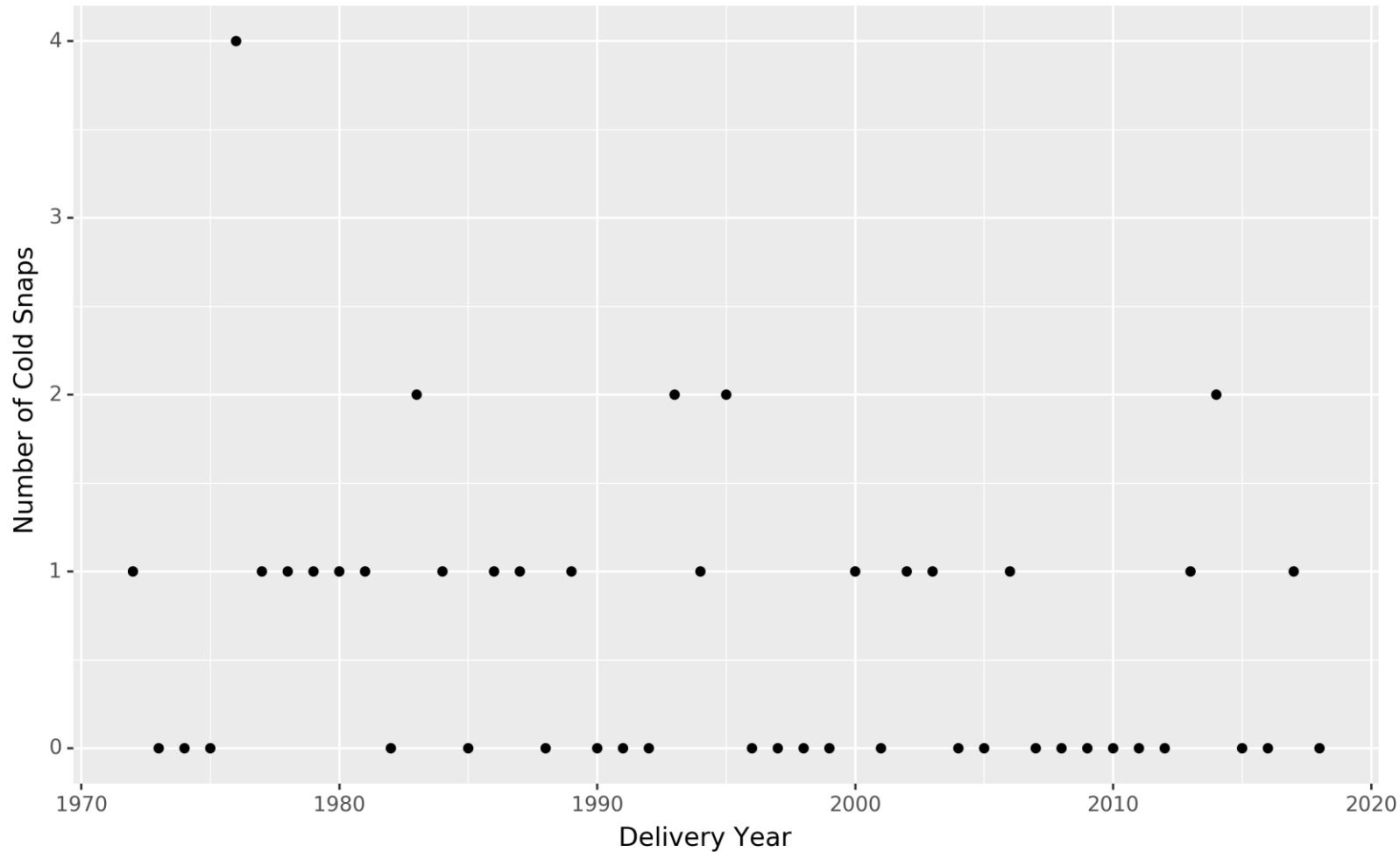
Relevant Risks Identified at June FSSTF Meeting

