PerspECCtive

Theme:
Performing While Transforming: Executing Now, Evolving for Tomorrow

2021 ECC Conference Sponsors Only Session

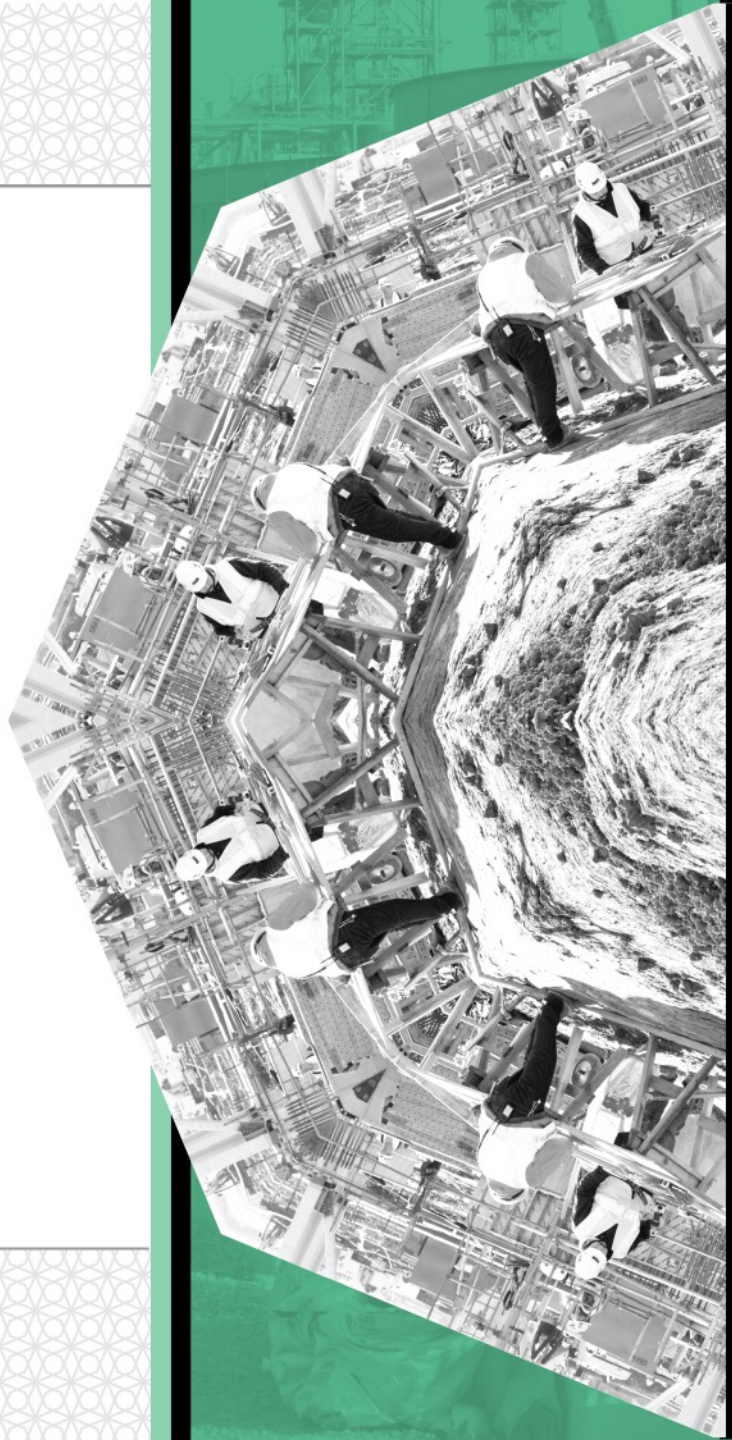
Andras Marton, PhD, IPA
Christopher Howell, Shell
John Platt, Bechtel
Jason Kraynek, Fluor

Year: **2021**

Date: **Sept. 8**

Location: **Gaylord Texan Hotel Grapevine, TX**

ECC



ECC Conference Sponsors Only Session Workshop

- Workshop Theme: **Performing While Transforming: Executing Now, Evolving for Tomorrow**
  - Forum for ECC sponsor companies to share best practices in the capital projects industry
  - Sharing perspectives from multiple lenses from planning/prioritizing capital investments to completing complex/ challenging projects during the pandemic

Andras Marton, PhD, IPA

Christopher Howell, Shell

John Platt, Bechtel

Jason Kraynek, Fluor

Sponsors Only Session Workshop agenda	Timing (CDT)
• **Welcome, Workshop Overview, and Introductions** • Featuring Shell's PennChem Project: "Performing while Transforming"	1:00 p.m.
• **Capital Projects Industry Overview: Performing** – Andras Marton, PhD (IPA's Business Manager for the Energy Sector)	1:05 p.m.

• **Pennsylvania Chemicals Project Overview**
  – Chris Howell (Shell – Project Director)
  – John Platt (Bechtel – Senior Project Manager)
	1:30 p.m.

• **Facilitated Breakout Session #1** – "Performing": taking care of the workforce and community	1:55 p.m.
• **Break** (10 minutes)	2:35 p.m.
• **Capital Projects Industry Overview: Transforming** – Andras Marton (IPA)	2:45 p.m.
• **Facilitated Breakout Session #2** – "Transforming": prioritizing innovation/digitalization efforts and ensuring effective implementation (and that we're solving the right problems)	3:05 p.m.
• **Closing and Key Learnings from the PennChem Project**	3:45 p.m.
• **Workshop adjournment**	4:00 p.m.

Jason Kraynek, Session Focal Point

Andras Marton, Session Moderator & Presenter

Chris Howell, Shell Project Director & Session Presenter

John Platt, Bechtel Senior Project Manager & Session Presenter

Performing while Transforming

FLUOR®

IPA

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Independent Project Analysis

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Coming Through the Pandemic—
How the Capital Projects Industry Responded to COVID-19

ECC Sponsors Only Session
September 2021

Andras Marton
IPA Business Manager for Hydrocarbon Processing & Transportation

Overview

- We will review the effect of the COVID-19 pandemic on capital projects and share the strategies different owner companies have used to mitigate these effects
- The good news is that 1.5 years after the start of the pandemic, capital project engineering and construction productivity are returning to near-normal levels
  - However, materials pricing and availability are a growing challenge
- As capital investment and project re-starts begin to accelerate, staffing projects and managing the supply chain are key challenges for projects to navigate
- Later, we will talk about how the industry is increasing looking to digitalization as a solution to these and other challenges

State of Industry Through COVID-19

IPA's COVID-19 Owner Survey

IPA's COVID-19 survey obtains detailed responses regarding how the coronavirus is currently affecting capital projects

Collected Data on Relevant Topics

Effects on Engineering and Construction and Internal Operations

Supply Chain Disruptions

Portfolio Implications

Mitigation Strategies

Owner Company Participants: 48

Surveys issued quarterly starting in March 2020 and continuing through 2021

This presentation shares preliminary findings from most recent survey in August 2021—focused on North America respondents only

Representing Various Industrial Sectors

Exploration and Production

Refining

Chemicals

Midstream

Power

Mining, Minerals, and Metals

Pharma

Overall Portfolio Impact of the Pandemic

- IPA surveys showed that owners cut capital expenditure by 30% to 40% in 2020
- On average, owners postponed 40% of their capital projects portfolio
  - The average size of the postponed projects is $17MM
  - The mean duration of the postponement was 25 weeks on projects stopped and restarted
- Very large projects were more likely to be canceled outright
  - The average size of the canceled projects is $200MM
- Projects that proceeded during the past year described varying effects on engineering, procurement, and construction, as shown in the next slides

Engineering Is Less Disrupted as We Have Acclimated to the Situation, but Some Delays Continue

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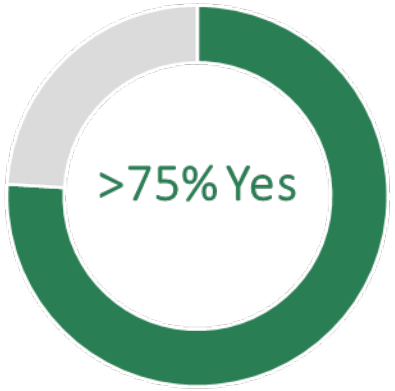
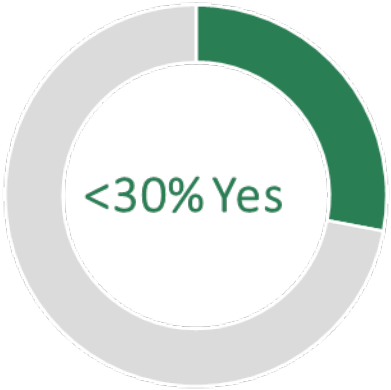
Are you experiencing disruptions in engineering?

