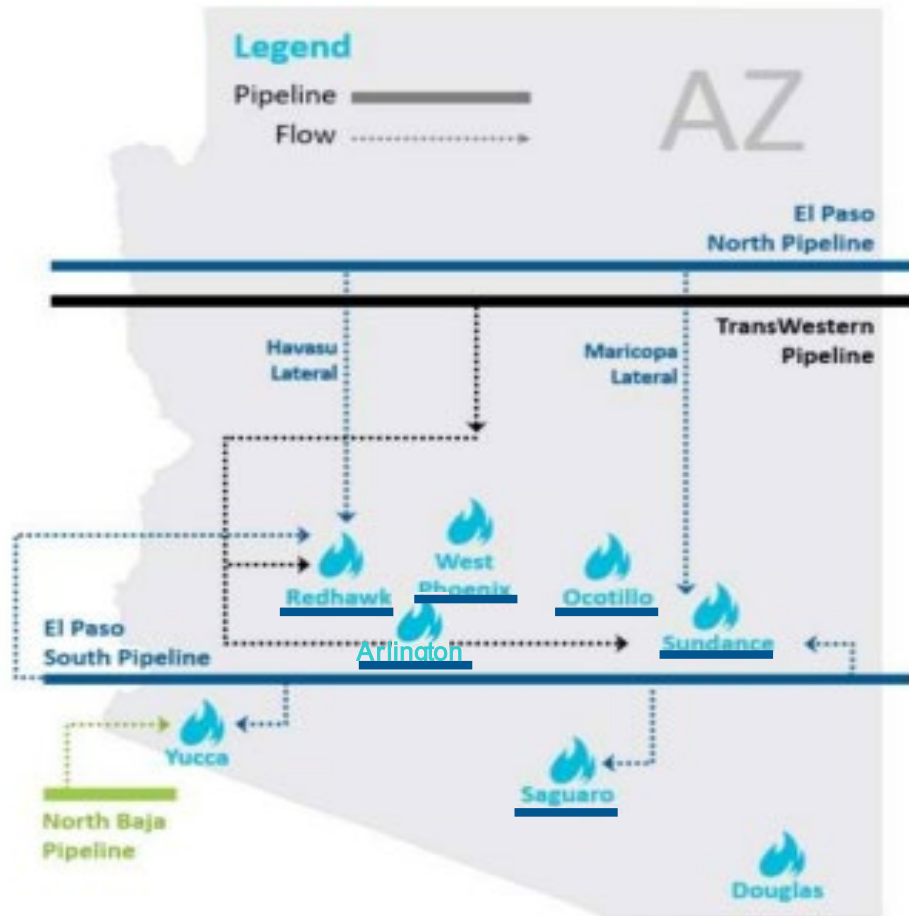


Southwest Entities Natural Gas Operational Challenges

Arizona Natural Gas System

AZ Natural Gas pipeline map



Past (to 2018)

