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IRP Technical Conference

IRP 2018 Schedule

- February 21, 2018 – Technical Conference
  - IRP Standards and Guidelines
  - Review of 2017 Order
  - Interruptible Tariff
  - Proposed 2018 IRP Outline
  - Demand Response
- March 13, 2018 – Technical Conference
  - Heating Season Review
  - Design Peak-Day Calculation
  - Supply Reliability
- April 24, 2018 – Technical Conference
  - RFP Recommendations
  - Wexpro Matters
- May 16, 2018 – Technical Conference
  - To be Announced
- June 26, 2018 – Technical Conference
  - Presentation of Integrated Resource Plan

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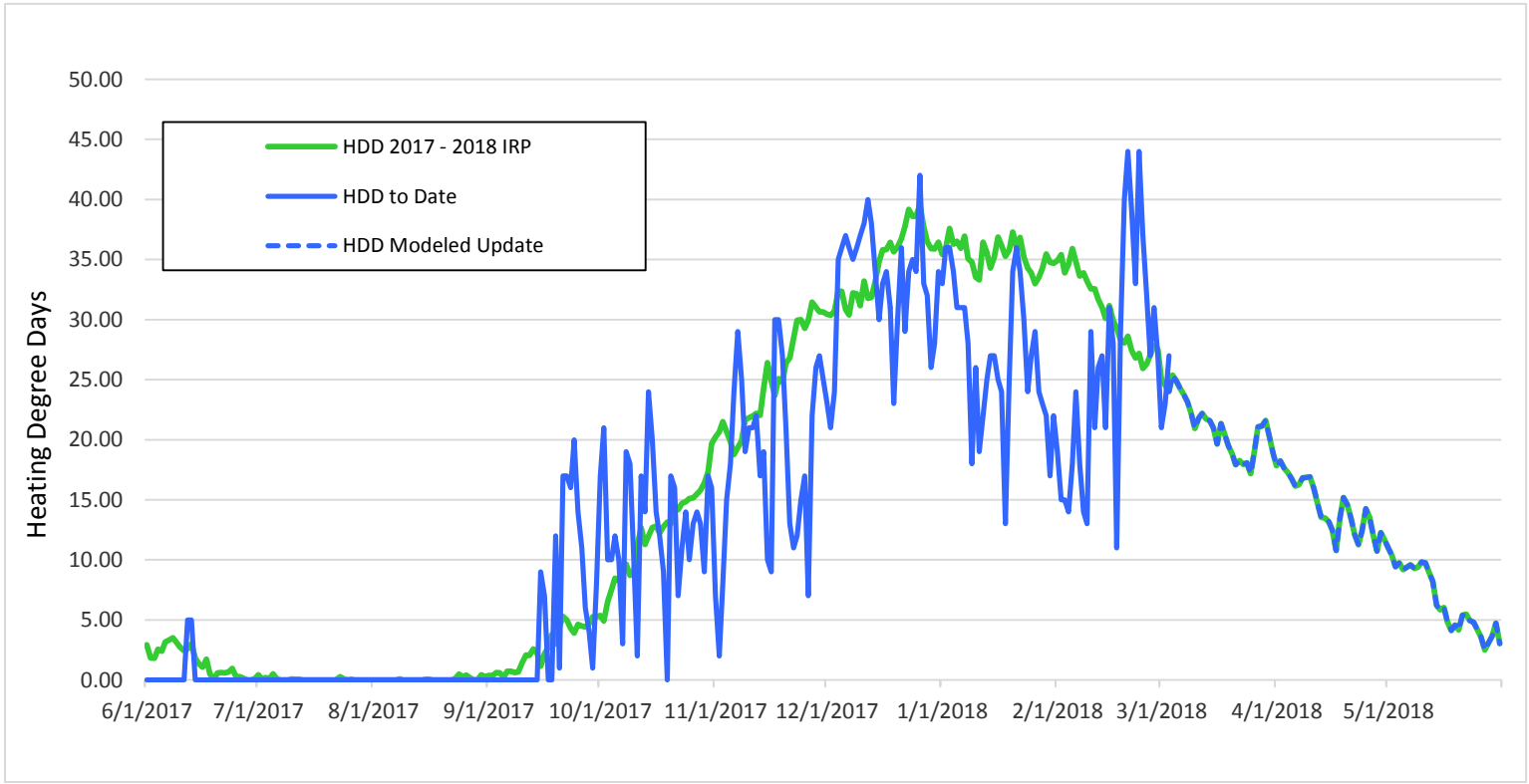
Agenda

- Heating Season Review
- Design Peak-Day Calculation
- Supply Reliability

Heating Season Review

Heating Degree Days



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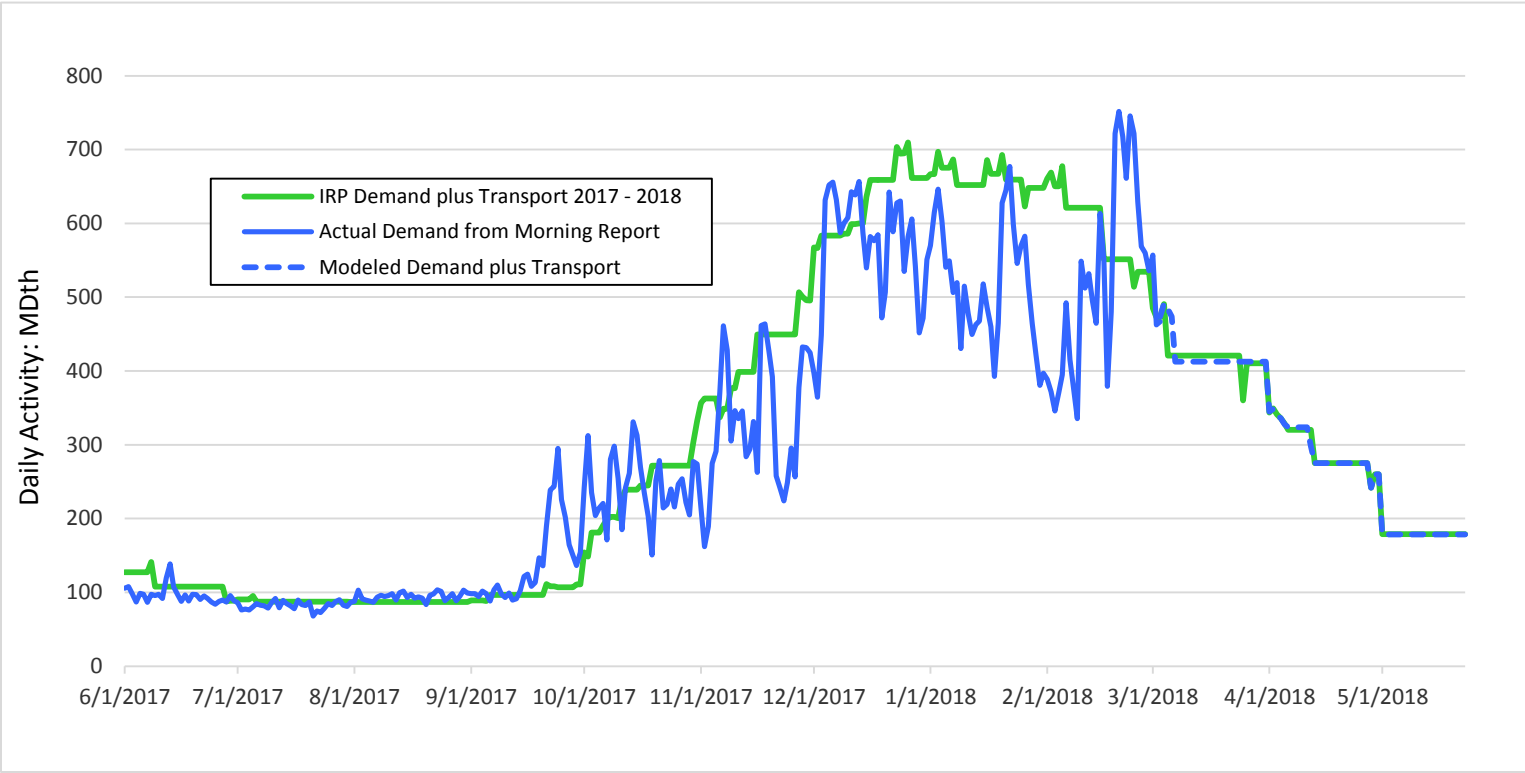
Demand