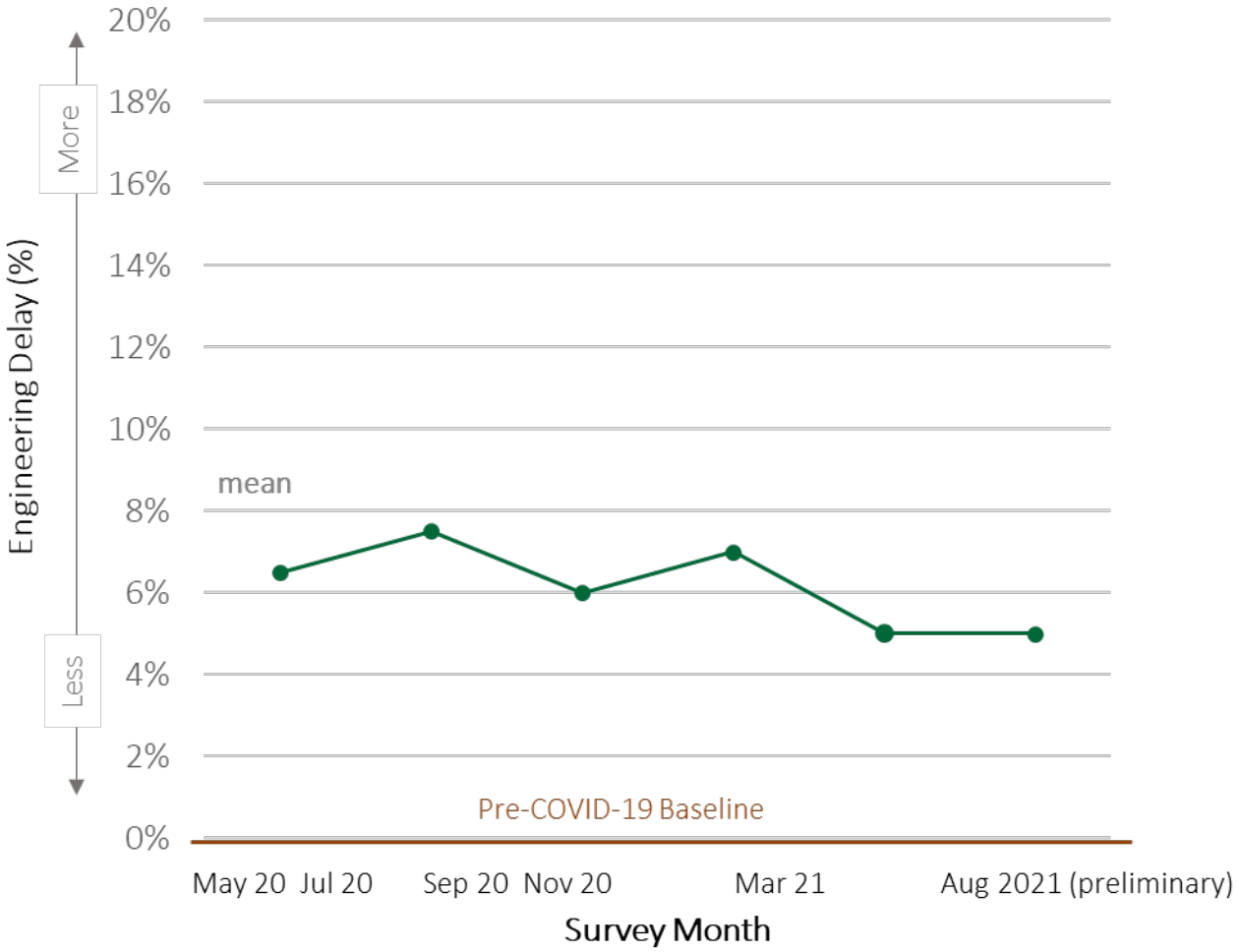
Start of pandemic:



Most recent feedback:

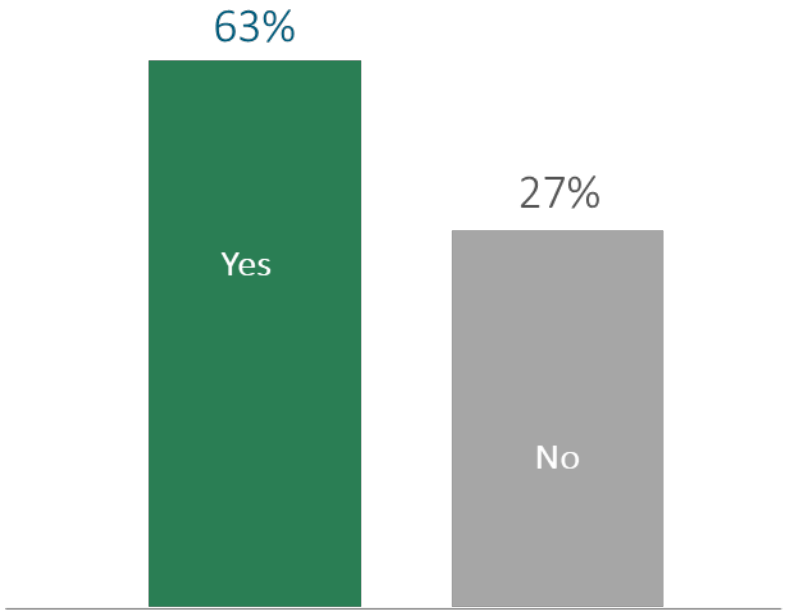


How much engineering delay are you experiencing?



There Are Growing Concerns about How Engineering Companies Will Respond to Increased Project Activity

Are you concerned about how engineering companies are likely to respond as project activity ramps up?



"Design performances are significantly reduced due to absence of core face to face meetings"

"Significant layoffs and head count reductions will make it difficult to staff back up in expected time frames"

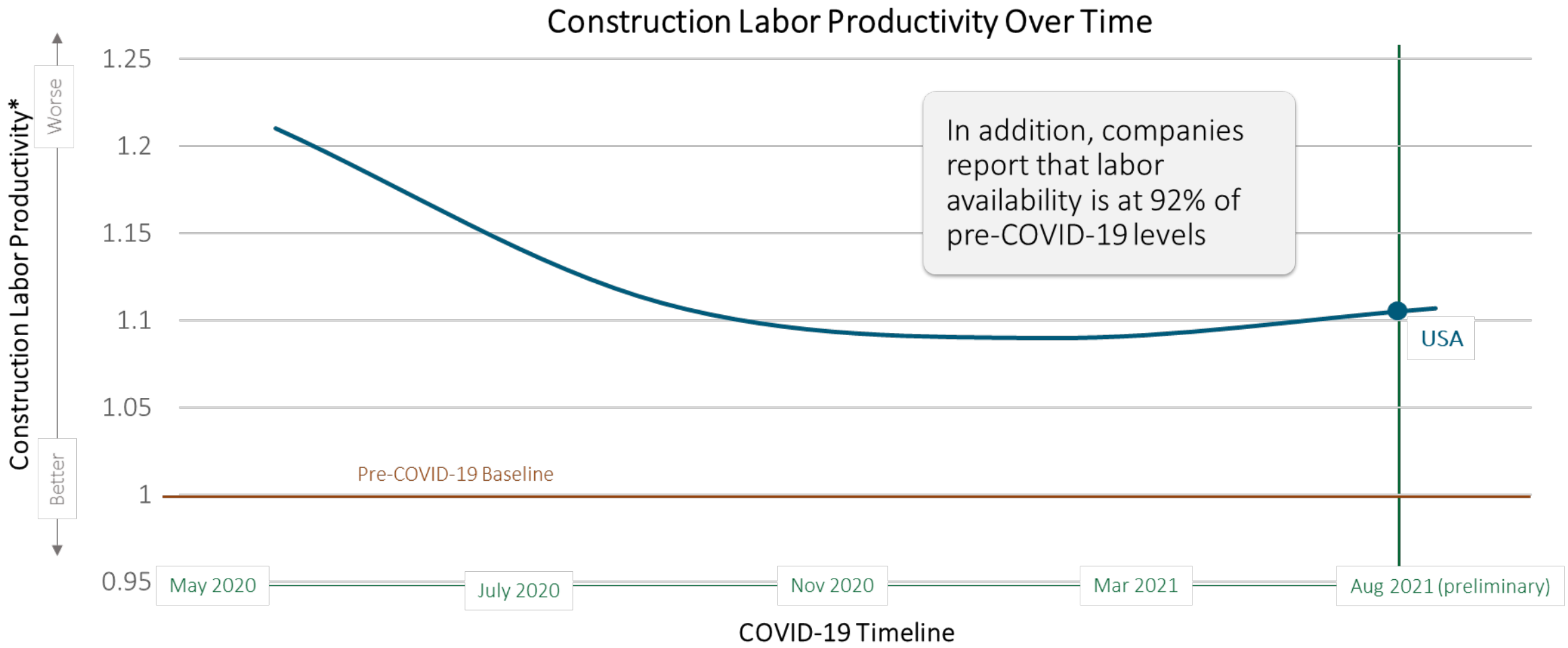
"Concern about ability to ramp up with qualified resources"

