PLAINS ALL AMERICAN PIPELINE, L.P.

2018 EIA Energy Conference

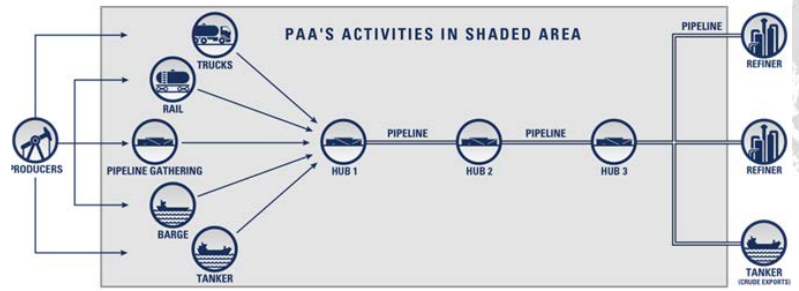
June 4, 2018

Discussion Outline

- **Brief Overview of Plains All American Pipeline**
- **High Level Takeaways**
- **U.S. Energy Environment – Perspectives on:**
  - ✓ **Where we have been**
  - ✓ **Where we are now**
  - ✓ **Where we are going with respect to U.S. crude oil**
- **Contrasting "Then" vs "Now" (& Associated Challenges)**
- **NPC Current Activities**

Plains Has One of the Largest and Most Integrated Crude Oil Midstream Systems in North America

PAA's Crude Oil Value Chain

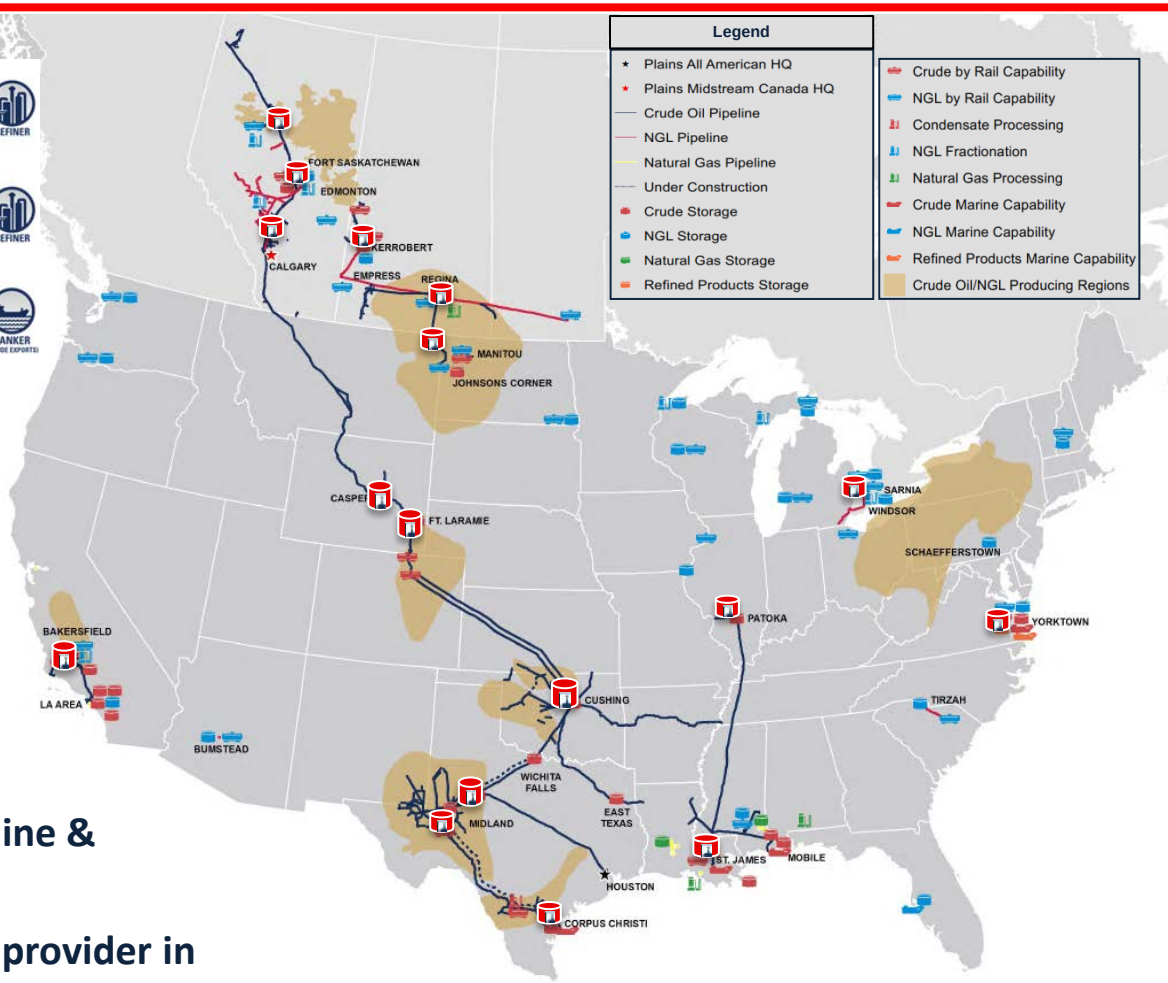


Plains' Current Profile

- **Volumes Handled[1]:**
  - ✓ ~5.3 mmb/d Transportation
  - ✓ ~1.4 mmb/d Supply & Logistics
- **Total Enterprise Value:** ~$31B[2]
- **PAA Total Assets:** ~$25B[3]

Focus Points:

1. Highly integrated U.S. crude oil pipeline & terminal system
2. Leading crude oil midstream service provider in the Permian Basin



Note: Map contains only most significant PAA assets, including current projects and equity-investments assets.

(1) Average daily Transportation segment and Supply & Logistics segment volumes for the quarter ending 3/31/18.
(2) Based on closing unit prices as of 5/21/18.
(3) Based on balance sheet data as of 12/31/17.