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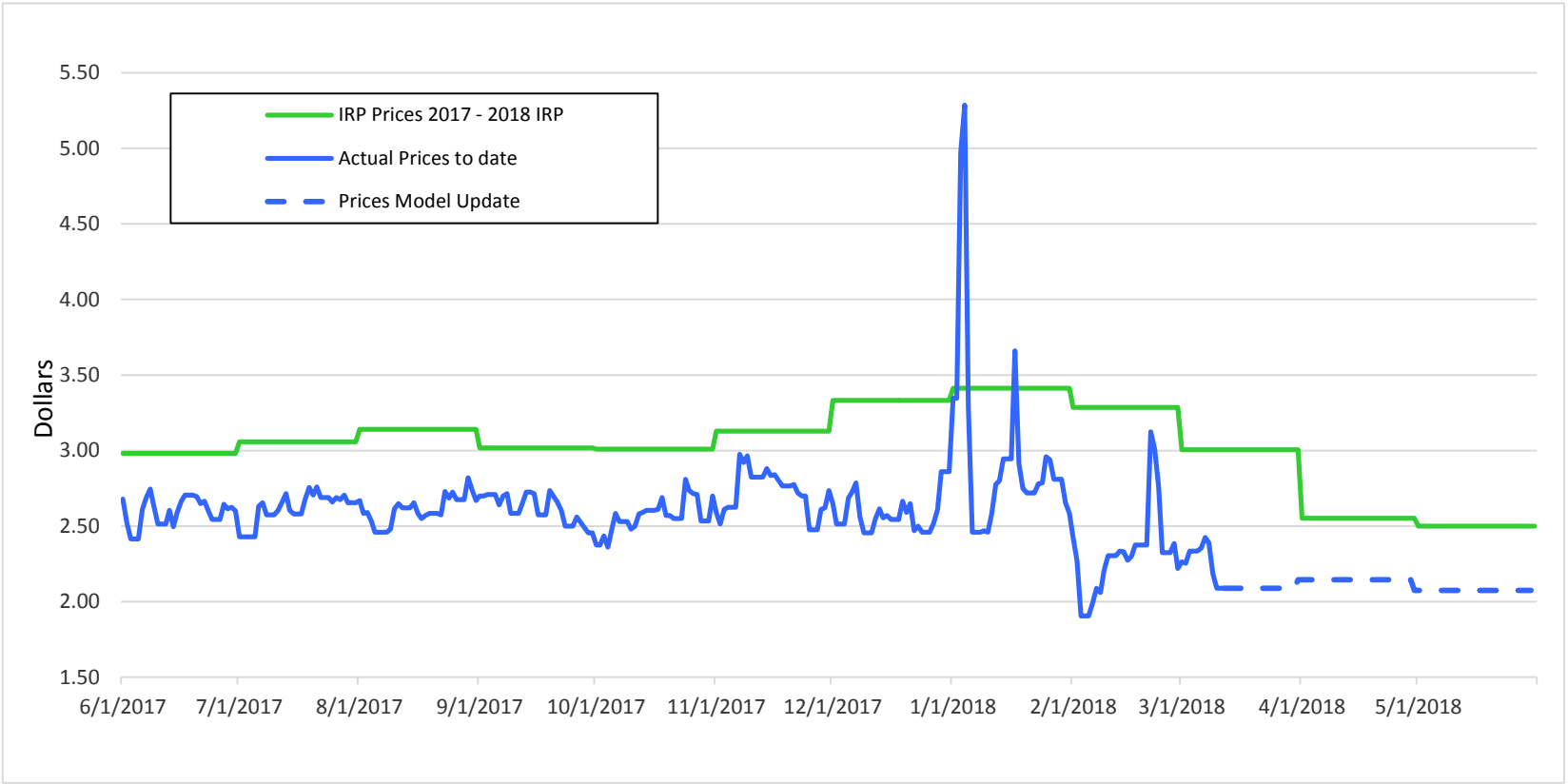
Index Prices