"More acute expertise gap than before the pandemic"

"Our engineering value center in India has been functioning at 25% to 75% of full capacity due to delta variant"

"Less experience on contractor side means we (owner) need to maintain increased presence at their offices – we haven't been able to do this during the pandemic and that caused cost growth and schedule delays"

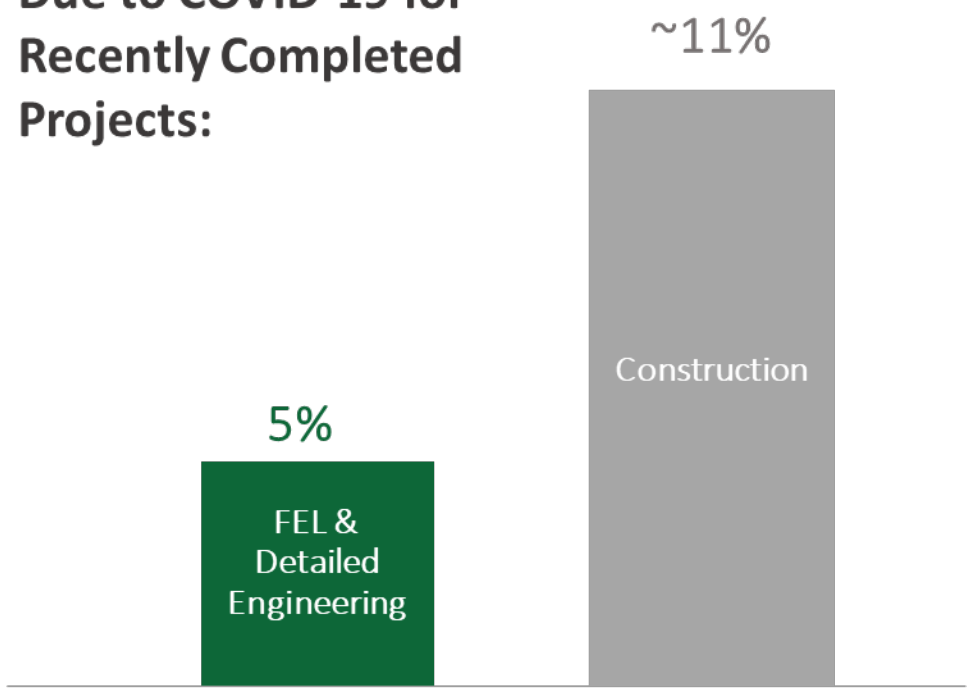
Construction Labor Productivity Initially Improved but Is Recently Degrading



*Where 1.0 equals pre-COVID baseline and numbers >1.0 represent worse productivity

Companies Report Cost Growth Is Most Significant for Construction

Reported Cost Growth Due to COVID-19 for Recently Completed Projects:



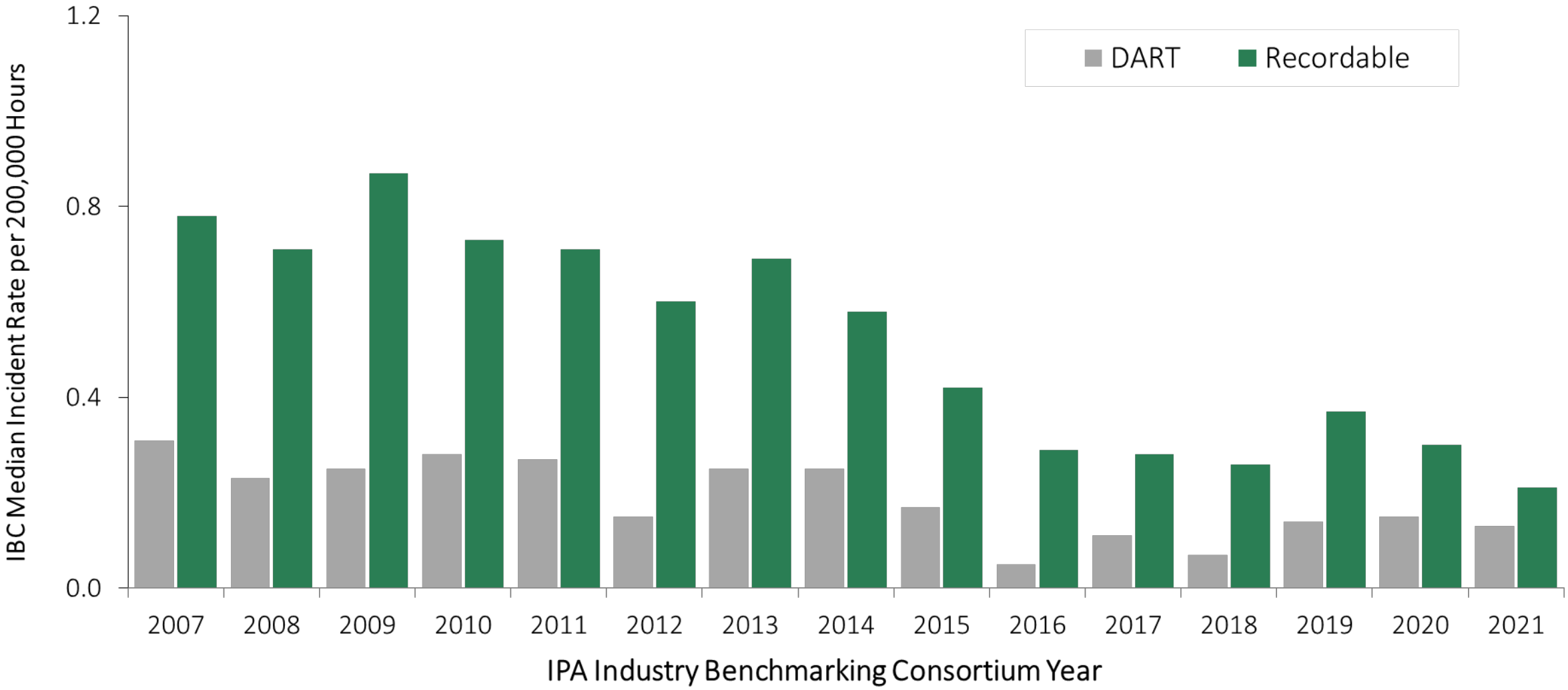
"Projects using our EVC in India incurred 10% engineering cost growth in June"

"Project organizations adapting to reduced project portfolios; some reduction in indirect costs by shifting construction management responsibilities from contractors to owners"