PAA Crude Oil Fundamentals Group

Staffed with +/- 8 dedicated analysts, engineers & professionals

- **Primary objectives – understand and project:**
  - ✓ Future well & regional basin performance
  - ✓ Quality related issues
  - ✓ Regional supply / demand balances versus infrastructure capabilities
  - ✓ Optimal pipeline & asset location and capacity requirements
- **Actively monitor & track drilling & completion activities & production in key regions.**
  - ✓ Maintain decline curves and performance analyses for each well drilled/completed in the Permian, Eagle Ford, Williston, DJ, PRB & STACK/Scoop (also Canadian resource plays)
    - Tracking individual well performance, rates, cums,
    - Emulating economic returns & likely capital allocations by company
    - Technological advances / setbacks; producer practices (single well versus pad; lateral length; sand volume, etc.)
    - Also utilize 3rd party studies/analyses for other areas to augment our regional, U.S. & macro assessments as well as cross check our data /observations for key areas we track
- **3rd party sources used for activities outside U.S. & Canada (IEA, EIA, OPEC, etc.)**
- **All data rolled up into macro assessment**
- **Major user of EIA weekly & monthly data & analyses to cross-check / calibrate with our assessments**

Main Takeaways From This Presentation

- **The U.S. has undergone a significant, positive transformation over the last +/- 40 years with respect to petroleum and natural gas**
- **Now is a great time to be in the energy business in the United States of America, ….**
- **….but there are still challenges / hurdles to overcome and room for further improvement.**

Note: Plains is primarily a crude oil focused entity, so the majority of detailed comments will focus on crude oil/petroleum

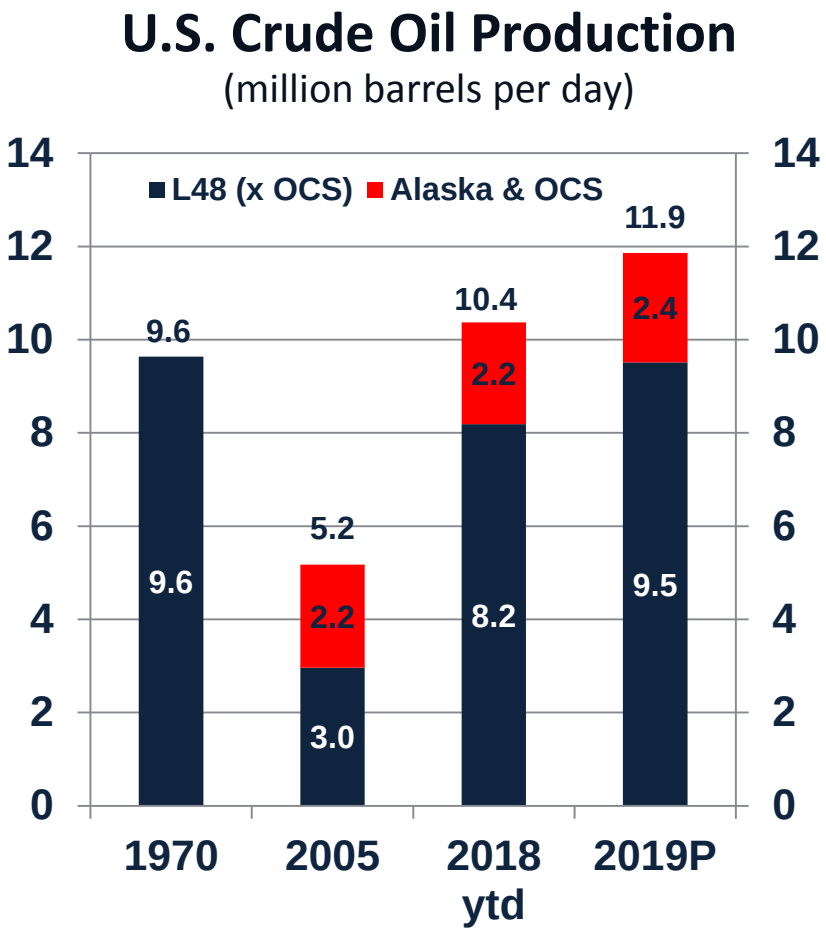
U.S. Conditions in 1970s /Early 1980s

- **Crude oil production peaked in 1970 (increasing our reliance on foreign imports)**
  - ✓ Lower 48 onshore decline would continue for ~35 years (thru 2005)
  - ✓ Alaska production commenced in 1973 *(production peaked in 1988)*
  - ✓ Federal waters production (OCS)commenced in 1981 *(effectively peaked in 2002)*
- **Natural gas production peaked in 1971**
  - ✓ Decline would continue for ~25 years (through 1996)
- **Crude oil and natural gas subject to price controls**
  - ✓ MLP meant "maximum lawful price"
  - ✓ Crude oil price controls removed 1981
  - ✓ Natural gas price controls removed in stages mid-to-late 1980s
- **Relatively fresh memories of gasoline rationing/waiting lines and the potential for a new "ice age" (global warming/climate change was not yet an issue)**
- **1980: +/- 250 refineries with average capacity of ~60kb/d**
  - ✓ Multiple "tea kettle" refineries (< 10kb/d)
- **Crude oil infrastructure primarily owned by majors/integrated oil companies**
  - ✓ Majority built in 1930s to 1950s

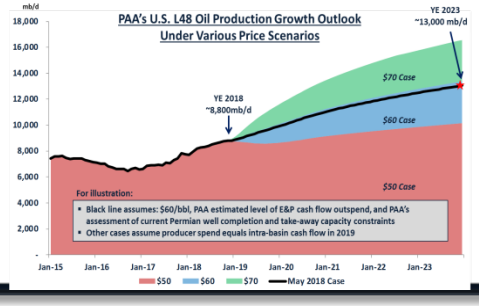
So, if the future is so bright now, what changed?

- **The U.S. energy industry addressed almost all of the challenges and overcame many of the obstacles that created those conditions.**
- **Selected contributing factors:**
  - ✓ **Shift to market prices, open markets, futures market (crude 1983; nat gas 1990)**
  - ✓ **American innovation, ingenuity and entrepreneurial spirit**
  - ✓ **Re-discovery of "shale" & "resource" potential thru new technological lens**
  - ✓ **Horizontal drilling & hydraulic fracturing**
  - ✓ **Collaboration and teamwork**
  - ✓ **Development of fiber optics**
  - ✓ **Advancements in computing technology**
  - ✓ **Enhanced awareness of safety, environmental and social responsibility matters**
  - ✓ **Capitalism at its best**

Reversing a 35 Year Production Decline; Outlook for Rising / Sustainable Production Profile