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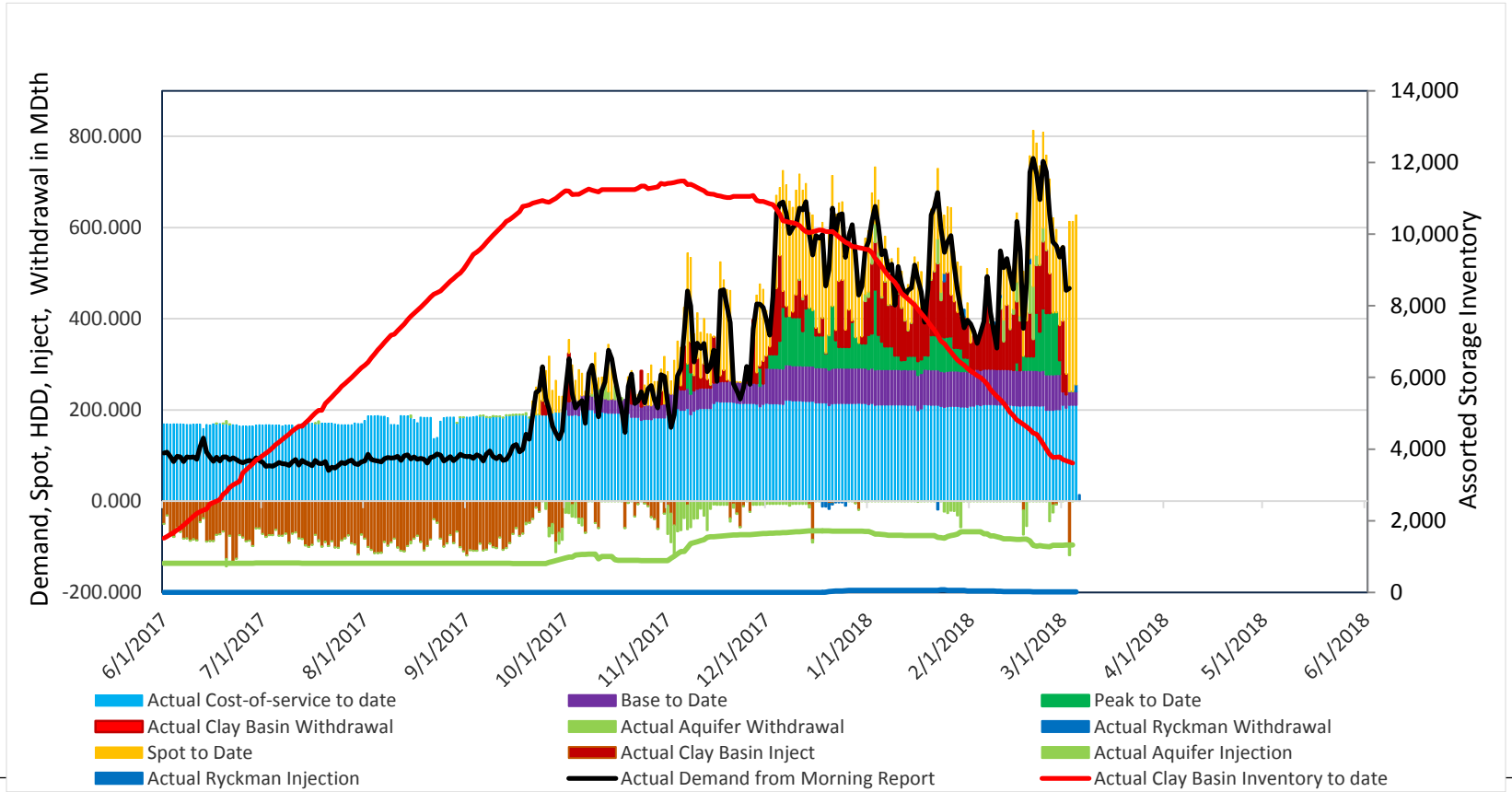
Supply vs. Demand



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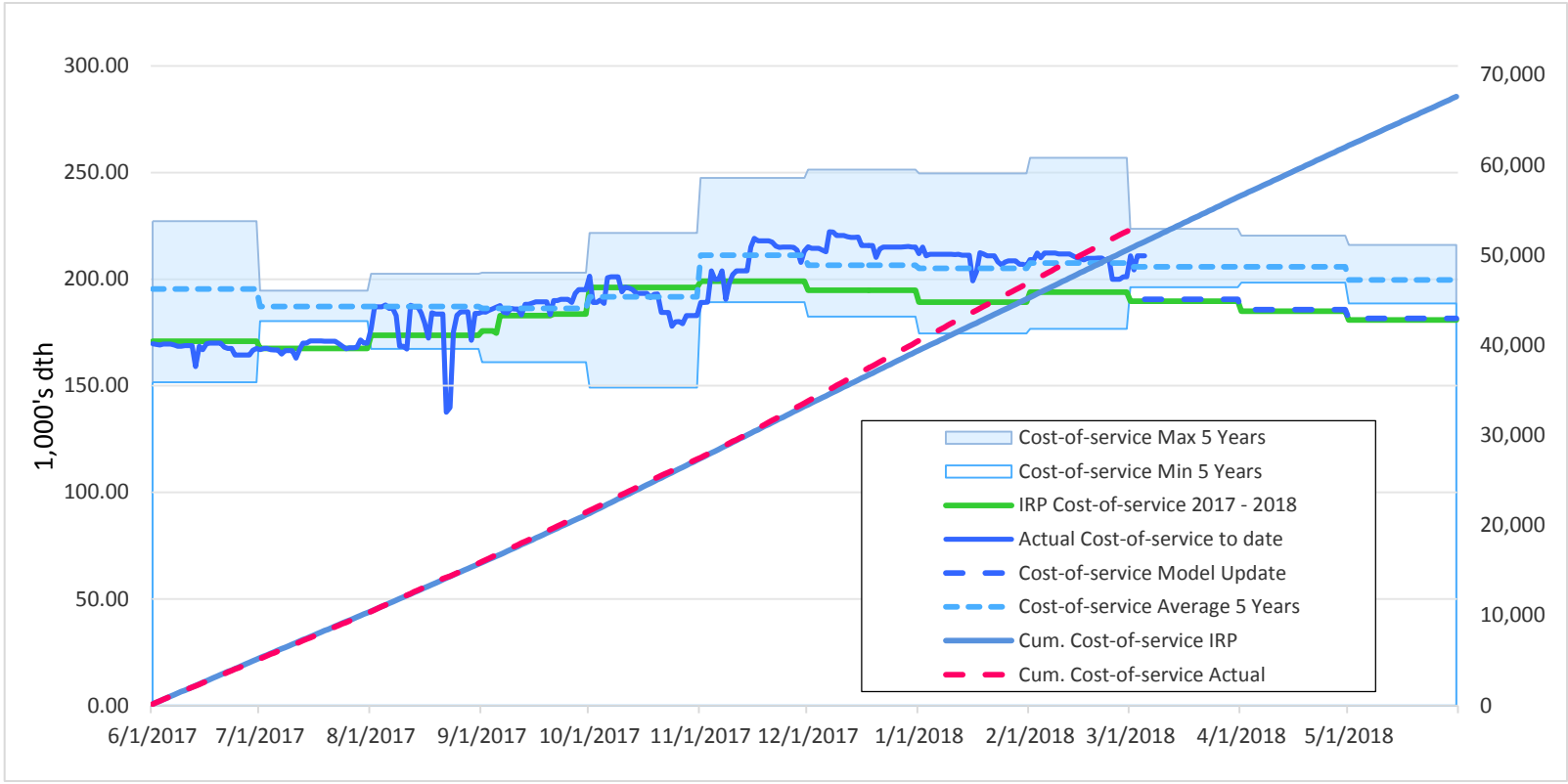
Cost-of-Service Production