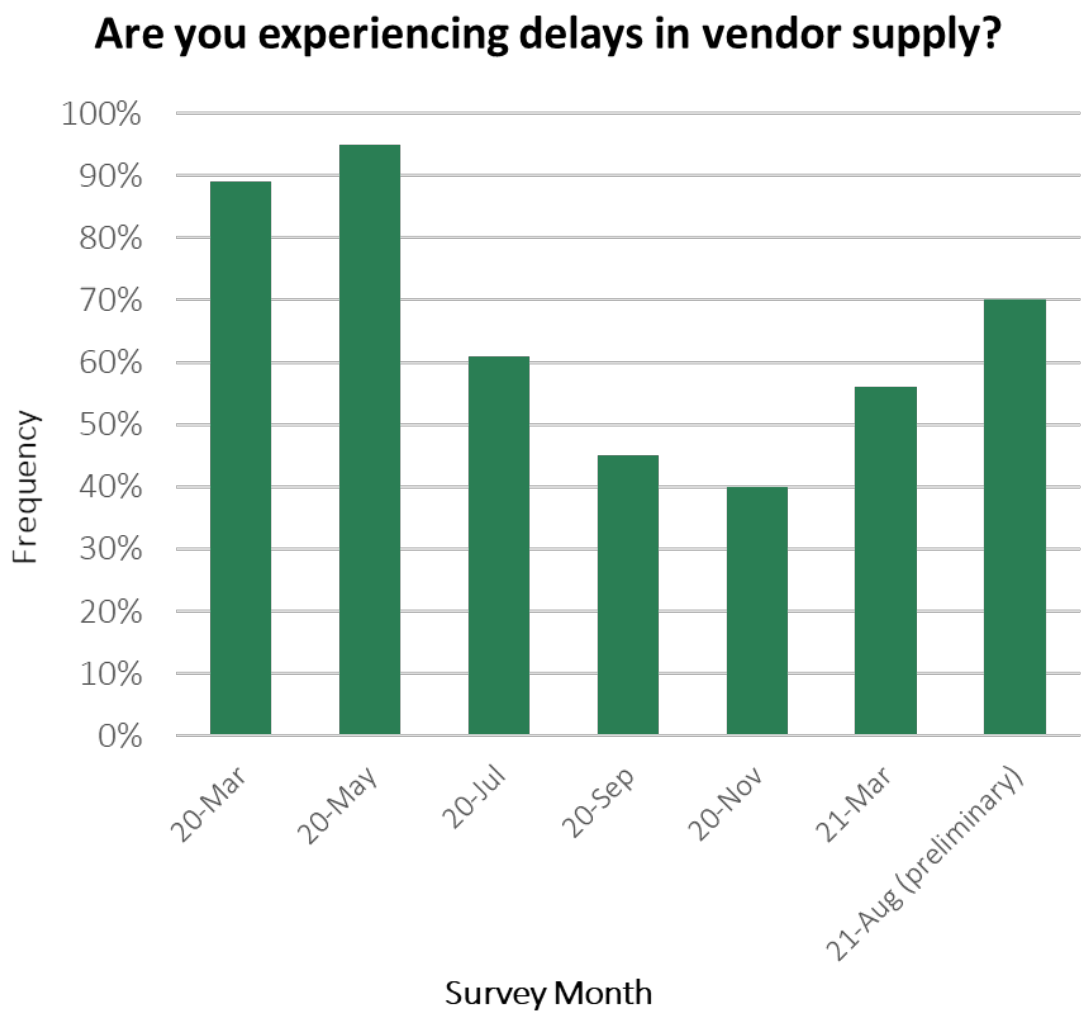
"Construction productivity losses due to lost time getting to the job; projects and Turnarounds taking longer to complete"

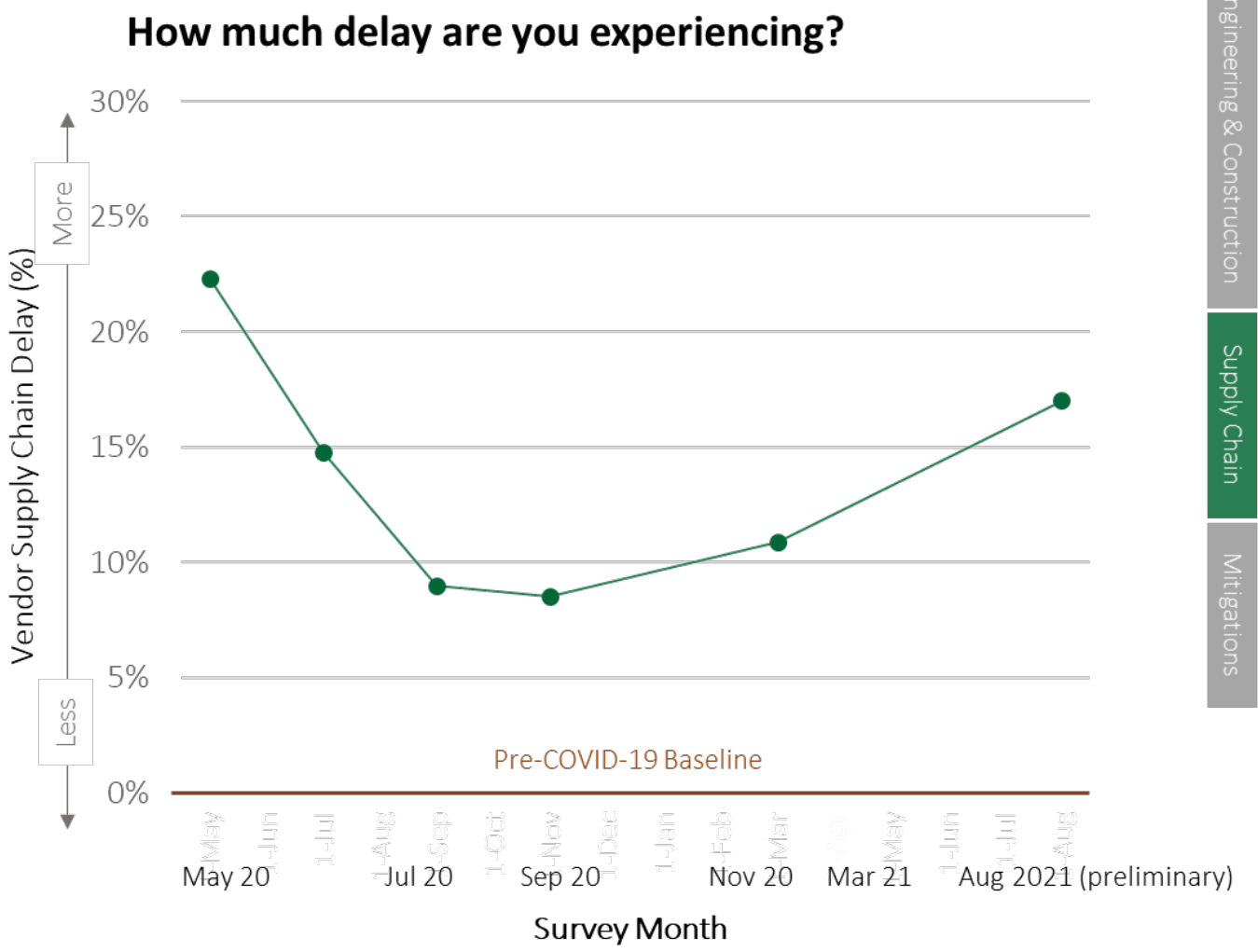
"We had to stagger bussing of craft arrival/departure, add lunch tents, etc."

Safety Data Continue to Show a Recent Improvement Trend



After Improving in Late 2020, Vendor Delays Have Increased in 2021





Procurement Delays Are Significant and Affecting Equipment Sourced From Most Parts of the Globe

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"Overseas shipping is delayed due to limited availability of shipping vessels"

"We have decided not to place any orders from outside of the US during the pandemic"

"Experiencing piping and pump delay delivery from oversea countries, ships out from China are extremely busy"

"Do not trust any lead times given for materials"

"Critical engineered equipment is experiencing significant delays with equipment sourced from Europe being the worst"

"Unexpected and seemingly minor components cause delays"

Examples of Owner Mitigation Strategies—Engineering

- Appropriate engagement and clarity of support to firms on prioritization and expediting of deliverables; diligent, more deliberate communication
- Working with other companies, equipment suppliers, and vendors to partner in utilizing virtual technologies
- RealWear headsets used in the field for walkdowns and questions
- Use of engineering document management system for engineering review & approval
- Using unmanned vehicles to capture photogrammetry in place of quantity surveyors
- Doing more work than usual internally on engineering workscope definition
- A company that usually changes PMs at authorization kept both development and execution PM on project until startup to avoid further disruptions