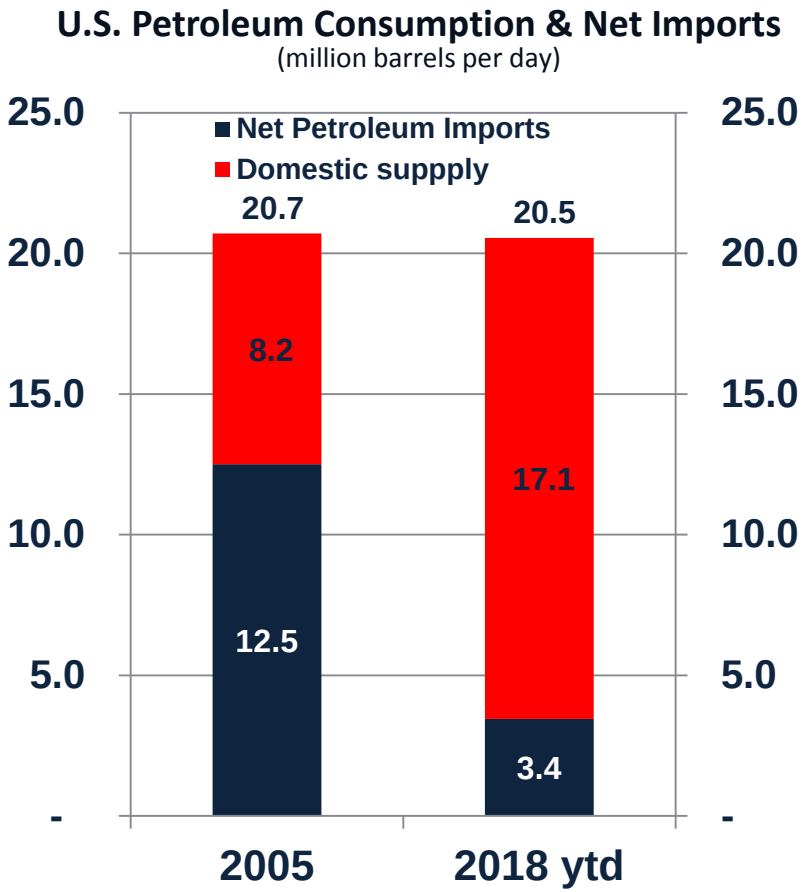


- **L48 oil production peaked in 1970 at 9.6 mmb/d** (full year avg)
  - ✓ **Likely to equal or exceed initial peak in 2020**
- **Alaskan oil production commenced 1973**
  - ✓ **Peaked in 1988 at 2.0 mmb/d**
  - ✓ **Currently around 500 kb/d**
- **OCS production commenced 1981**
  - ✓ **Initially peaked at 1.6 mmb/d in 2002**
    - **Currently averaging near peak levels over the last 18 months**
  - ✓ **Expected to reach 1.9 mmb/d in 2019**
- **At current prices, activity levels and resource estimates, L48 production could increase an additional 3+ mmb/d by 2023**



Source: EIA & PAA estimates

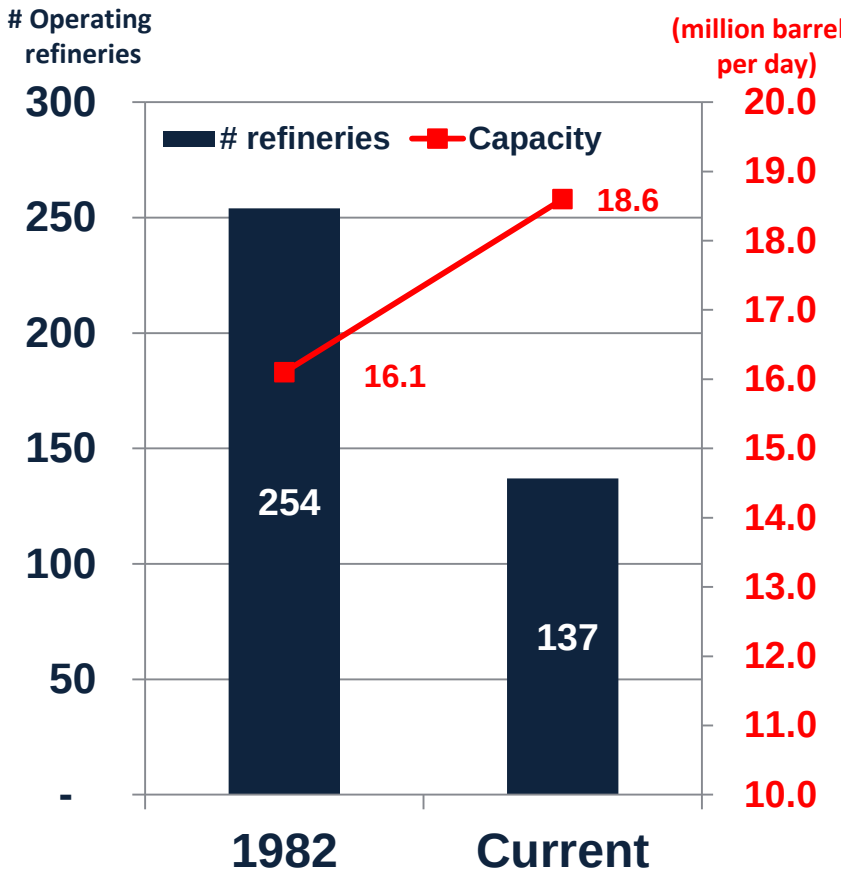
U.S. Reliance on Net Petroleum Imports Reduced From ~60% to Under 20% -- Potential to Approach 0%



- 2005 – net imports totaled ~60% of total U.S. consumption
- 2018 ytd – net imports total +/- 17% of total U.S. consumption
- Visibility for increased domestic production to reduce net imports to +/- 10% over next few years –
  - ✓ Potential to approach 0% in the next 5 years
- Each 1 mmb/d reduction in net petroleum imports reduces the U.S. trade deficit by ~$24 billion/year
  - ✓ Meaningfully greater impact on GDP

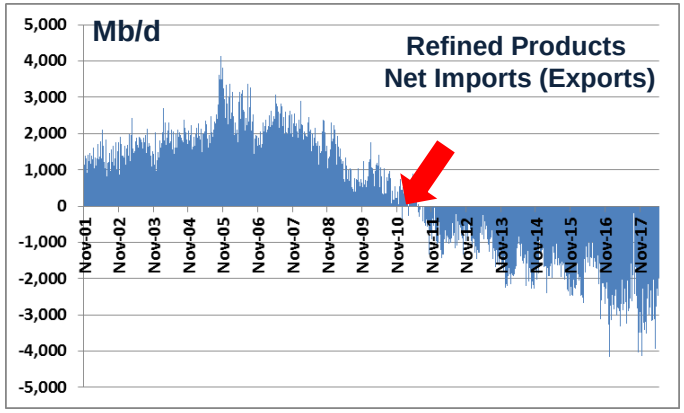
Source: EIA & PAA estimates

U.S. Refineries Today Relative to Early 1980s: ~Half the Number; 15% More Capacity



~135kb/d avg/refinery current versus ~60kb/d

- Rank among the best, most efficient and effective refineries in the world
- Top of class in terms of environmental friendliness and safety for workforce and communities in which they reside.
- Access to competitively priced crude oil and NGL feedstock and low cost, abundant and reliable natural gas
- Since 2010, the U.S. has shifted from a net importer to a net exporter of refined products