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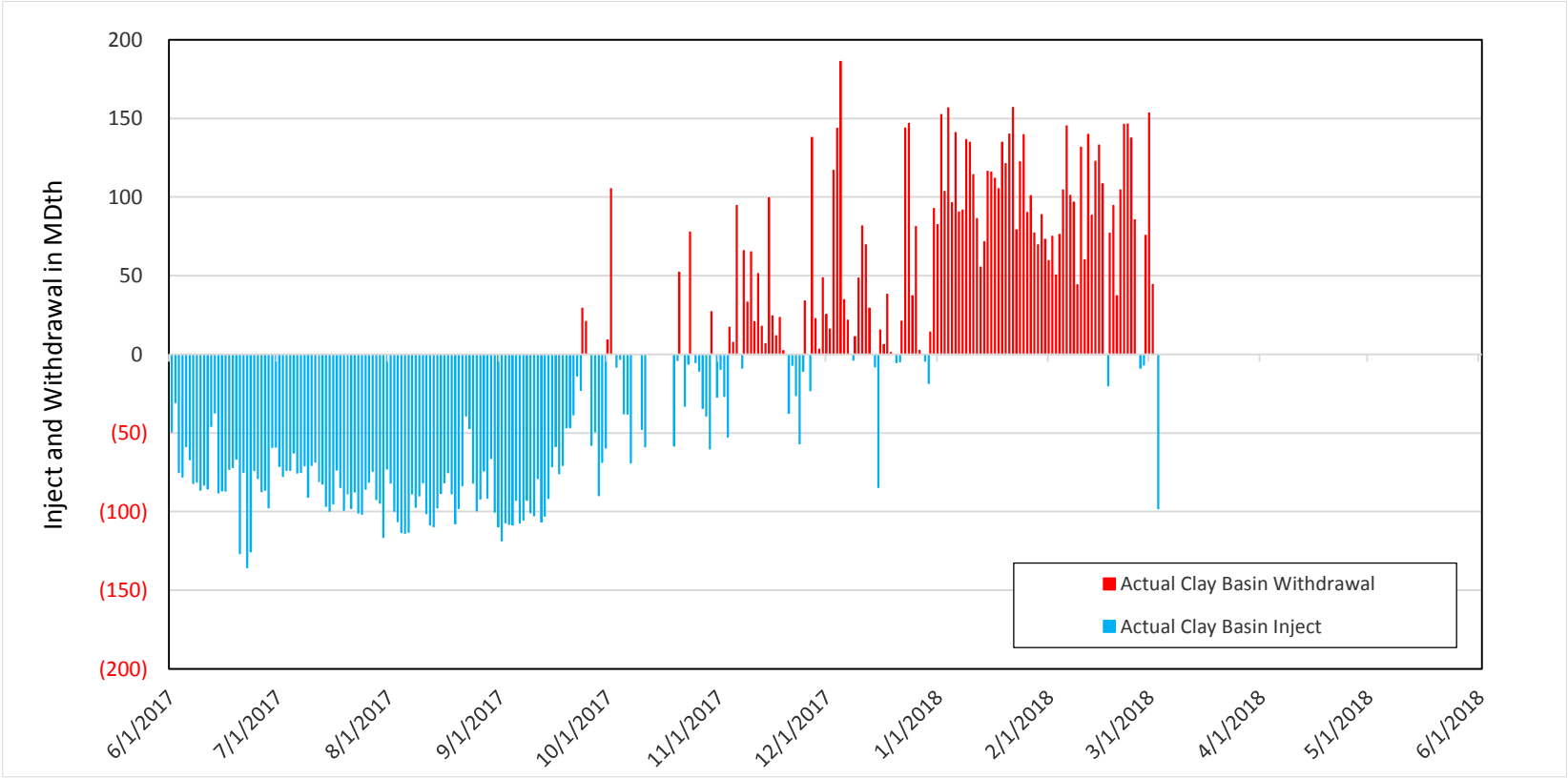
Clay Basin Daily Usage



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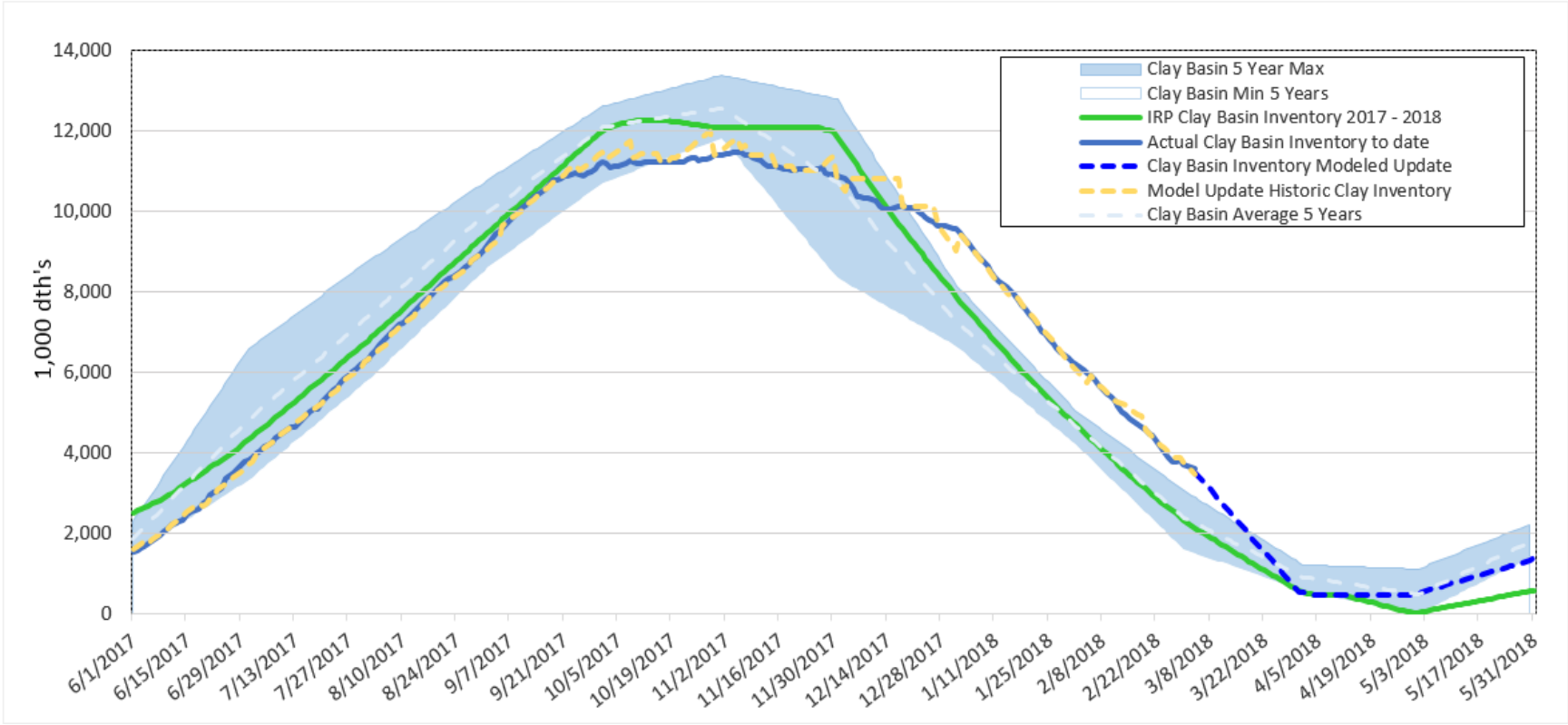
Clay Basin Inventory