Examples of Owner Mitigation Strategies—Supply Chain

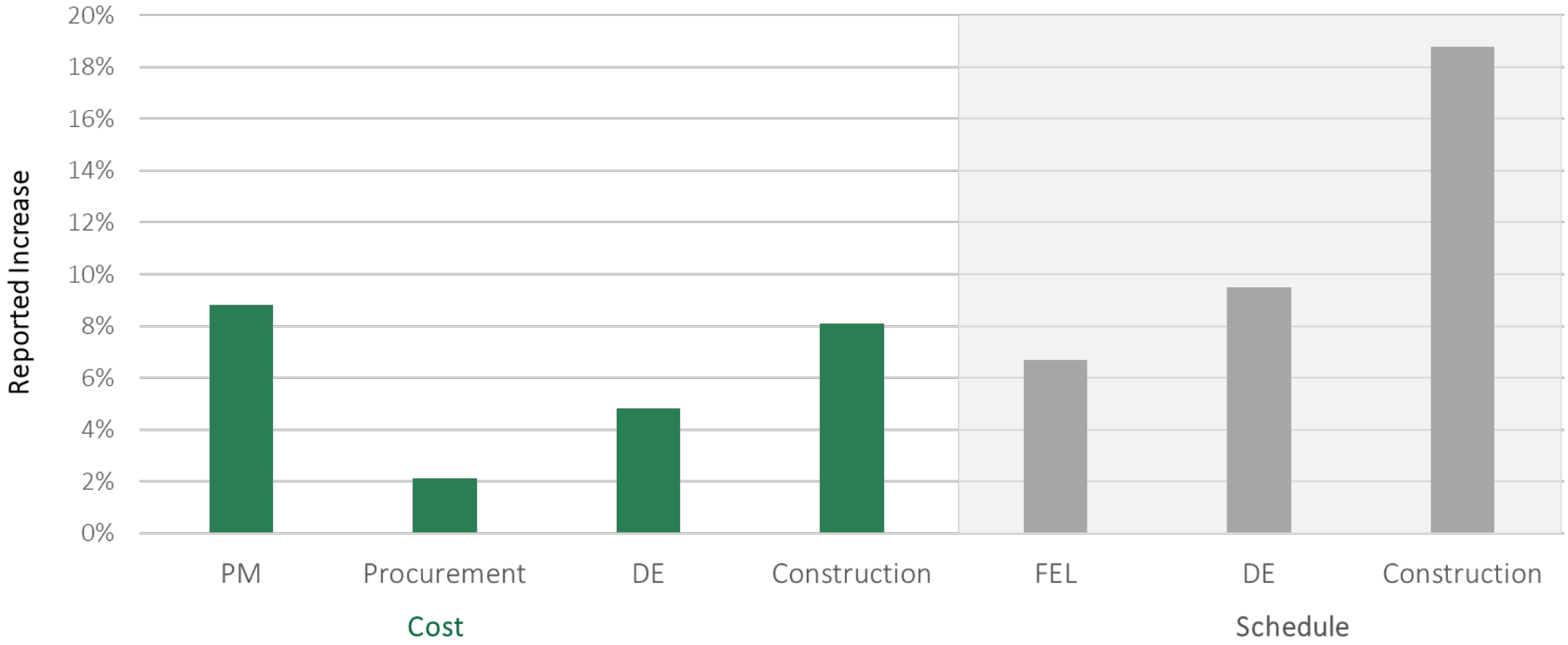
- Looking for alternate vendors
- Tracking the country of origin at the widget level
- Developing relationships with contingency supply chain vendors
- Increasing owner engineering resources to catch up in China as the local vendors resume work
- Asking suppliers to utilize alternate inventory locations
- Placing orders earlier to improve chances of on-time delivery
- Seeking off-the-shelf equipment even if it's not the exact project requirement
- Requiring weekly updates from key vendors
- Incentives for acceleration measures
- Adding staff to track deliveries

Examples of Owner Mitigation Strategies—Construction

- Repeated COVID-19 testing and tracking
- Contact tracing
- No visitors policy
- Eliminating turnstiles
- Hand sanitizing stations
- Touchless work processes
- Staggering busing of craft labor to and from site
- Social distancing in lunch tent
- Examine craft living arrangements to mitigate risk of 1 positive case causing a large group to quarantine
- Proximity alarms on worker badges
- Requiring vaccinations for all employees and visitors

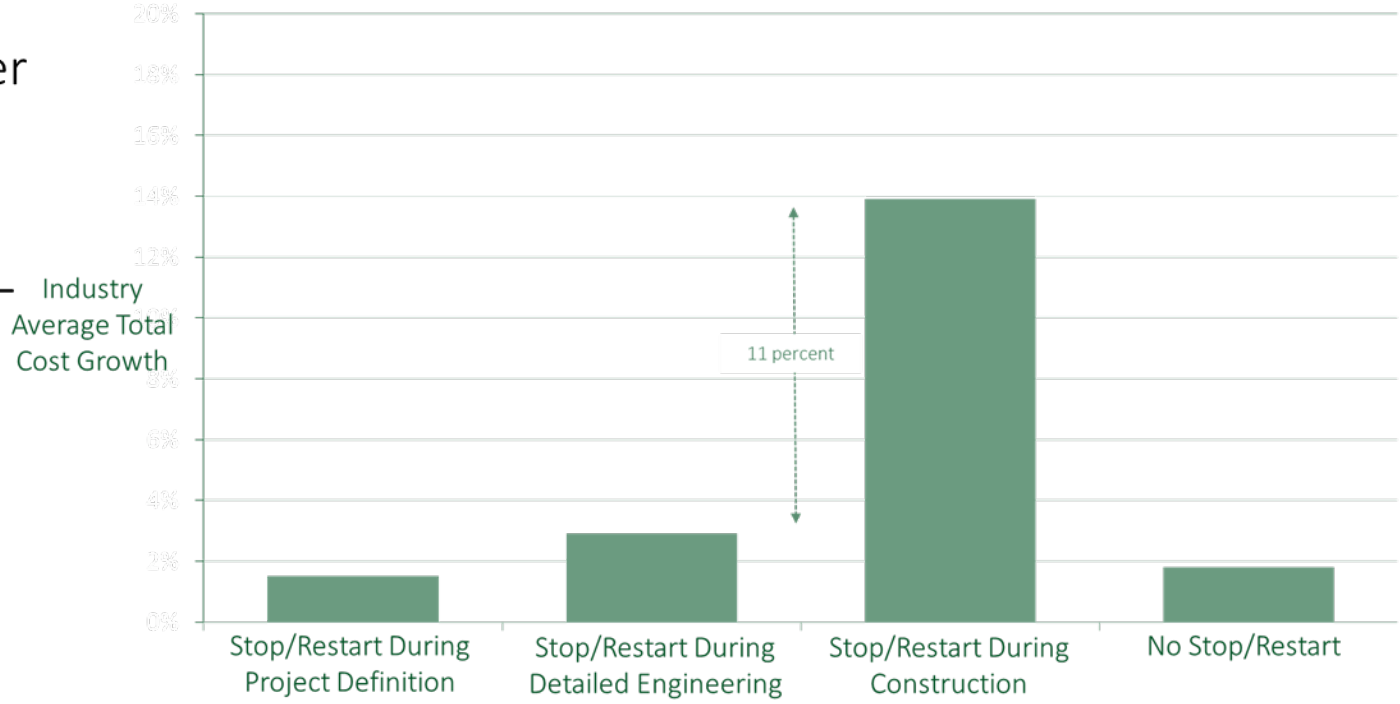
Overall, Companies Have Adjusted Cost & Schedule Targets to Reflect Challenges of Pandemic

Question: How has the COVID-19 pandemic influenced cost and schedule targets in your system?



IPA Research on Mitigation Strategies for Project Restarts

- Recognize that projects paused in later phases (construction) are likely to incur 11% higher cost growth than projects paused in early phases (FEL or detailed engineering)
- Plan time for team formation—if team has disbanded, re-forming an effective new team can take more than a year
- Consider the speed of the re-start—fast-paced restarts tend to have higher rates of recordable incident rates than slower re-mobilizations
- Avoid indefinite holds when feasible—the longer the pause, the higher the risk of missing NPV forecasts and being subject to new regulations or permitting issues



What Do We See Right Now?

Leading Indicators Are Reason for Optimism

- Consumer and business confidence has improved
- Both US and Canadian economies have proven resilient, even in the face of the Delta variant and new, localized lockdowns
- Capital spending is recovering—half of survey respondents indicate they plan a significant increase in number of projects entering execution
  - Even upstream and refining and transportation sectors, which were hardest-hit during pandemic, are developing major new projects
  - Significant investment in semiconductors, data centers, warehouses, etc.
  - US seeing more capital spent on renewables, low carbon projects, and CCUS projects
- Industry has adapted to working in pandemic environment
  - A few clients report their projects may be even more productive—less congestion, unity around coming through the pandemic together

What Do We See Right Now?