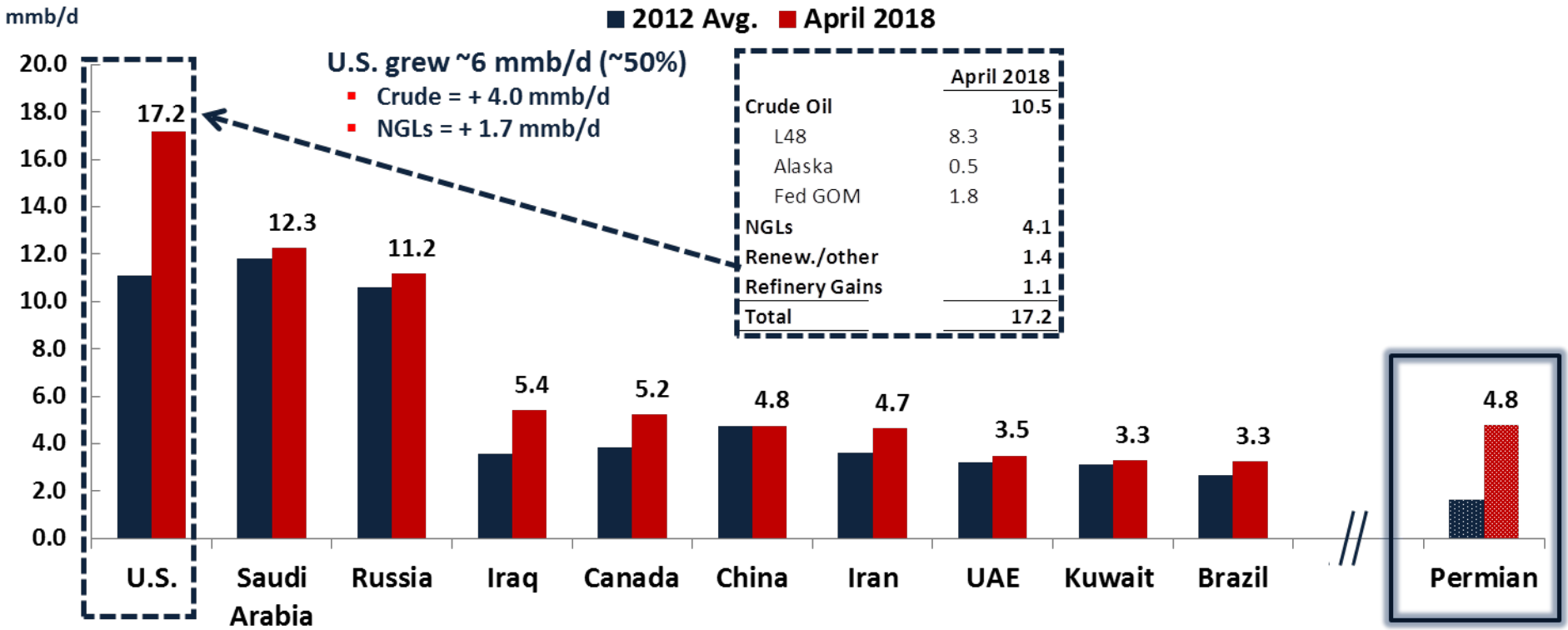
Source: EIA & PAA estimates

U.S. Has Become The World's #1 Petroleum Liquids[(1)] Producer

Permian Basin: Largest U.S producing region

- **World Liquids Production: ~100 mmb/d as of April 2018**
  - ✓ **As a standalone country, the Permian Basin would rank #7 among the world's top liquids producers; expected to be the main driver for continued U.S. production growth**

Top 10 Liquids Producing Nations



	April 2018
Crude Oil	10.5
L48	8.3
Alaska	0.5
Fed GOM	1.8
NGLs	4.1
Renew./other	1.4
Refinery Gains	1.1
Total	17.2

Source: EIA, BTU Analytics & PAA Estimates

(1) Liquids includes production of crude oil (including lease condensates), natural gas plant liquids, biofuels, other liquids, and refinery processing gains.

Contrasting “Then” vs “Now”

(…and associated challenges)

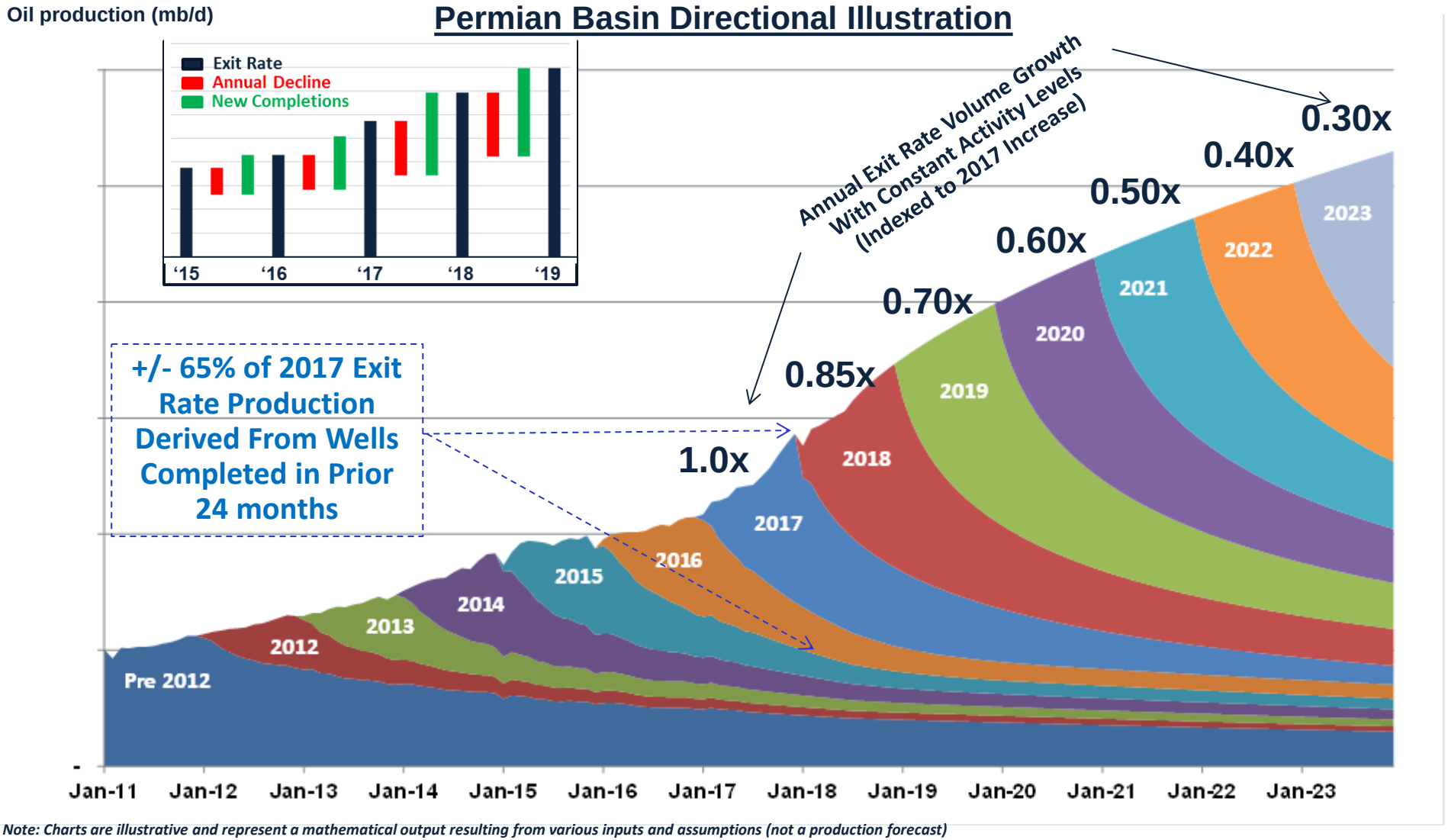
Notable Differences Between "Then" and "Now"