- Pipelines had spare capacity

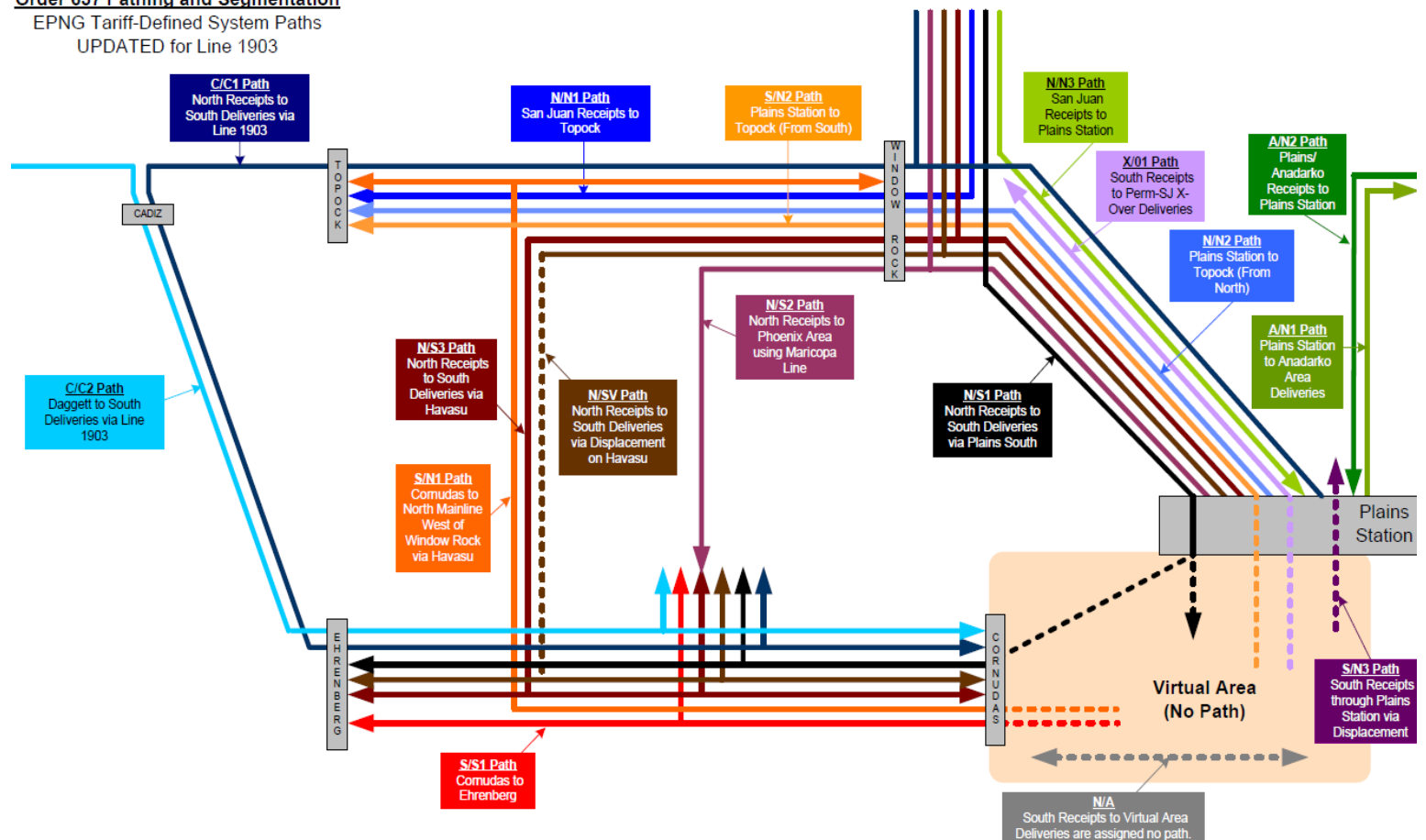
Present

- Main pipelines are **fully subscribed**, with no additional firm capacity available
- No gas storage available for SW Electric entities
- Transport limits and utilization is increasing with higher reliance on natural gas