Relevant Risks
Long Duration Cold Snap Short Duration Cold Snap Natural Gas Pipeline Disruptions
Solar Intermittency Wind Intermittency
Coal Refueling (Bridge Failure) Coal Refueling (Lock and Dam Failure) Coal Refueling (Rail Failure) Coal Refueling (River Freezing) Coal Unavailability (Coal Quality) Natural Gas Unavailability Non-Firm Units Oil Refueling (Oil Terminal) Oil Refueling (Truck Restrictions) Nuclear Regulatory Shutdown (Fuel Related) Nuclear Regulatory Shutdown (Non-Fuel Related) Nuclear Unavailability (High Winds) Hydro Unavailability (Freezing Rivers) River Freezing (Cooling Water Impacts) Ice Storm (Transportation Impacts)

- A series of 5 or more contiguous days where the average RTO wind-adjusted temperature (WWP) in each of such days is less than 21.5°F
 - The RTO WWP for a given day is calculated as a load-weighted average across 30+ weather stations in the current PJM footprint, and across the 24 hour readings of each day
 - The 21.5°F threshold corresponds to an estimate of the 90th percentile value of historical daily RTO average WWP values

- Weather data from period DY1972 - DY2018 (47 winter periods)
- Average RTO wind-adjusted temperature (WWP) is calculated for each of the winter days

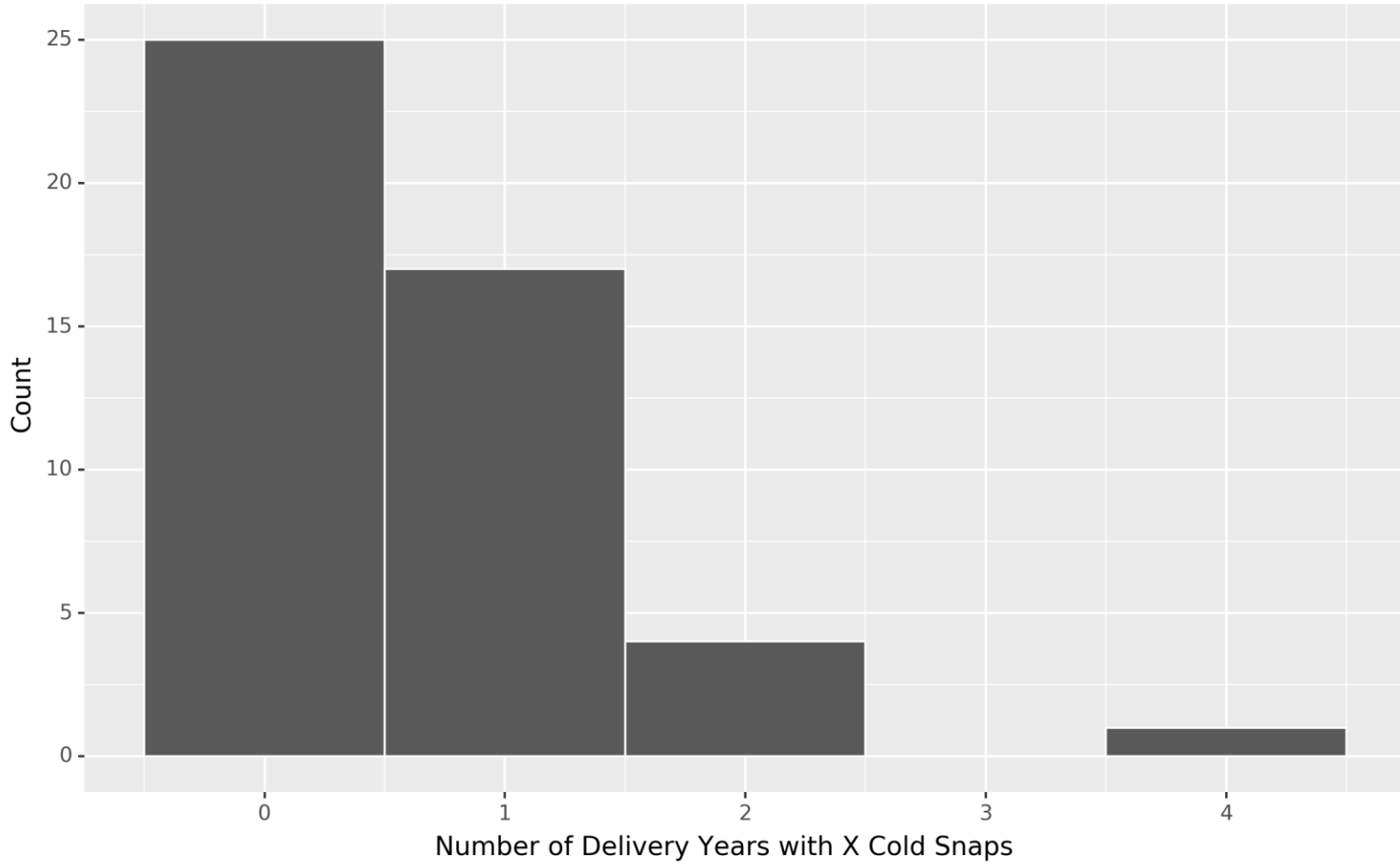
Cold Snaps – Delivery Year vs Number of Cold Snaps