Short-Cycle vs Intermediate to Long-Cycle Projects

- **1970s to Early 2000s:**
  - ✓ Primary industry efforts focused on large deep-water & frontier reserve targets
  - ✓ Involved significant exploration activities
    - Multiple very expensive dry holes / uneconomic developments
    - Long lead times between successful discoveries and first production
  - ✓ Significant upfront capital, long production lives and high operating margins
    - Attractive IRR with high ROI (…but, economics highly dependent on prices at 1st production)
- **Current environment:**
  - ✓ Onshore projects with limited exploration activities; known productive areas & high success rates
    - Primarily a development / manufacturing activity
  - ✓ Short cycle economics
    - Rapid production declines with high sustaining capital costs
    - High IRR with modest ROI (able to respond quickly to changes in prices)
  - ✓ Heightened recognition of the need to:
    - operate in a safe and environmentally responsible manner &
    - embrace alternative energy sources as a fundamental need for our future

High Decline, Short-Cycle Production Profile Requires High Reinvestment

Like Climbing Up A "Down Escalator" At Ever Increasing Speeds



Note: Charts are illustrative and represent a mathematical output resulting from various inputs and assumptions (not a production forecast)

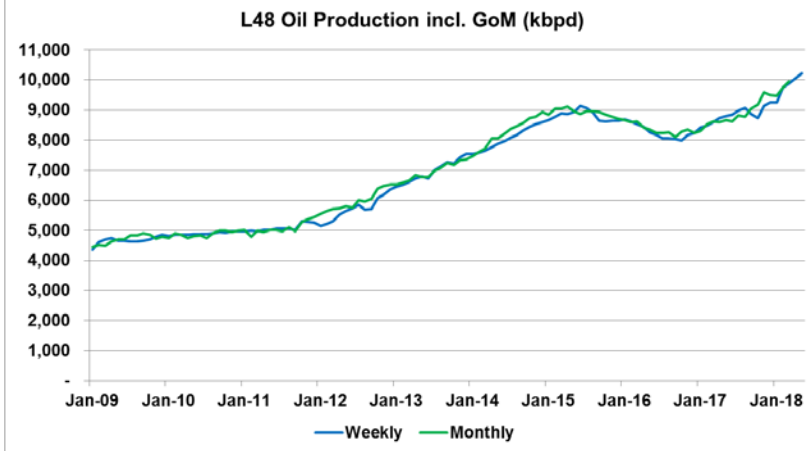
EIA Data Tracking Capabilities, Analyses & Publications Have Come A Long Way as Well

Publication	Time Period	Pages	Frequency	Cost
Monthly Energy Review	Jan 1980	112	Monthly	$23 yr;
	Jan 1993	172	Monthly	$71/yr
	May 2018	245	Monthly	Free on line
Short Term Energy Outlook	1Q1983	74	Quarterly	$24/yr;
	1Q1993	43	Quarterly	$14/yr;
	May 2018	46	Monthly	Free on line

Now available on line, free of charge in various electronic formats along with extensive data bases, multiple analyses and dynamic modeling capabilities

EIA – Collecting, Processing, Analyzing and Publishing Data Is Challenging, Never-Ending and Often Thankless Work

- Although not without variances and occasional revisions, the quality of the information is very good
- Examples of info published weekly include petroleum/crude oil:
  - ✓ Production, consumption, imports, exports, refinery runs, inventory, etc.
  - ✓ Reliant on multiple data sources of varying reliability
- The relative accuracy is impressive. Example:
  - ✓ Comparison of real time weekly crude oil production estimates to monthly estimates based on more complete reports received from states on +/- 2 month lag



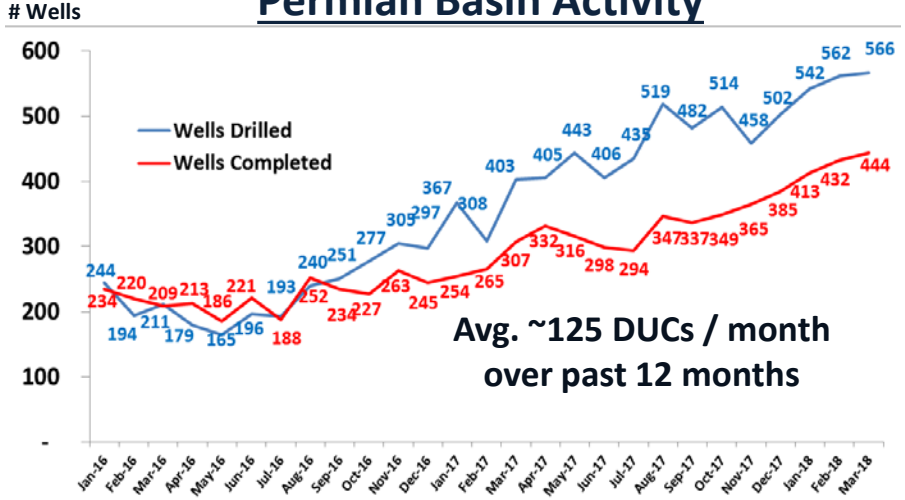
- … and also requires continuous adaptation to changing conditions (e.g. horizontal vs vertical drilling; increasing API gravity, etc.)