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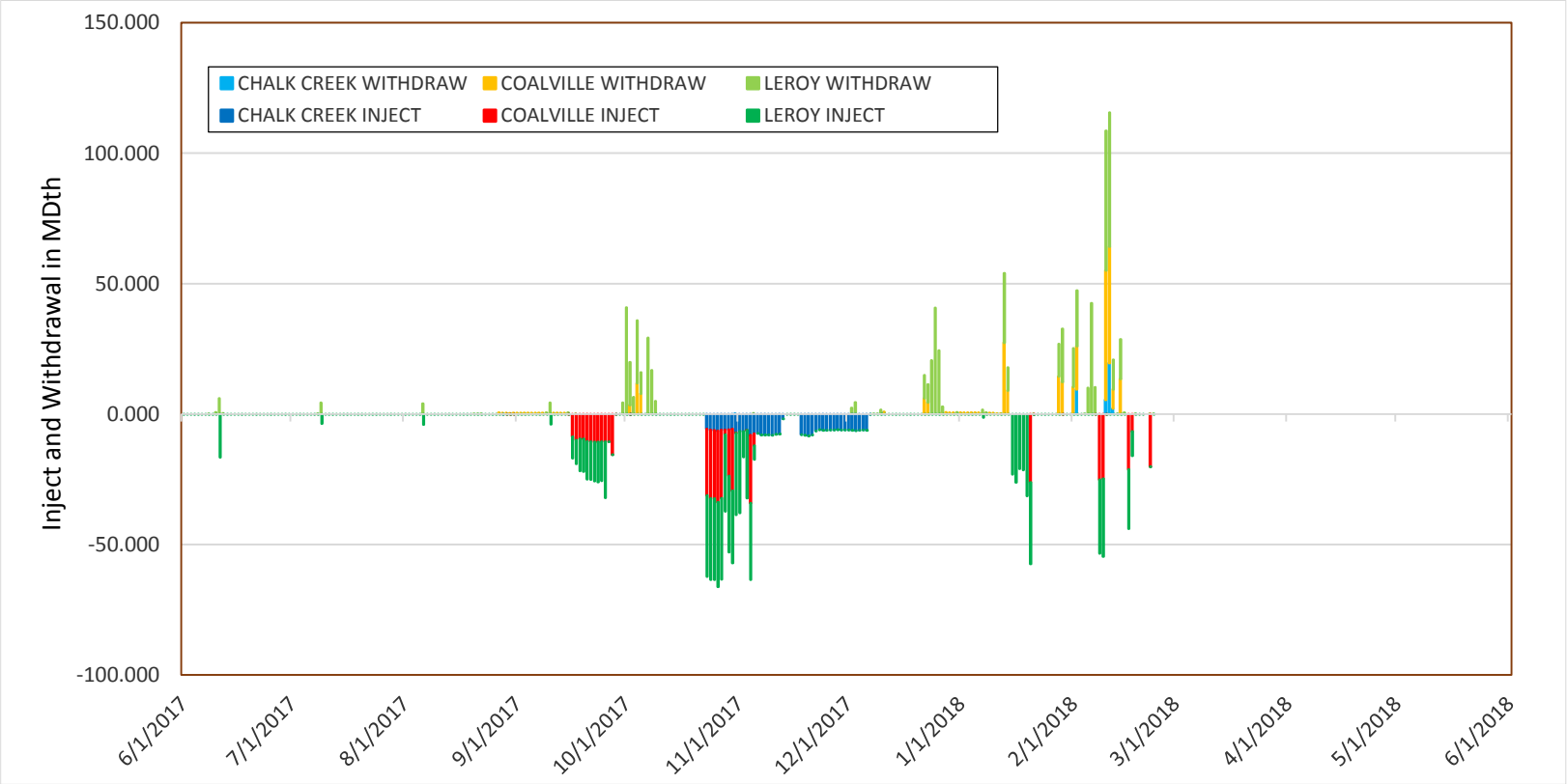
Aquifer Daily Usage