Pipeline Systems Are Complex

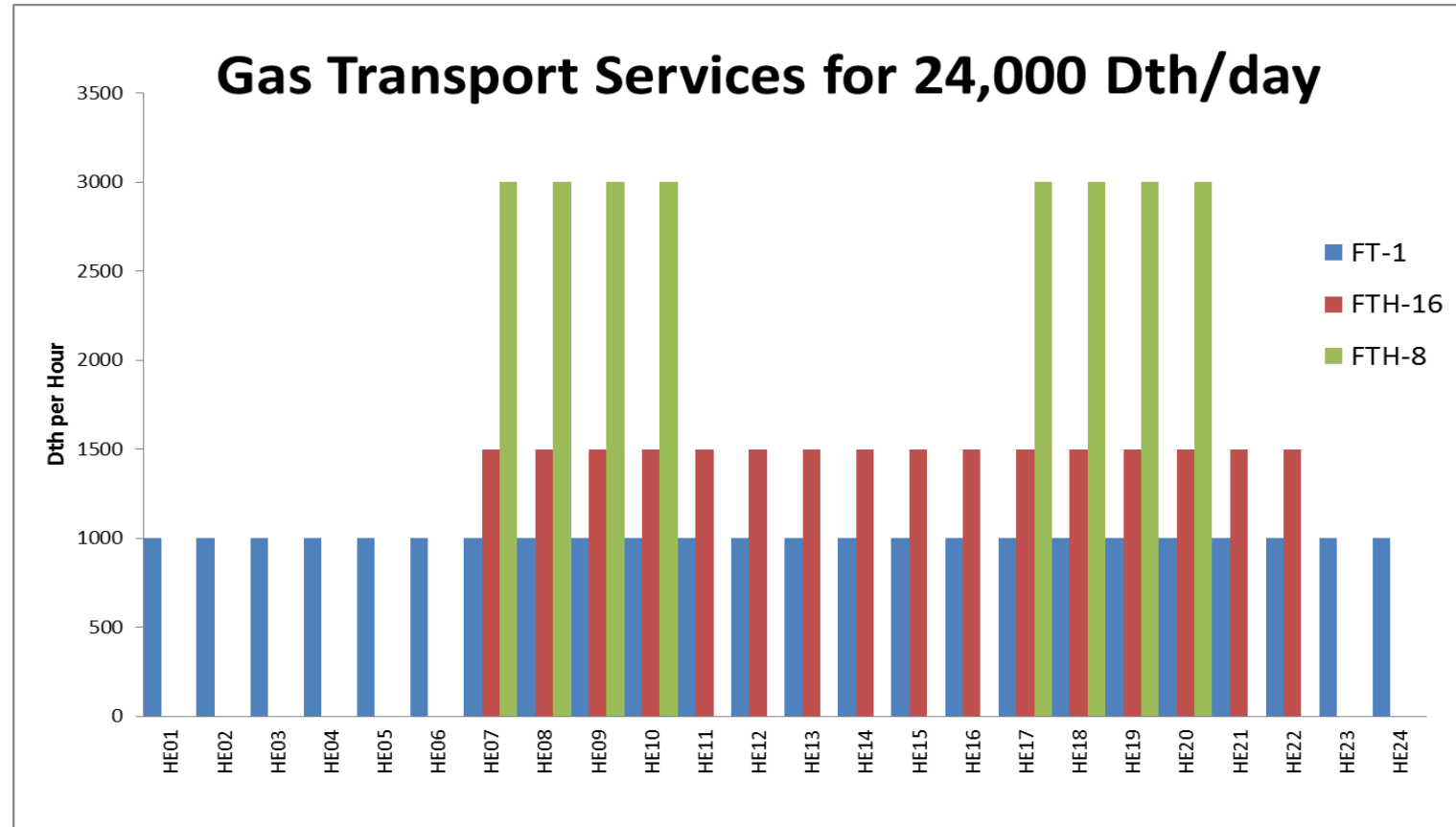
- Transportation contracts driven by locational needs
- Pipelines issue capacity using “Primary” pathing rights
- Multiple paths from point to point, but firm rights are allocated on specific paths
- SW electric entities have long term firm gas transportation contracts.

Order 637 Pathing and Segmentation
EPNG Tariff-Defined System Paths
UPDATED for Line 1903