A total of 29 cold snaps in 47 winter periods are identified

Average: 0.6 Cold Snaps per Delivery Year (Winter)

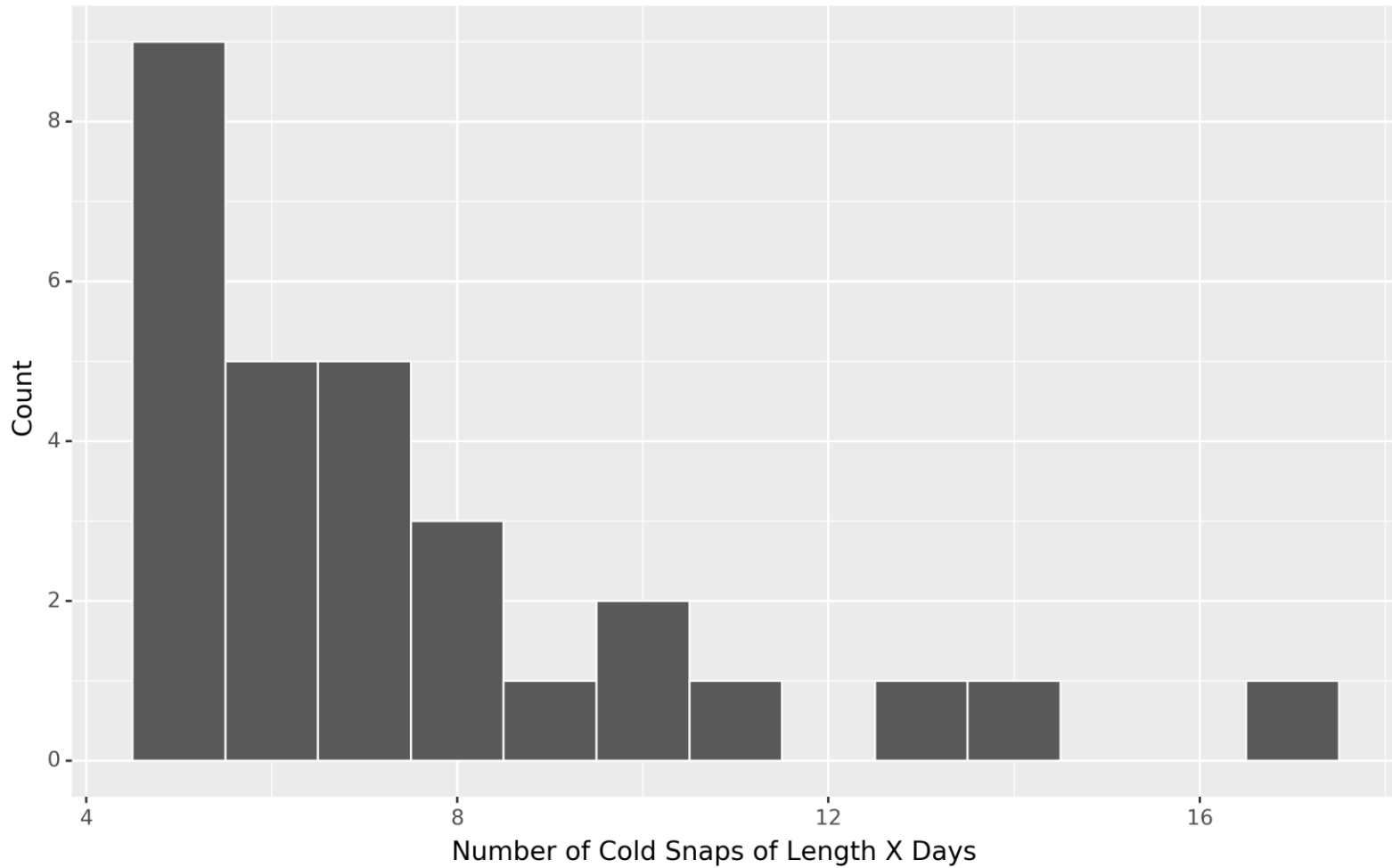
Cold Snaps – Number of DYs with X Cold Snaps