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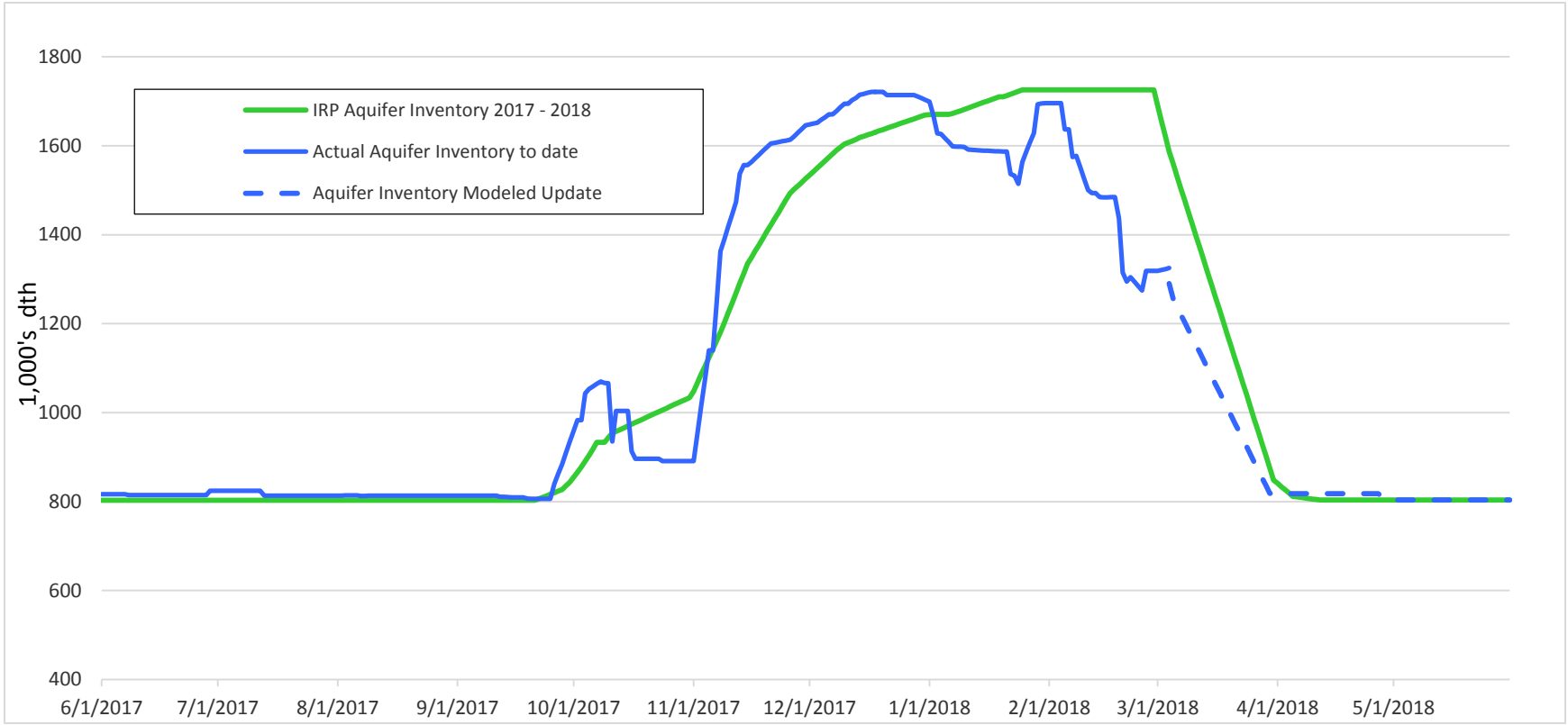
Aquifer Inventory



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Summary

- The heating season was warmer than normal
  - We had no design-day event this heating season
  - We had several cold snaps
    - Supply issues surrounding the end of February cold snap
- We have received more Cost-of-service gas than estimated in the IRP
- Low index prices in December
  - The model used Spot gas instead of Clay Basin

Design Peak-Day Calculation

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Design Peak Day Demand Means:

- Firm sales is estimated through ***statistical analysis*** of daily sendout variables that affect consumption

- Firm transportation is the ***summary*** of daily firm contract amounts

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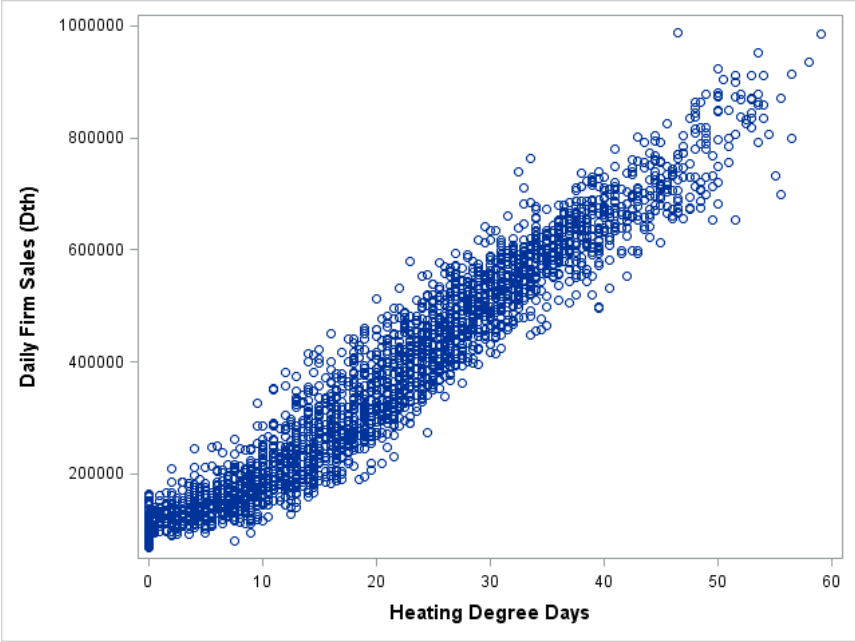
Peak Firm Sales Estimation

Daily Firm Sales Estimation

Variables that affect firm sales are:

- Heating degree days
- Prior day firm sales
- Average wind speed
- Maximum sustained wind speed
- Day of the week (sales lower on Fridays and weekends)
- Holidays (sales lower on winter holidays)



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What does one-in-twenty mean?

- ***Recurrence interval (1/20): means 5% probability of occurrence in a given year***
- ***May occur once in a 20-year period (38%)***
- ***May occur more than once in a 20-year period (64%)***
- ***May not occur at all in a 20-year period (36%)***

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Low Temperature Occurrences

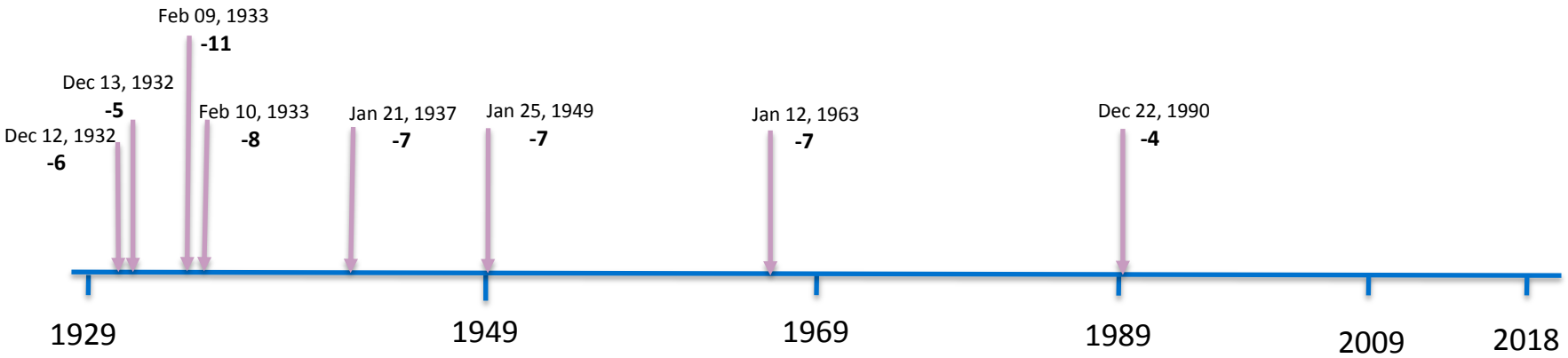

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Illustration

- ***Lowest average daily temperature for the year is at -5 degrees or below***
- ***This occurs 5 times in 89 years of data***
- ***Formula: (number of data points + 1) / number of occurrences***
- ***90 / 5 = 18: a 1-in-18 year recurrence interval***