EIA Tracking of Drilled but Uncompleted Wells ("DUCs")

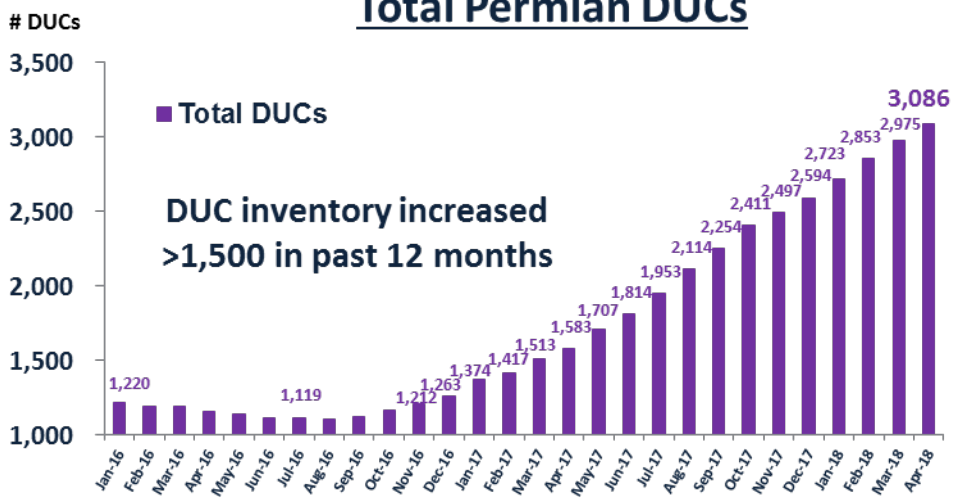
Facilitates Forecasting Completion Activity Independent of Drilling Rig Count

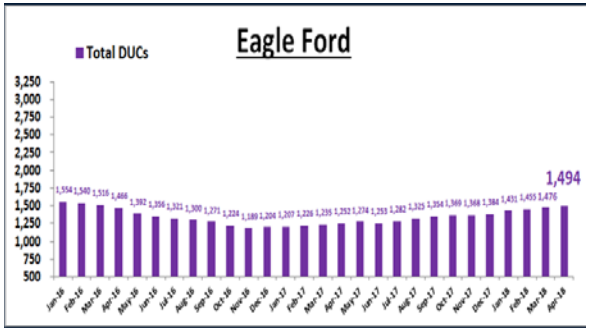
- **Variances in wells drilled vs wells completed adds to/decreases DUC inventory**
  - ✓ **Most major basins currently averaging 6 to 9 months inventory**

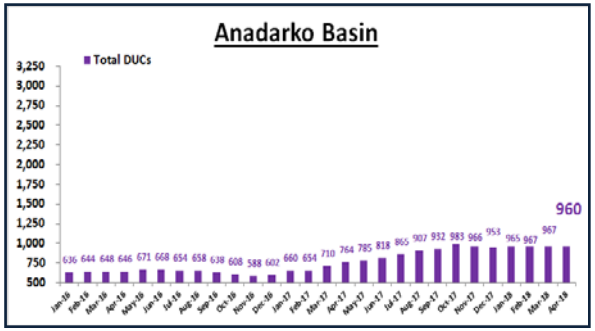
Permian Basin Activity

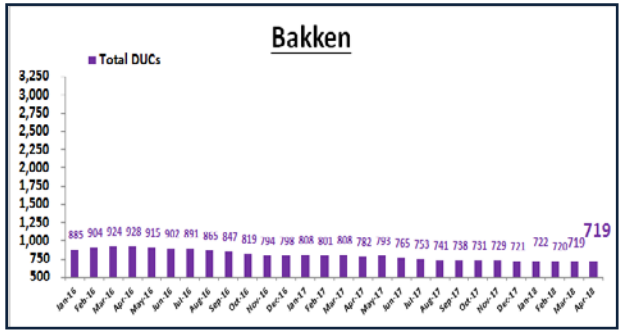


Total Permian DUCs







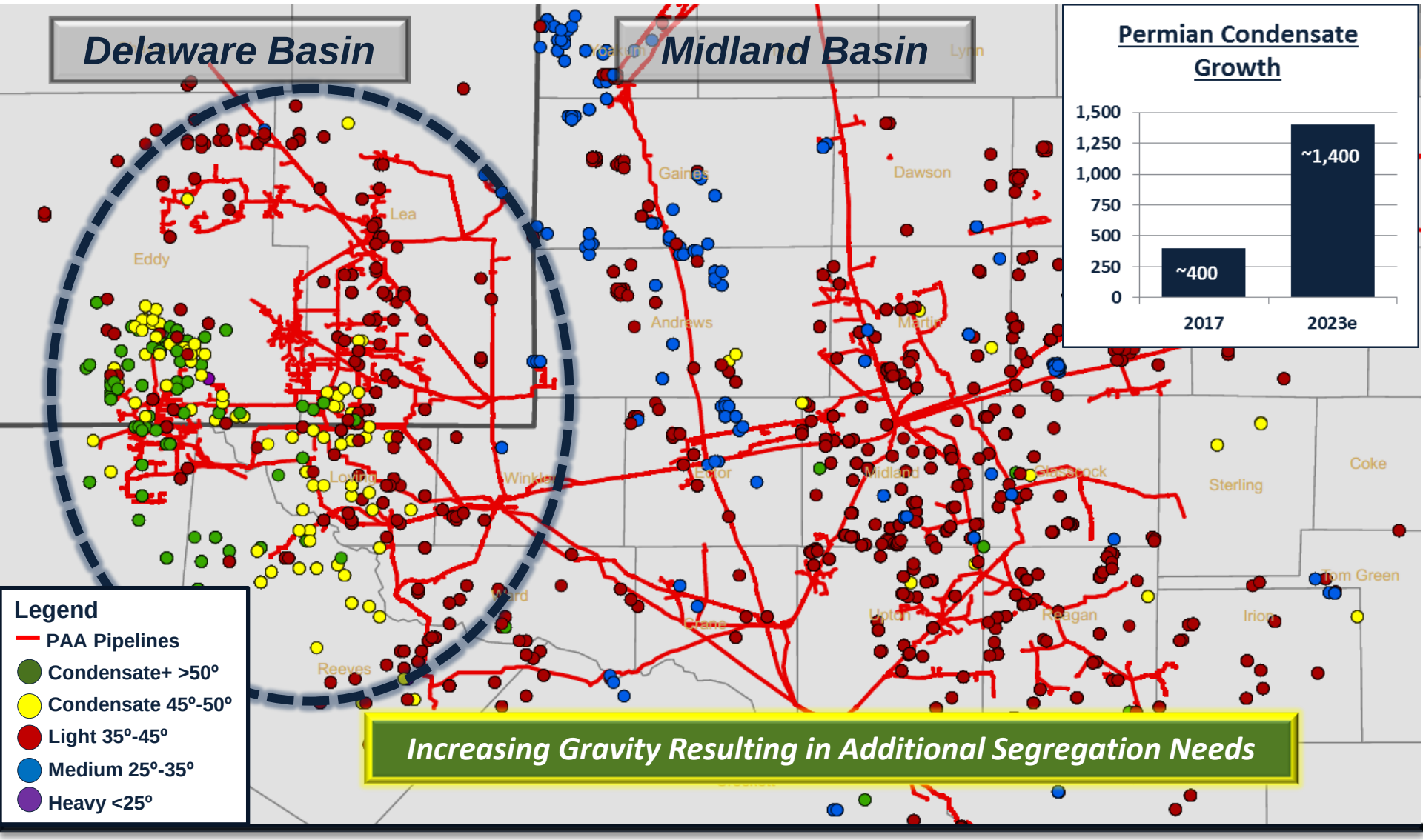


Note: EIA data published May 14, 2018

Source: EIA

Illustration of Changing Conditions: Crude Quality

Permian Basin Driving Increased Light Crude Production



Source: Drilling Info, PAA Estimates

Note API Gravities: Condensate+ >50; Condensate 45-50; Light 35-45, Med 25-35, Heavy <25