New Challenges Lay Ahead

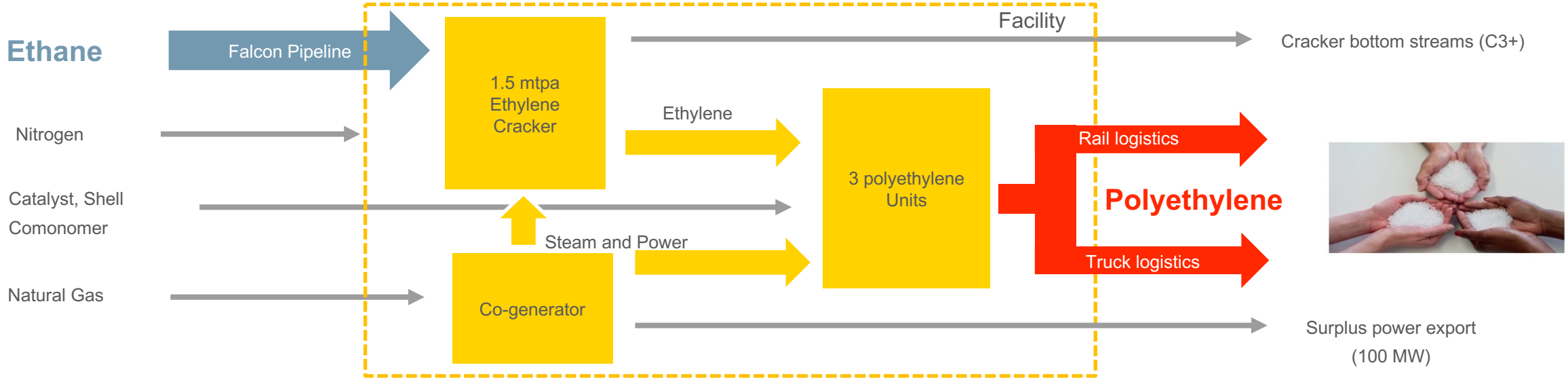
- It is harder to staff projects
  - Retirements and layoffs during the pandemic—combined with current competition for industry talent—mean both experienced and junior staff are in short supply
- Commodity prices are surging, particularly in the housing sector; iron ore and steel prices are projected to stay elevated; and oil prices are expected to continue a slow rising
  - IPA forecasts that engineering and construction labor wage rates in the US and Canada will continue increasing at a measured pace over the next few years (with localized increases balanced out by increasing use of EVCs and modularization)
  - However, materials are more likely to continue increasing at a rapid clip; in particular, we expect piping, mechanical equipment, and electrical equipment to increase at an annual rate of 2% to 4% over the next few years
- Challenges have accelerated interest in digitalization as a solution to increase cost and schedule effectiveness on capital projects

Pennsylvania Chemicals Project

Shell Project Director, Chris Howell

Bechtel Senior Project Manager, John Platt

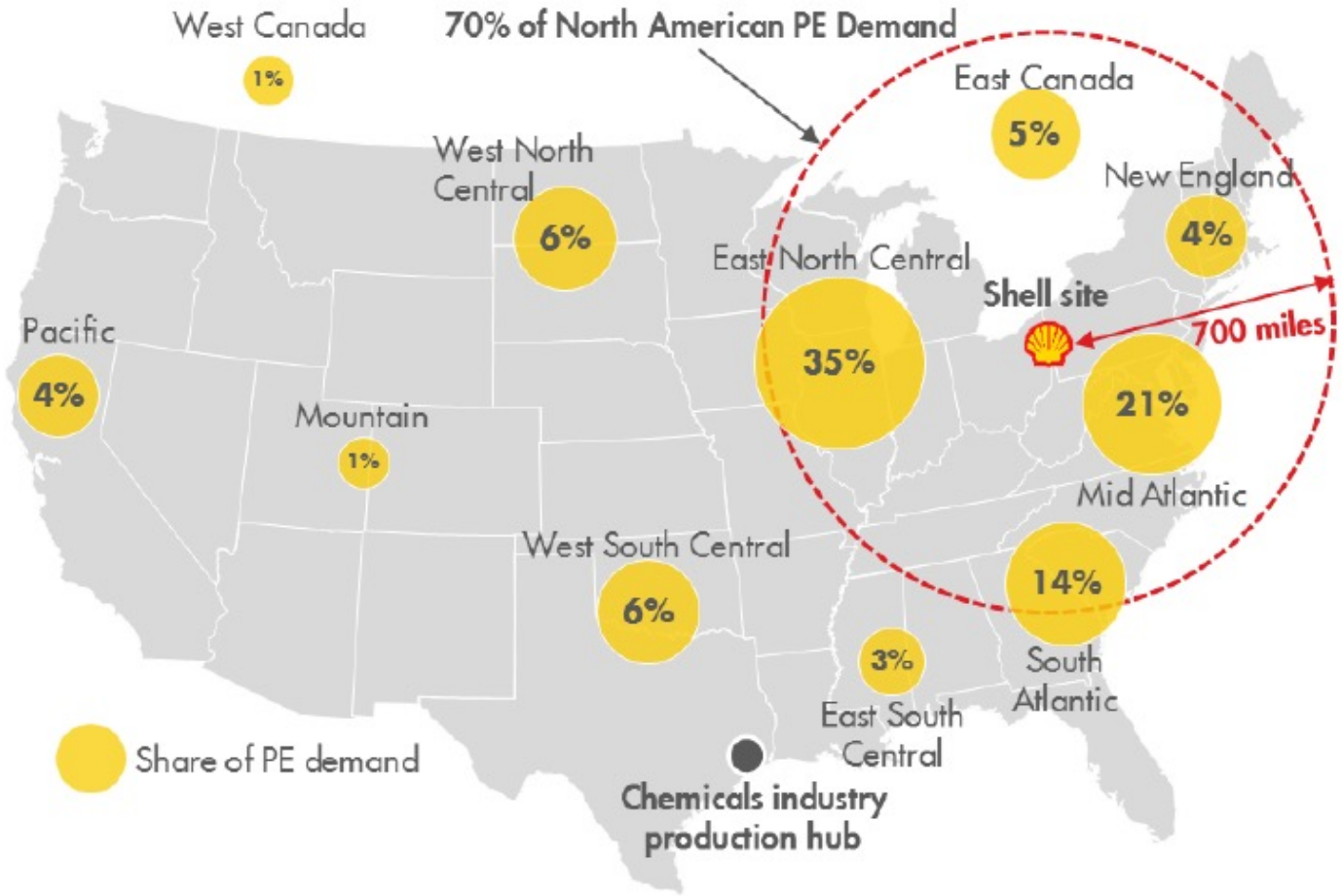
What are we building?



Why Western PA?

Shell's Plant in Beaver County

- Local supply of ethane
- Local conversion to Polyethylene
- Marketed to regional PE users
- Access to rail, river and Interstate