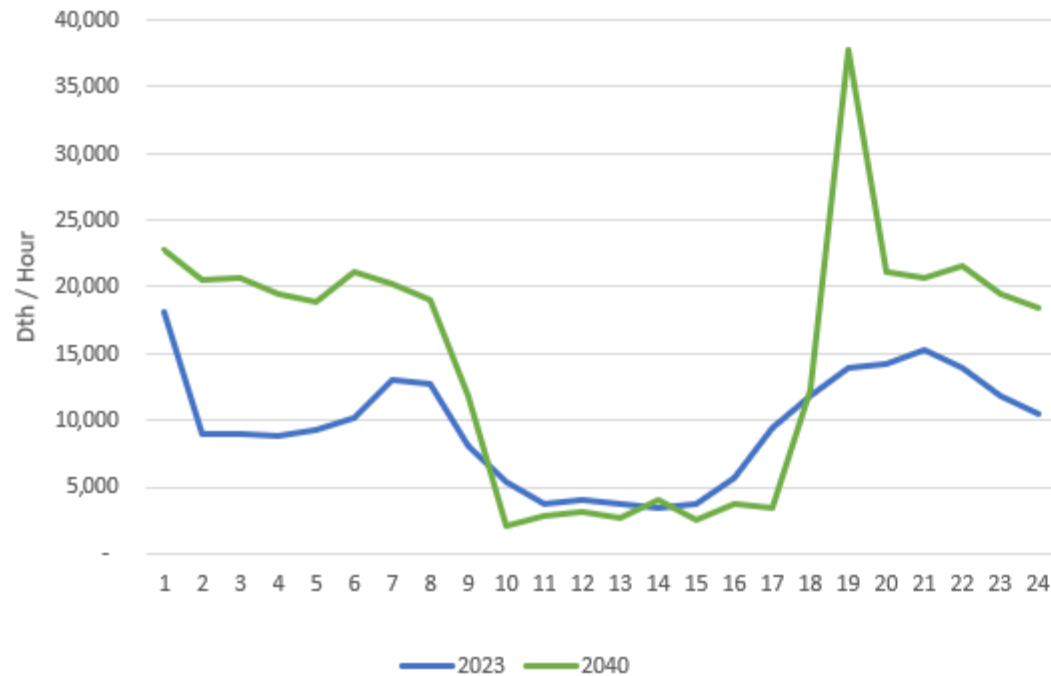
Pipeline Contractual Rights

- Pipeline contracts have daily and hourly flow limits.
- Exceeding limits results in financial penalties.
- During strained pipeline conditions the penalties are much higher and can be significant.
- 4 • Some entities have storage, but the size is limited.