The Crude Industry Is Constantly Changing / Adjusting

Requires constant adjustments to data collection & analysis

- **Examples of current / expected issues:**
  - ✓ Distinguishing wells drilled/completed between horizontal & vertical
  - ✓ Age and orientation of DUC inventory (i.e. when drilled; vertical/horizontal)
  - ✓ Tracking length of Hz laterals, volume of sand / water used in fracturing operations
  - ✓ Impact of multi-well pad drilling, down spacing on infill wells, etc.
  - ✓ Assessing the impact on forecasts of differing production practices (i.e. choking back wells vs open choke)
  - ✓ Regional & inter-regional supply / demand balances (e.g. refinery capacity creep, takeaway capacity, etc.)
  - ✓ Tracking the impact of increasing volumes of higher gravity crude oil on the common stream and related segregation needs and import/export influences

Potential Challenges to The Near Term Production Outlook

Key variables to monitor – Items Below are Specific to the Permian

Labor

- Very tight market
- Monitoring: quality and availability of labor

Frac Spreads

- PAA believes frac capacity could limit completions in 2018
- Monitoring: timing of additional frac spreads

Logistics

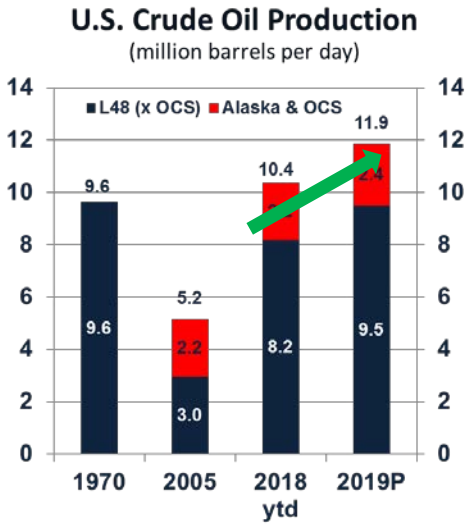
- Saltwater disposal (SWD): sufficient supply, monitoring permit challenges
- Fresh water: sufficient supply, monitoring sustainability
- Frac Sand: sufficient supply, monitoring last-mile logistics

Gas Processing

- Planned capacity appears sufficient
- Monitoring: long lead-time equipment and GOR trends

Take-away Capacity

- Oil: PAA expects capacity constraints for 12-18 months (until new pipes online)
- NGL: sufficient planned capacity
- Residue Gas: Waha basis reflects expected tightness in 2018
  - ✓ Dependent on Mexico demand
- Monitoring: timing of capacity expansions and new builds; impact of steel tariffs & quotas



Source: PAA Estimates

Conclusion

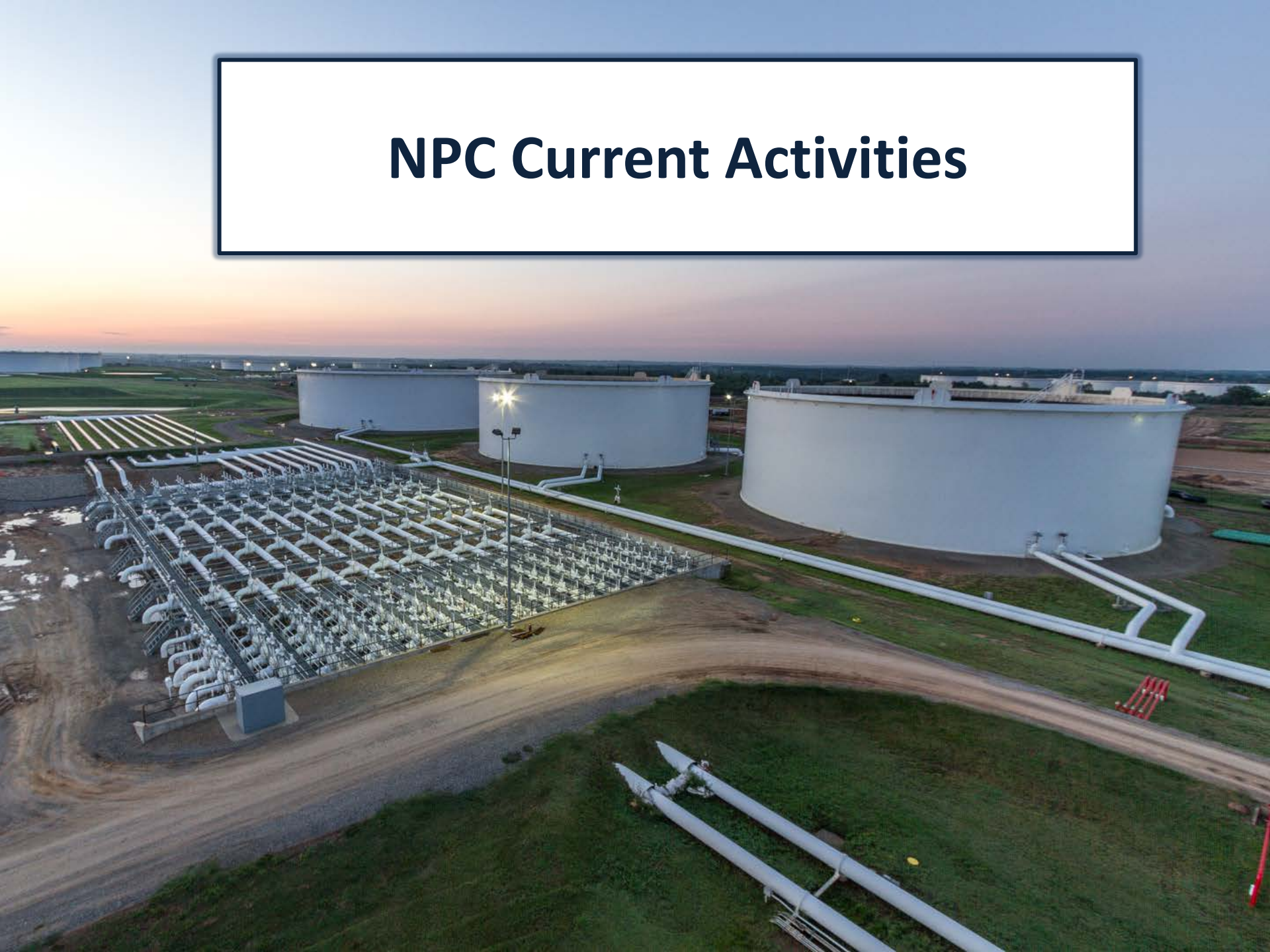
- **The U.S. has undergone a significant, positive transformation over the last +/- 40 years with respect to petroleum and natural gas**