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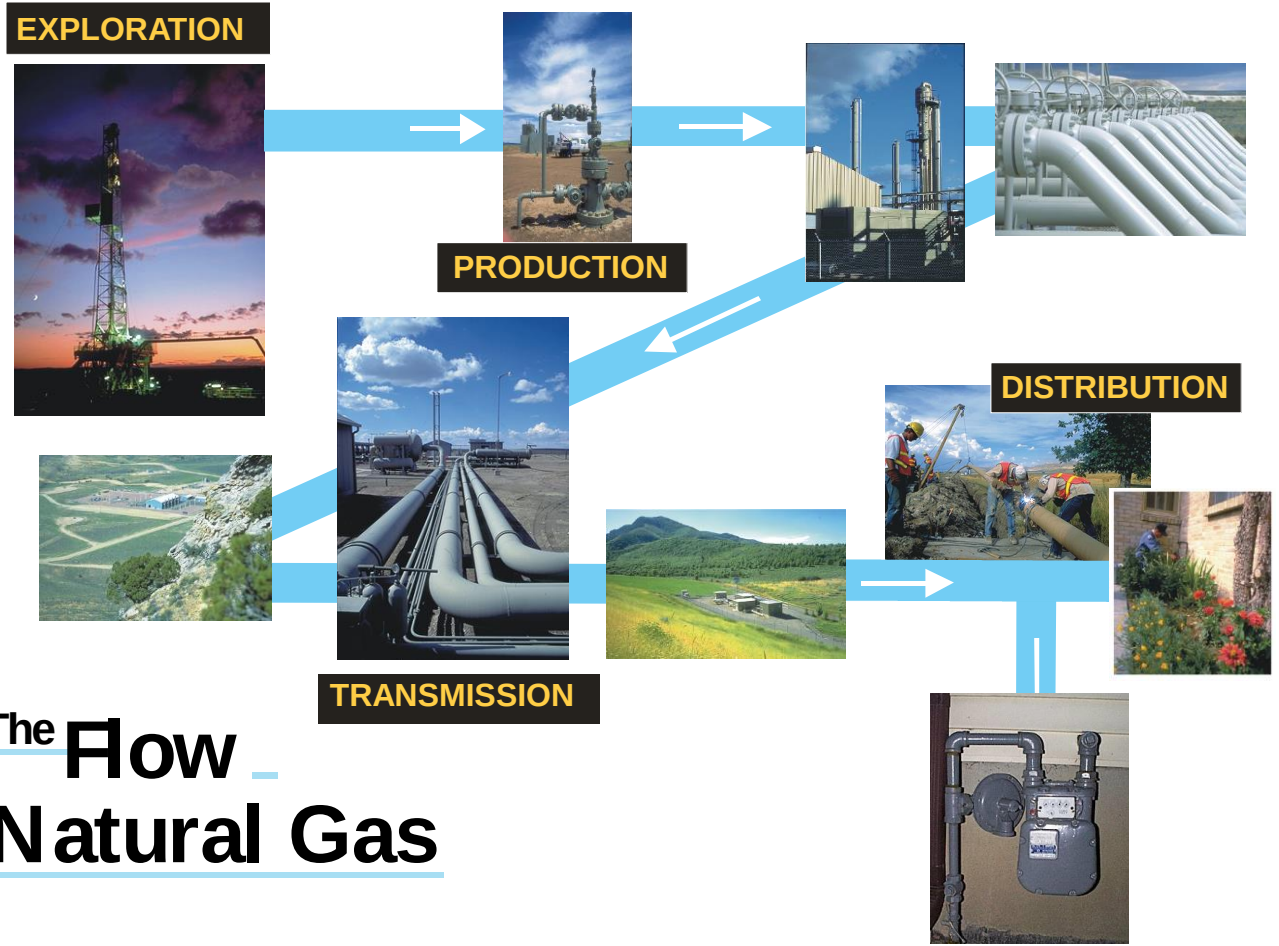
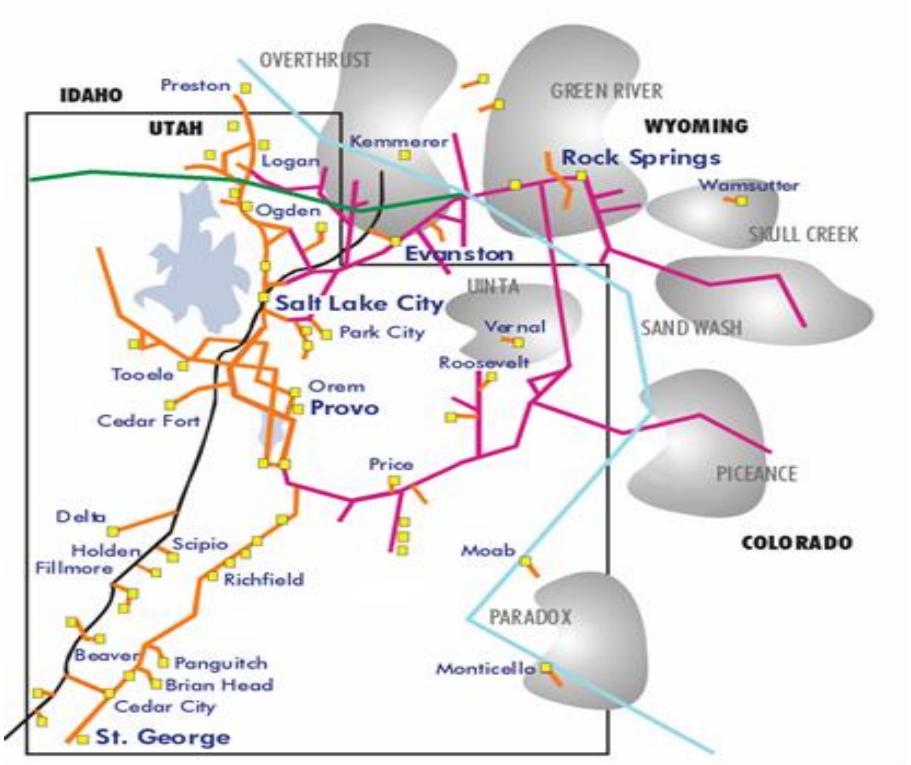
Supply Reliability Concerns