A total of 29 cold snaps in 47 winter periods are identified

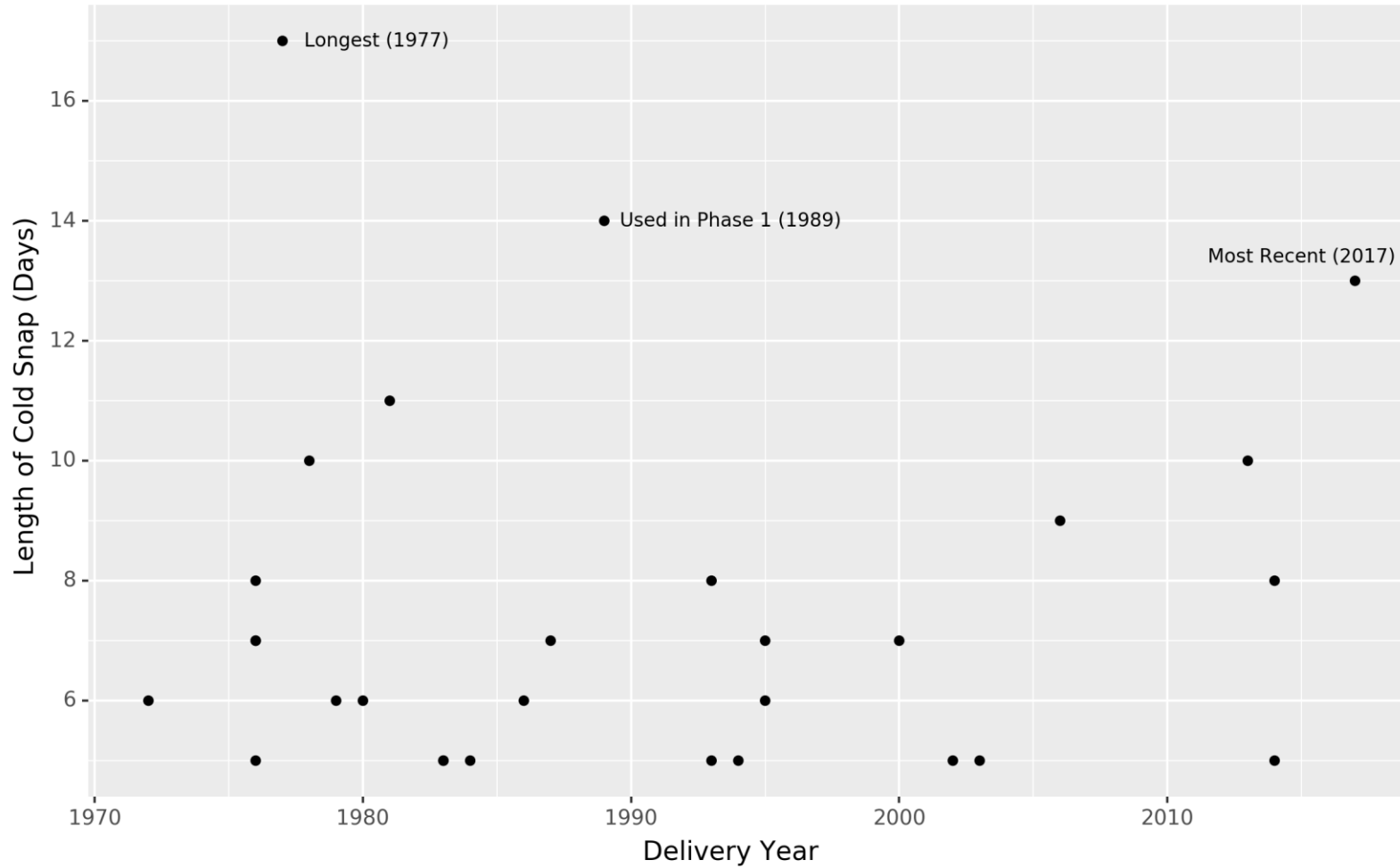
Average: 0.6 Cold Snaps per Delivery Year (Winter)