- **It is a great time to be in the energy business in the United States of America, ….**

- **….but there are still challenges / hurdles to overcome and room for further improvement.**

Many of these potential challenges / hurdles are the subject of studies currently being undertaken by the National Petroleum Council

NPC Current Activities



National Petroleum Council ("NPC") – Current Activities

- **The sole purpose of the National Petroleum Council (NPC) is to advise the Secretary of Energy on issues relating to oil and natural gas.**
  - ✓ The NPC only conducts studies in response to specific requests from the Secretary of Energy.
- **Secretary Perry has requested two studies, currently in process:**
  - ✓ Oil and Gas Transportation Infrastructure
  - ✓ Carbon Capture Utilization And Storage (CCUS)

Oil and Natural Gas Transportation Infrastructure Study

Excerpt from Secretary Perry's request:

Key questions to be addressed include:

- What are the important changes in future supply and demand patterns, and what transportation infrastructure improvements are required to leverage the regional and national opportunities offered by these changes?
- What advances in technology could improve the U.S. oil and natural gas transportation system, in terms of safety, reliability, efficiency, and environmental performance? In what new technology areas should research be progressed?
- How can State and Federal governments leverage efforts to support U.S. petroleum and natural gas supply and transportation infrastructure capacity improvements?
- Are there regulatory requirements or policies that may be causing unintended consequences on energy system resilience? If so, what solutions can accomplish the regulatory objective more effectively?
- What emerging issues should policy makers be aware of and what actions should be considered to address these issues?

Carbon Capture Utilization And Storage (CCUS)

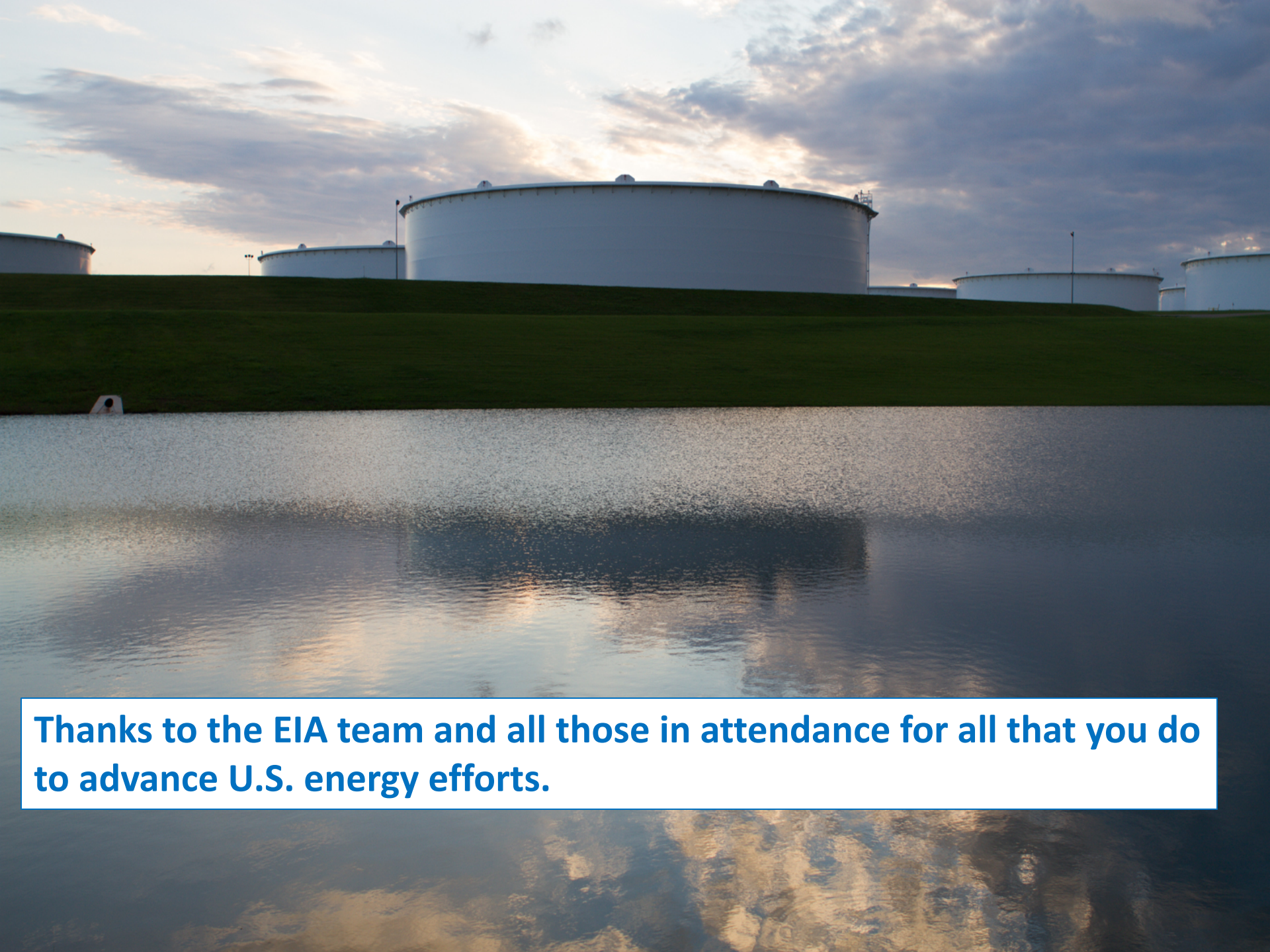
Excerpt from Secretary Perry's request:

Key questions to be addressed include:

- What are the United States' and global future energy demand outlooks and, based on these outlooks, the environmental benefits resulting from the application of CCUS technologies in various end-use sectors?
- What research and development, technology, and infrastructure barriers must be overcome to ensure the economic deployment of CCUS at scale in various end-use sectors?
- How should the success of CCUS at scale be defined?
- What actions can be taken to establish an economic framework that guides public policy and stimulates private-sector investment to advance the development and deployment of CCUS technologies capable of achieving substantive gains in efficiency, economics, and environmental performance?
- What regulatory, legal, liability, or other issues should be addressed to progress commercial CCUS investment and enable the U.S. industry to be the global technology leaders?

NPC Studies – Next Steps

- With NPC and DOE approvals, I will formally appoint Committees of Council members to prepare responses to the Secretary's requests
- Alan Armstrong, Williams, has agreed to Chair the Infrastructure Committee
- John Mingè, BP, has agreed to Chair the CCUS Committee
- Deputy Secretary Dan Brouillette will serve as Government Co-Chair of both Committees
- Committees will have Steering Committees, Subcommittees and Task Groups to conduct the studies and prepare reports – 100 to 200 participants on each effort
- Organizing, scoping and staffing are ongoing
- Completion expected in 12 to 15 months



Thanks to the EIA team and all those in attendance for all that you do to advance U.S. energy efforts.