The Flow of Natural Gas

Natural Gas Delivery Chain



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Supply Reliability

- DEU relies on suppliers to provide gas
- Supplies can be disrupted for different reasons all along chain
  - Wellhead
  - Gathering
  - Processing Plants
  - Interstate Pipelines
  - Storage

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Supply Reliability

- Cold weather results in more disruptions
  - Temperatures colder at wellheads than demand centers
    - Wellhead freeze-offs
    - Gathering line freeze-offs
    - Processing Plants have mechanical issues
    - Interstate Pipelines allocate capacity
    - Storage fields allocate capacity

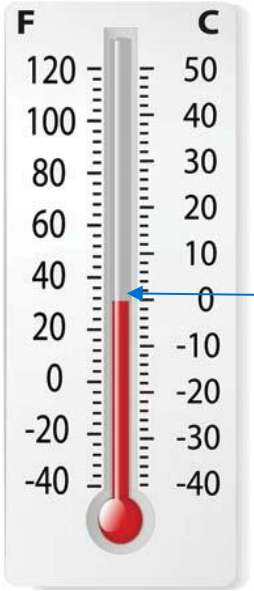
- Upstream pipelines deliver only what is received into their pipes

Issues in Arizona - February 2011

- Due to supply shortfalls, residential customers lost service
  - Arizona
    - 24,000 customers
    - Service restored in 7 days
  - VP of Gas Supply
    - 1 in 60 year weather event
      - 1 in 30 year peak weather event warming for 30 years
    - Cold weather forecast, lows decreasing closer to event

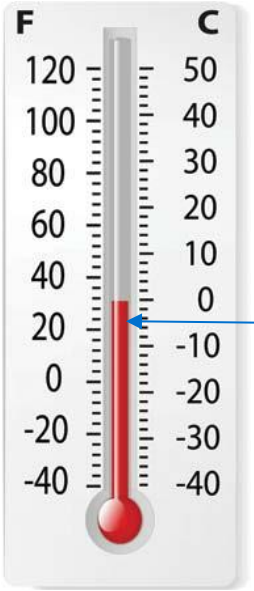
Issues in Arizona- February 2011

1 in 30 year event



29.5°

1 in 60 year event



23°

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Issues in New Mexico - February 2011

- New Mexico
  - 19,000 customers
  - Service restored in 6 days
  - $1M fund established to help with customer claims

- Similar situation in colder climate would have been much worse

Issues in West Virginia - December 2017

- Due to a compressor station failure, residential customers lost service
  - Town of Weston
    - 2,500 customers
    - Service restored in 6 days

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Issues on DEU - Supply Shortfalls

- Supply shortfalls have occurred multiple times in the last five years
  - 12/5/2013
  - 12/30/2014
  - 1/1/2016
  - 1/6/2017
  - 2/20/2018

- Supply shortfalls are expected to continue to be an issue when cold weather occurs

Supply Reliability

- Extent and length of supply disruption not predictable or foreseeable
- Decisions must be made without knowledge of future supply or demand changes
- Replacement gas is typically expensive and not always available to purchase

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Supply Reliability

- Reliable firm service is important to customers, DEU, and regulators
- DEU needs a tool to improve reliability for its customers to avoid future service outages

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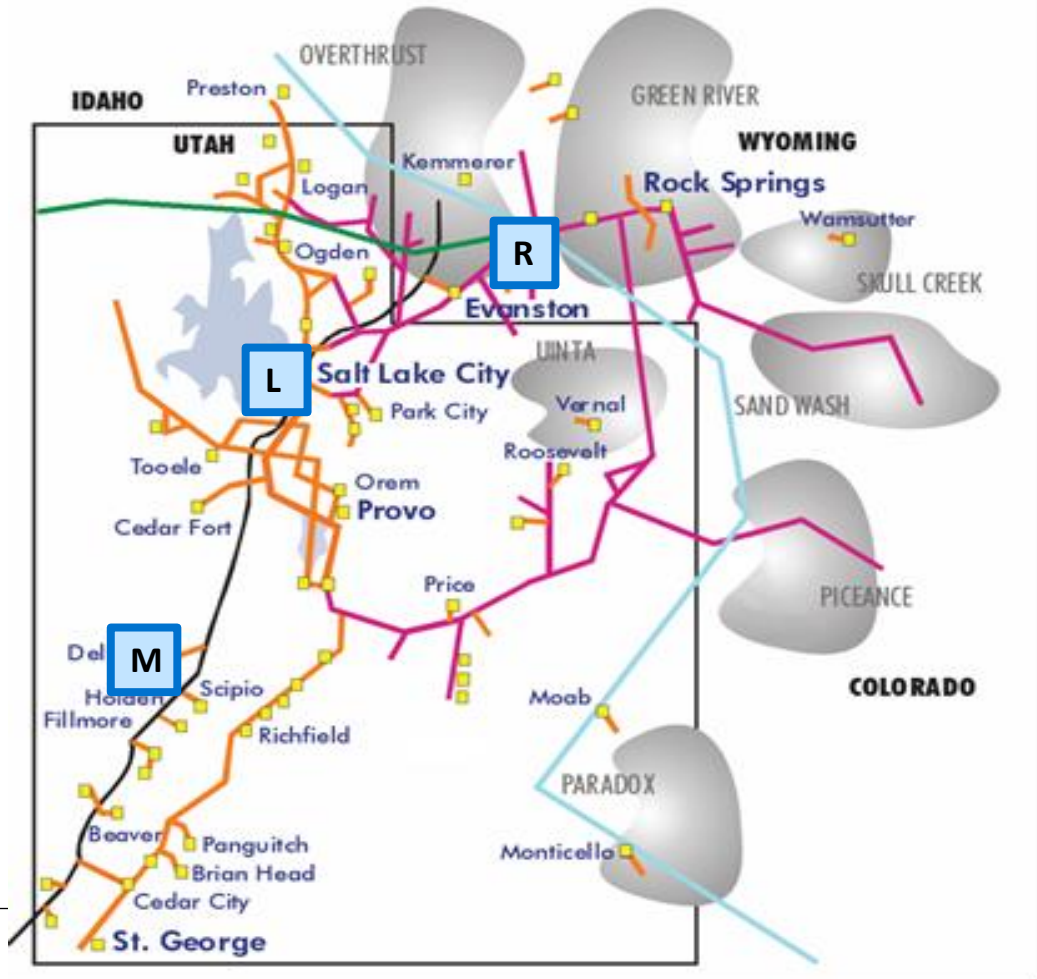
Storage options



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Questions?