Cold Snaps – Number of Cold Snaps of Length X Days



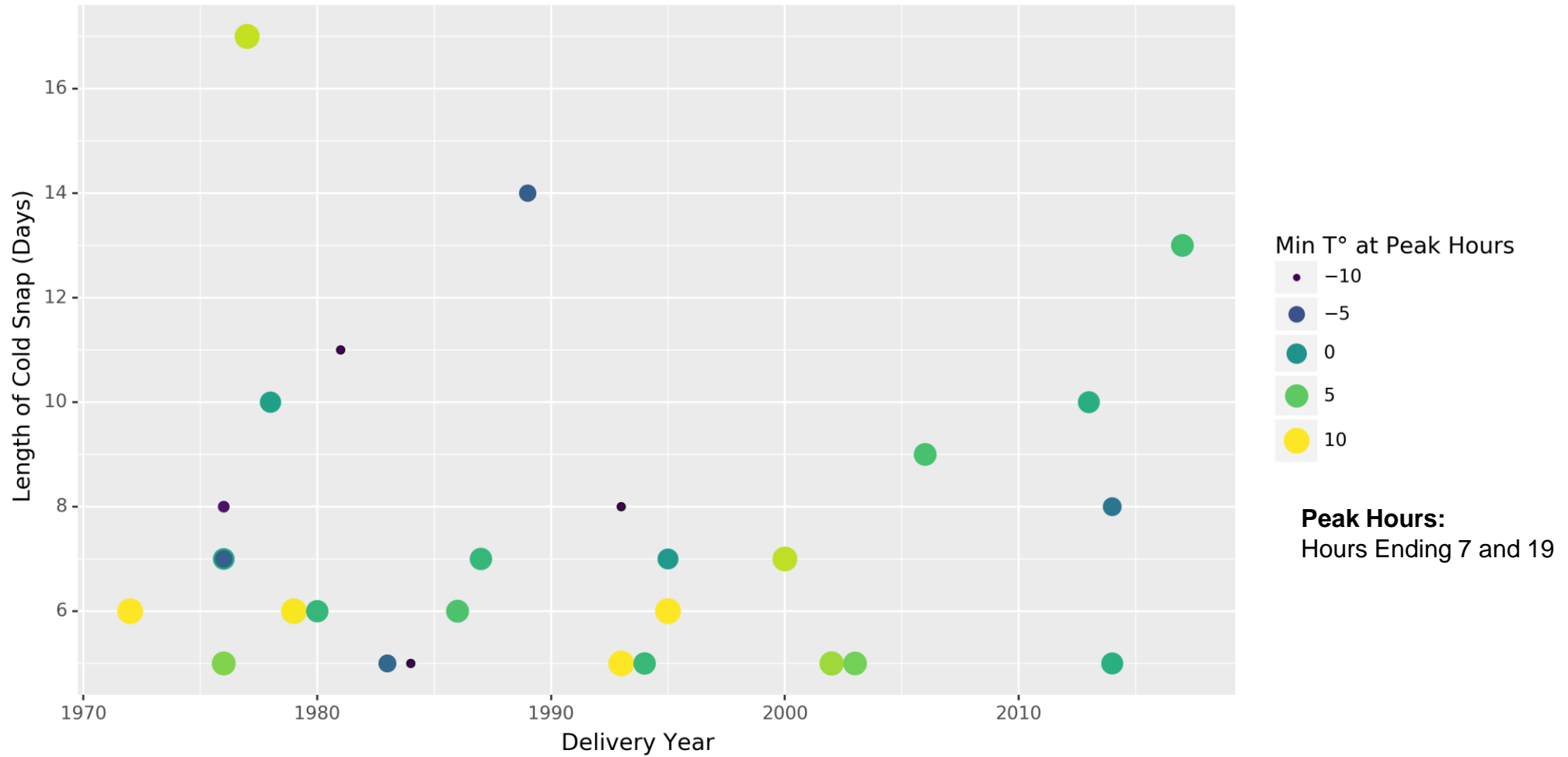
Average Length: 7.5 days

Cold Snaps – Delivery Year vs Length of Cold Snap





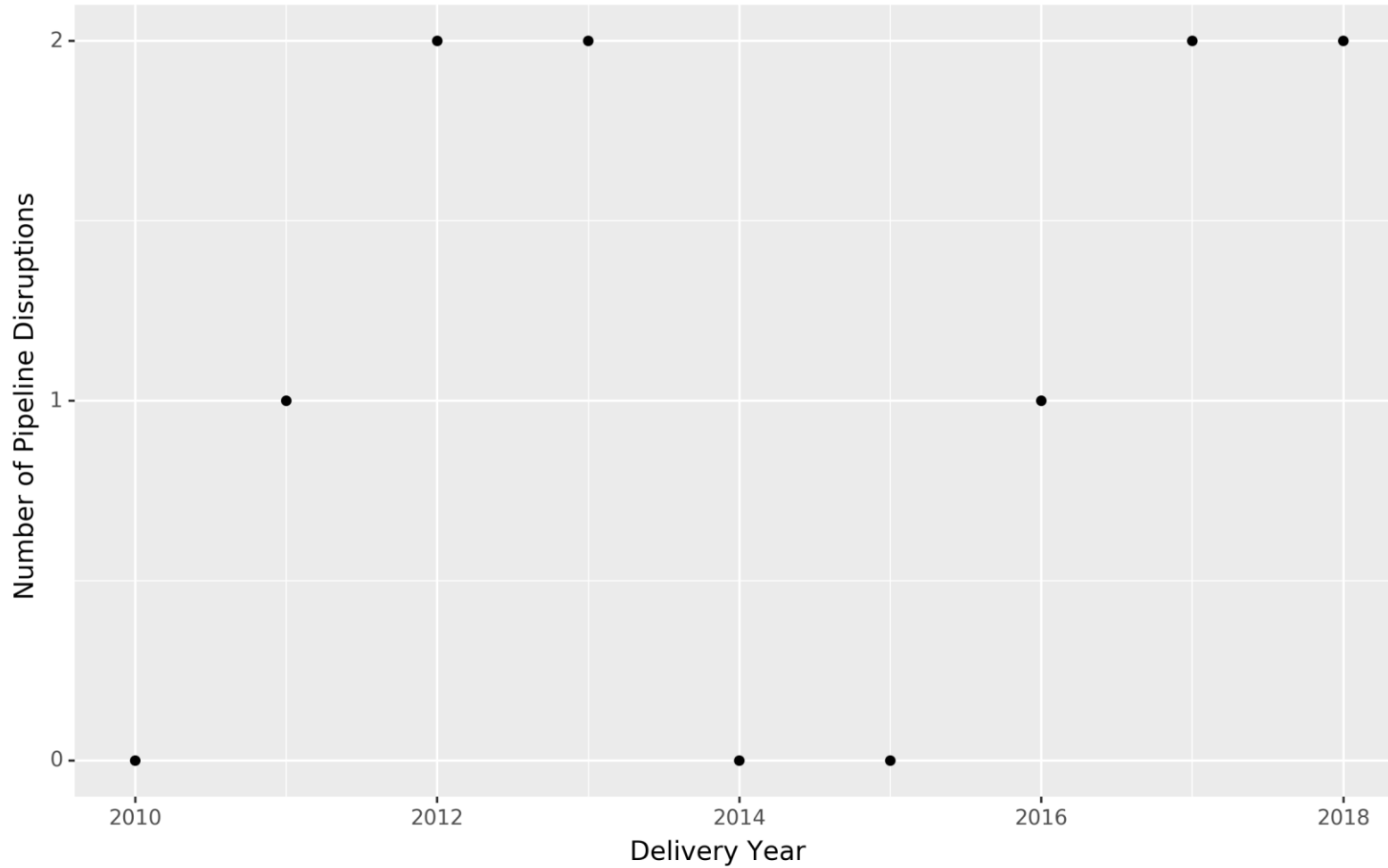
Cold Snaps – Delivery Year vs Length of Cold Snap (and Min T at Peak Hours)



- Pipeline failure event impacting the onshore gas transmission system where the reported failure mode is classified as either a Rupture or a Mechanical Puncture
 - Events where the reported failure mode is classified as a Leak or Other are not included as Pipeline Disruptions because they are deemed to be less impactful