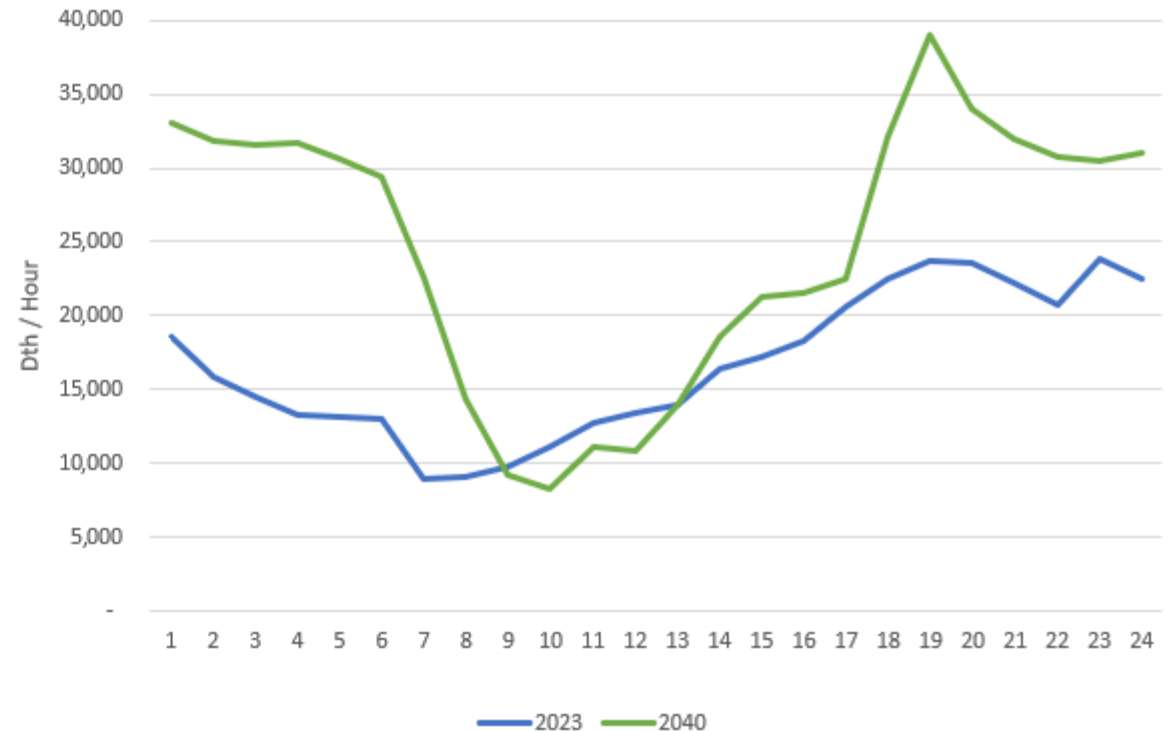


Gas Usage Patterns Are Changing

March

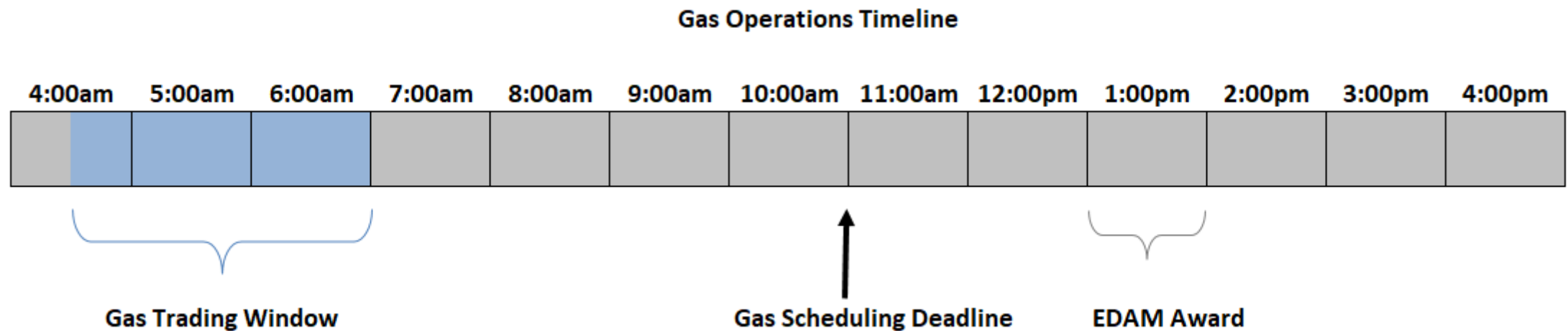


July



Gas Trading Schedule Complexities

- A potential timing mismatch exists between when physical gas trading occurs and when power awards are made by the EDAM
- Most gas for a given day trades between 5:30am-7:30am the day before flow
- Intraday gas markets are an imperfect solution since they have less liquidity than day ahead and the price is unknown at the time of the power award
- EDAM participants in Arizona carry liquidity and price risk as a result of the timing mismatch



Gas Day Versus Electric Day

Normal Week

Trading Day	Gas Flow Day
Monday	Tuesday
Tuesday	Wednesday
Wednesday	Thursday
Thursday	Friday
Friday	Saturday, Sunday, Monday

Holiday Week*

Trading Day	Gas Flow Day
Monday	Tuesday
Tuesday	Wednesday
Wednesday	Thursday
Thursday	Friday
Friday	Saturday, Sunday, Monday, Tuesday

*More complex trading patterns occur due to holidays such as Thanksgiving and when a month end falls on a weekend.

Summary of Challenges

- Limited pipeline contractual rights
- Gas flow and electric demand are mismatched
- Gas and power day mismatched timing
- Limited visibility of gas need during trading window
- No mechanism to inform market of gas burn limitations
- Huge financial and reliability risk at times
- Intraday gas purchase price adjustments can be limited by Market Power Mitigation
 - Reference Level Change Request process is very cumbersome

Recommendations

- Provide nomogram or similar mechanism to inform market software of gas limits
- Improve the Reference Level Change Request process to make it more user friendly
- Provide multiday market run look ahead for gas burn projections
- Closer alignment to the EDAM market awards and the gas trading schedules
- Possible Solutions to the power/gas timing mismatch:
 - EDAM participants will be notified of the volume of gas necessary to support the organized market award no later than 7am in the Winter and 6am in the Summer
 - If a firm, point estimate of gas requirements cannot be provided by 7am, then a reliable range must be provided. Ideally the lower and upper bounds of the range will match up with the amount of tolerance allowed by the pipelines.