October 2014

Mid 2017

Copyright of Shell Chemicals

May 2020

September 2021

Pennsylvania Chemicals at a glance

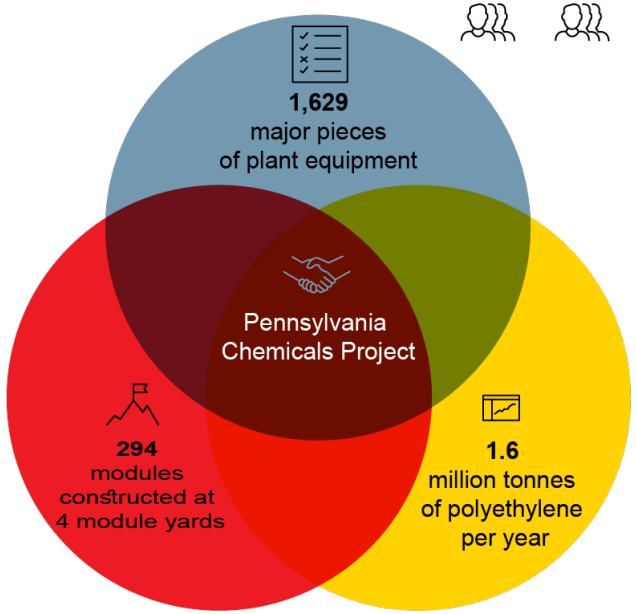
+9,000 employees at peak

150 local / regional suppliers

65 minority / women owned business

50 local / regional contractors on site

15 unions represented

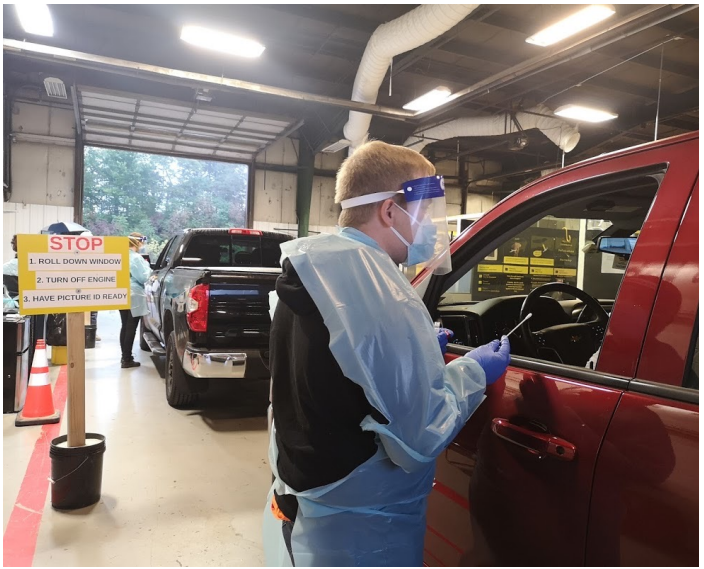


We are very proud to be working with our union partners

A CULTURE OF RESPECT:

How the Code of Excellence Transformed Pennsylvania Chemicals

Engagement 1 – Building Resiliency Around COVID-19



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Using the themes of building resiliency around COVID-19, sustaining culture and innovation, and based on your experience, what were your (critical) key actions taken to care for the workforce and community?

ⓘ Start presenting to display the poll results on this slide.

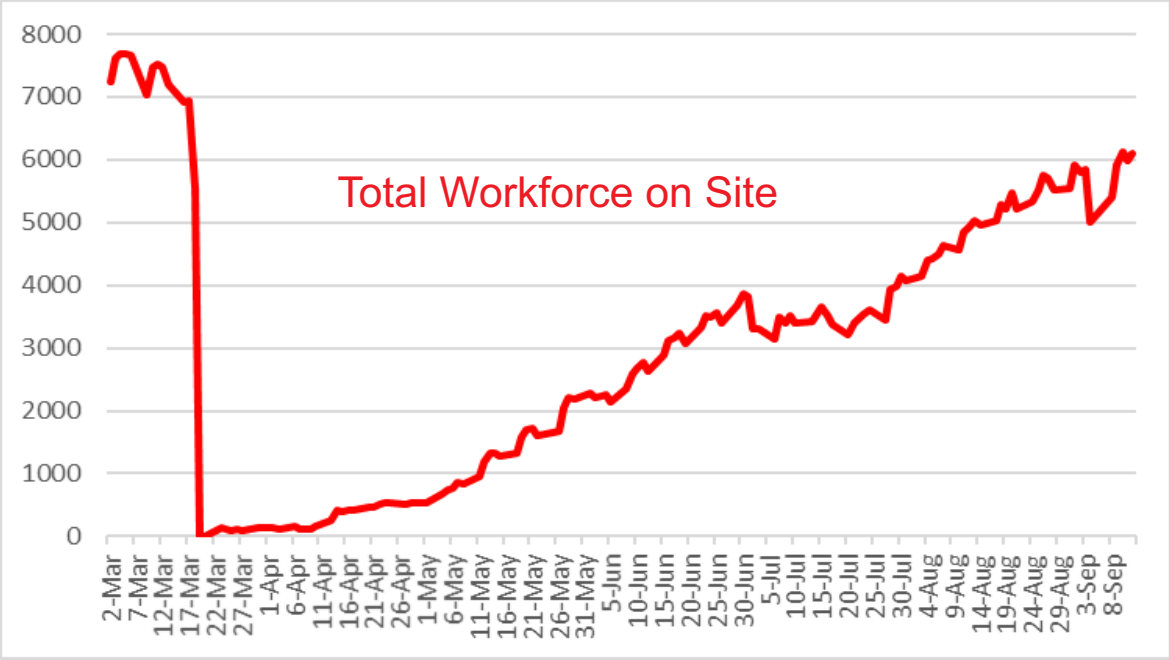
Workforce Impacts of COVID-19

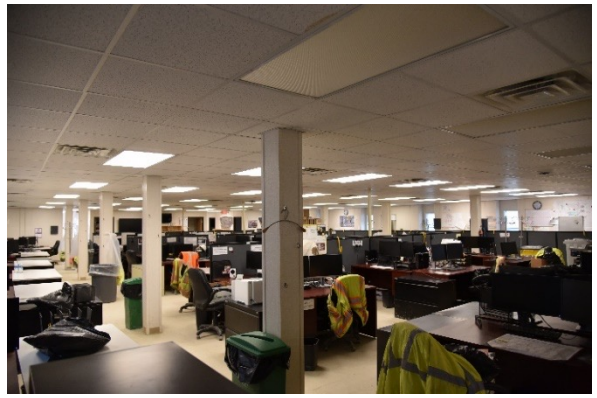
External Landscape - March 2020

- Outbreak in local nursing home
- Increasing community cases
- Concern of health care providers to meet local needs
- Local officials concerns of large workforce in their community

Situation required action

- On March 18th, the leadership decided to pause construction to understand and mitigate the risks of COVID-19
- Initiated a deep cleaning of the site
- Developed an extensive Exposure Control Plan
- Returned workforce in a controlled manner to ensure efficacy of mitigation measures
- Mid-July – added on onsite testing lab from RJ Lee – local company; results in 4-5 hours, which helps keep COVID offsite and helps in managing contact tracing.





Caring for Workers, their Families and the Community

Controls to mitigate the spread of the virus above and beyond State and CDC Guidance

- Medical facilities; staffing, competency, transport, PPE
- Social distancing in personnel facilities; lunch, office, restrooms, smoking
- Transport; 50% occupancy for busses, onsite vehicles
- Social distancing during onsite Construction and Commissioning work
- Onsite testing; diagnostic and screening COVID-19 test (track, trace, isolate)
- Changing well established habits and behaviors'; engagement, high transparency, collaboration

GOAL: PROTECT THE WORKFORCE, THEIR FAMILIES AND THE LOCAL COMMUNITY WHILST PROGRESSING THE PROJECT AND PRESERVING JOBS

Caring Through Covid

Pennsylvania Chemicals Project

Monaca, Pa

All interviews were conducted with 6 feet of distance following CDC guidelines and recommendations. Interviewee masks were only removed briefly while speaking and placed back on immediately following the interview conclusion.

Jason Kraynek, Session Focal Point

Andras Marton, Session Moderator & Presenter

Chris Howell, Shell Project Director & Session Presenter

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Performing while Transforming