- Event data collected by the Pipeline and Hazardous Material Safety Administration (PHMSA) of the United States Department of Transportation in the period 2010 – 2019 Q2
- Events with a start date in Winter time (Dec – Feb) are included
- Events reported by Pipelines or Local Distribution Companies (LDCs) to which PJM generators are connected are included
- Events that have occurred within a PJM State are included

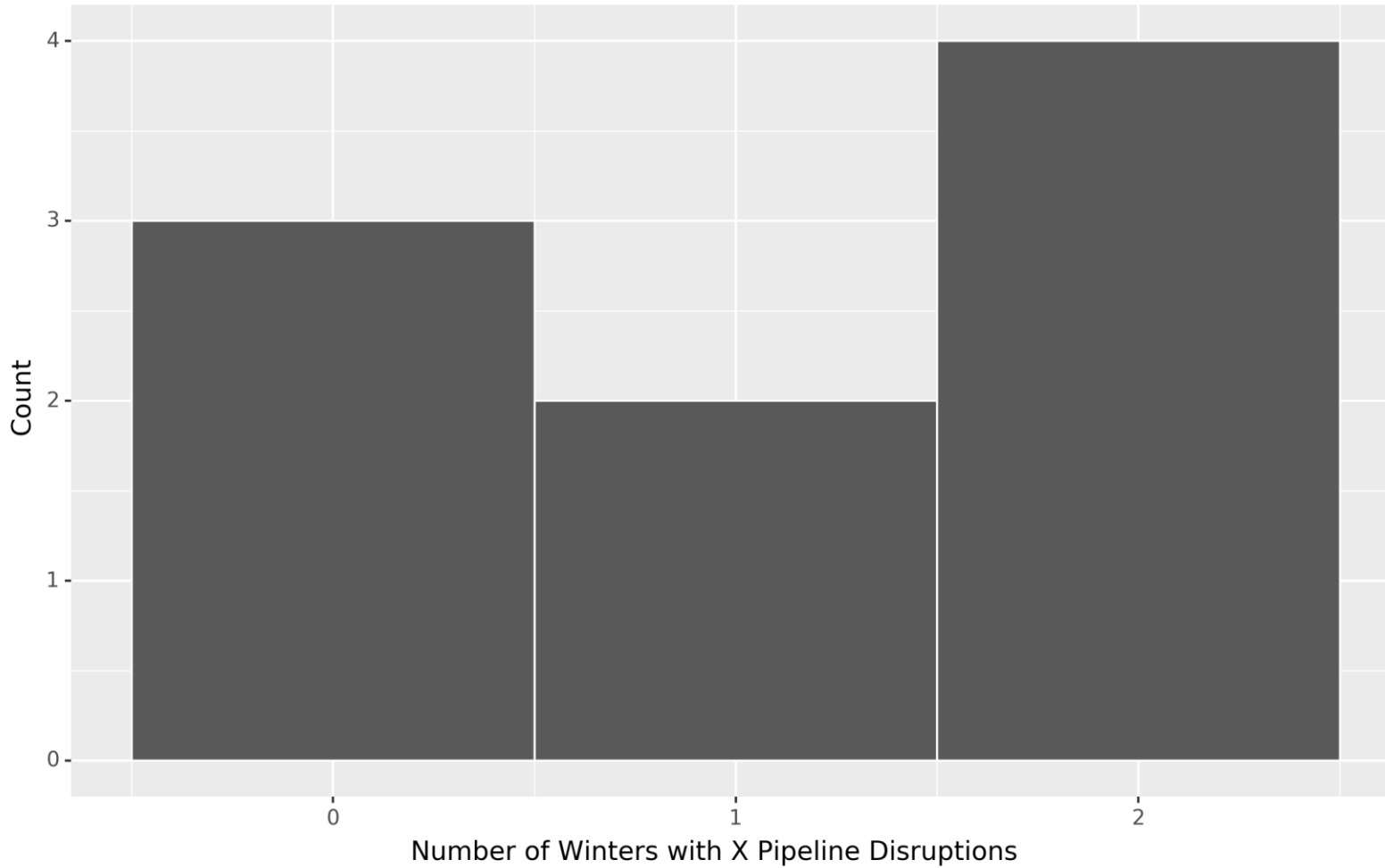
Delivery Year (Winter) vs Number of Pipeline Disruptions



A total of 10 disruptions in 9 winter periods are identified

Average: 1.1 Pipeline Disruptions per Delivery Year (Winter)

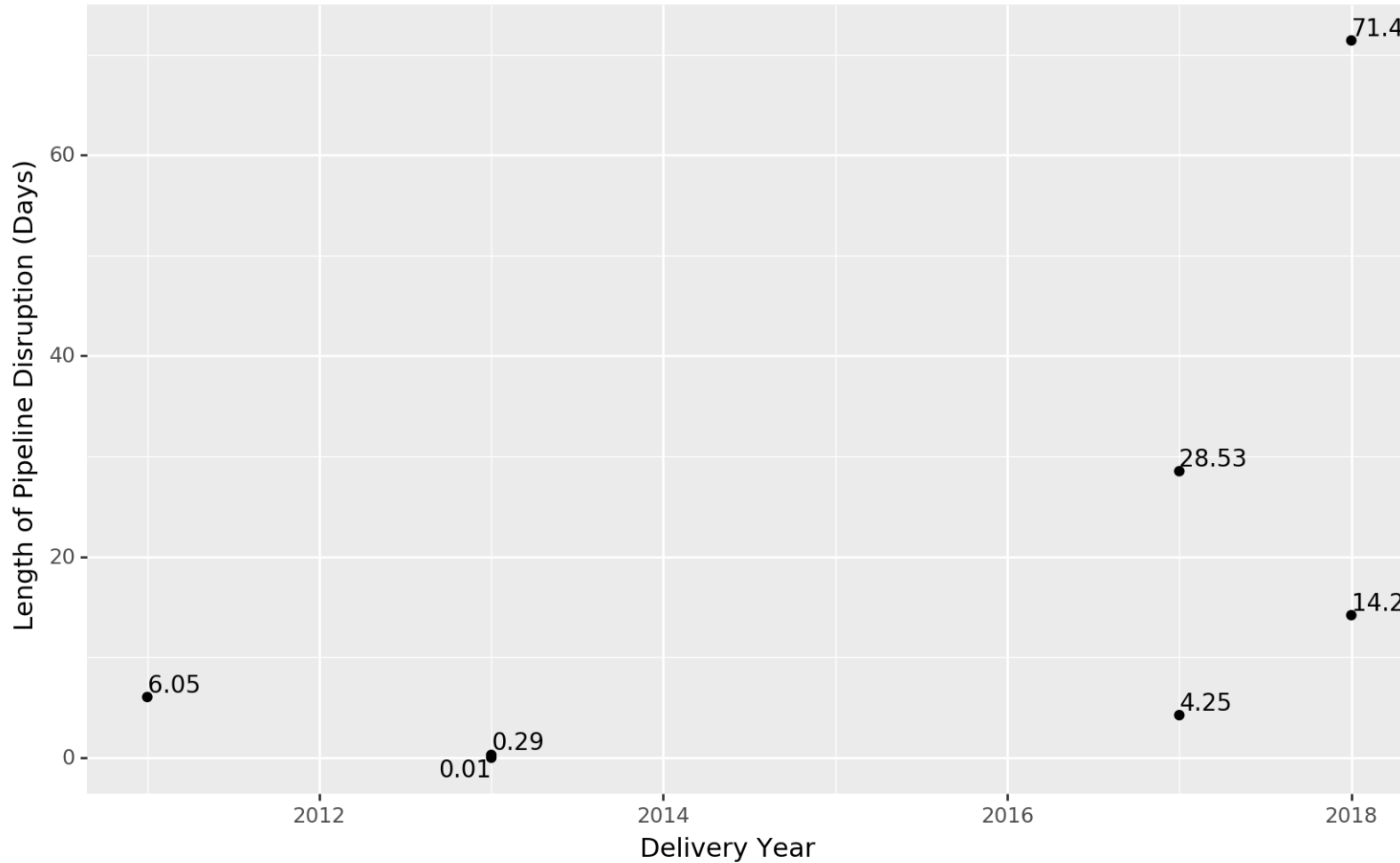
Number of DYs (Winters) with X Pipeline Disruptions



A total of 10 disruptions in 9 winter periods are identified

Average: 1.1 Pipeline Disruptions per Delivery Year (Winter)

Delivery Year (Winter) vs Duration of Pipeline Disruptions



Duration shown for 7 events only.

Outliers and events with missing data are not shown

State vs Number of Pipeline Disruptions