10 Minute Break

Independent Project Analysis

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Coming Through the Pandemic—
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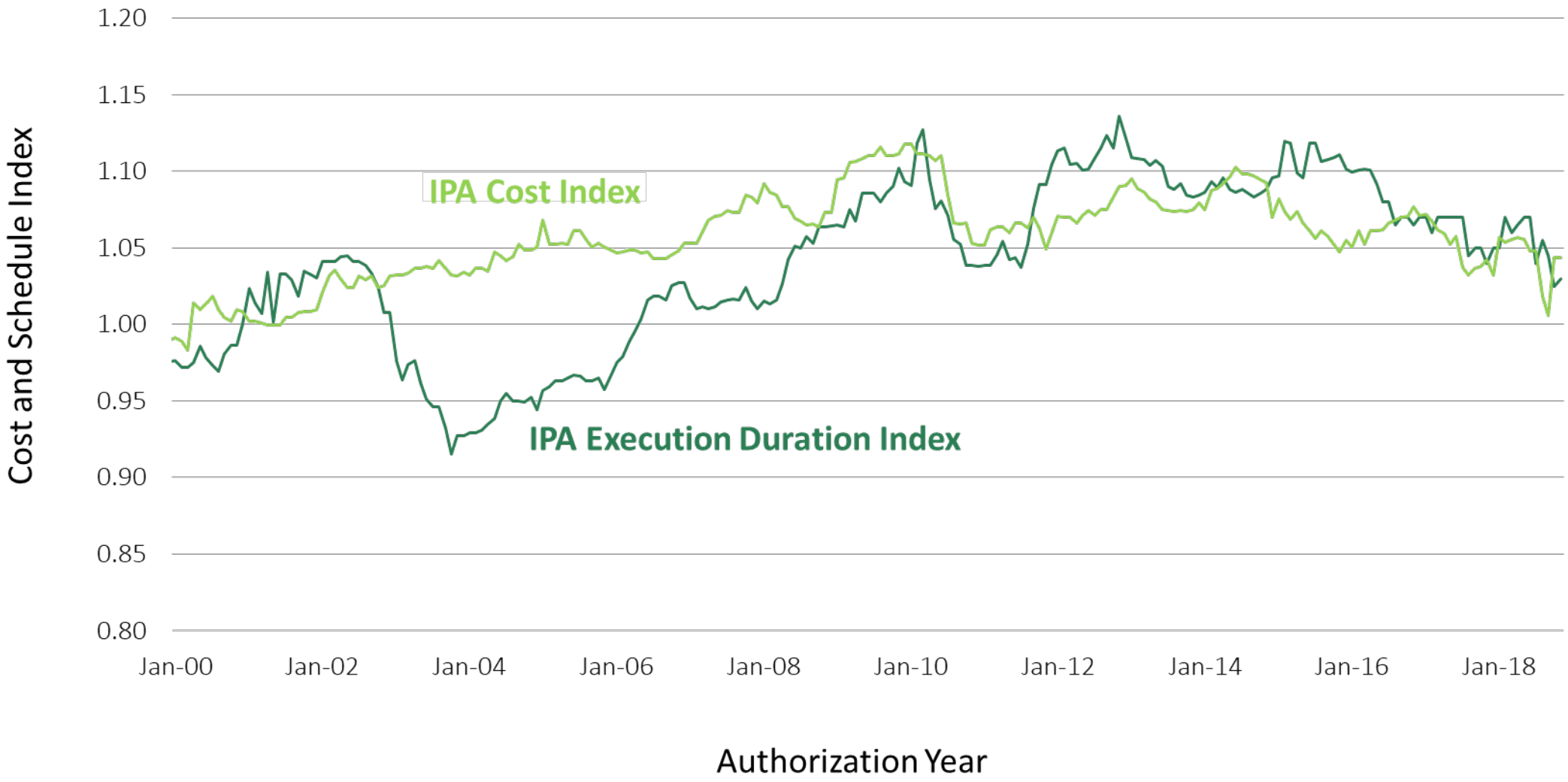
Andras Marton
IPA Business Manager for Hydrocarbon Processing & Transportation

Is Digitalization the Answer?

Capital Efficiency Has Slowly Eroded in the Projects World



* Indices are inflation adjusted

Can Digitalization Drive a Step Change in Efficiency?

Defining Digitalization and Interoperability

Digitalization

Gartner
The use of digital technologies to change a business model and provide new revenue and value producing opportunities

Interoperability

Oxford Dictionary
The ability of computer systems or software to exchange and make use of information

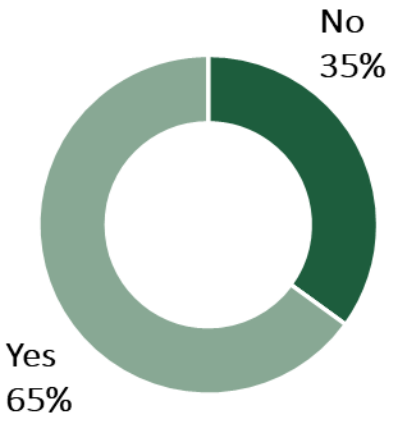
ISO
Capability of two or more entities to exchange items in accordance with a set of rules and mechanisms implemented by an interface in each entity, in order to perform their specified tasks

In the capital projects world, digital technologies are being applied to change and improve the way we deliver projects—to increase the volume, accuracy, and speed of information needed for key decision-making

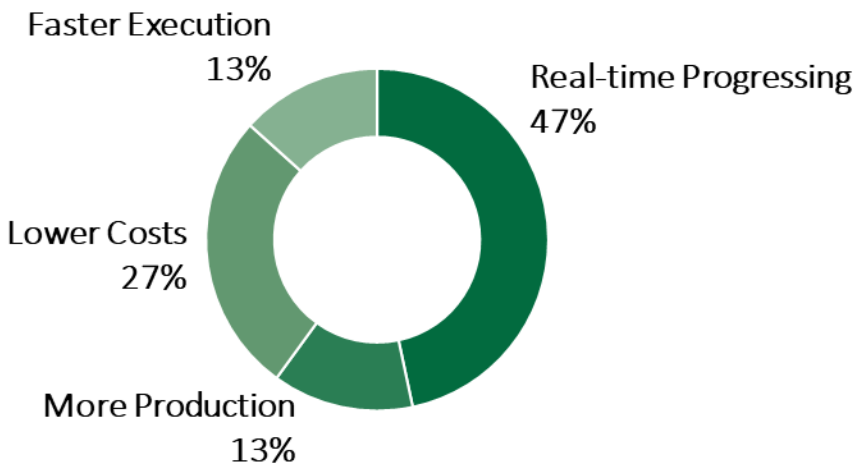
Capital Projects Industry—Digitalization Status

We Are Struggling to Get Our Digitalization Efforts Focused and Progressing

Digitalization Project Underway?



What Problem Are We Trying to Solve?

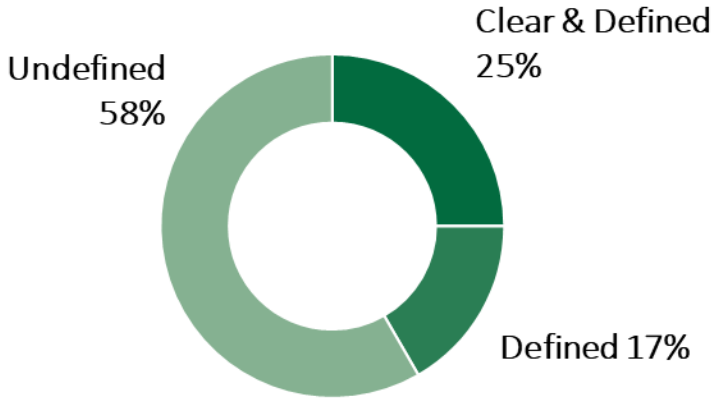


Are Digitalization Objectives Clear?

Clear: Objective has direct link toward business goals

Defined: Outlined objective, but indirect links to business objectives

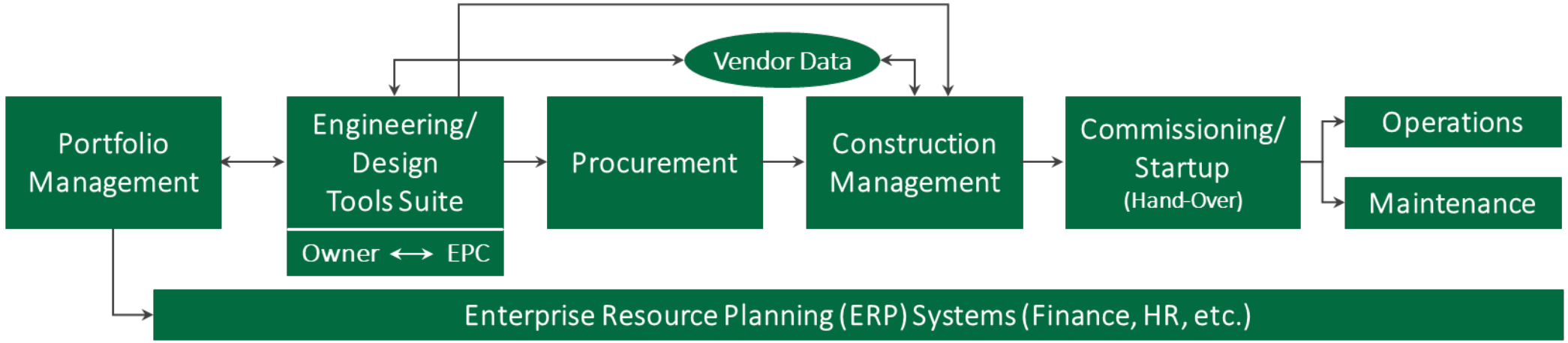
Undefined: No specific objectives yet identified



Digitalization

Entering Data Once and Having It Where You Need It

Project delivery requires **interoperability** of over 200+ pieces of *specialized* software

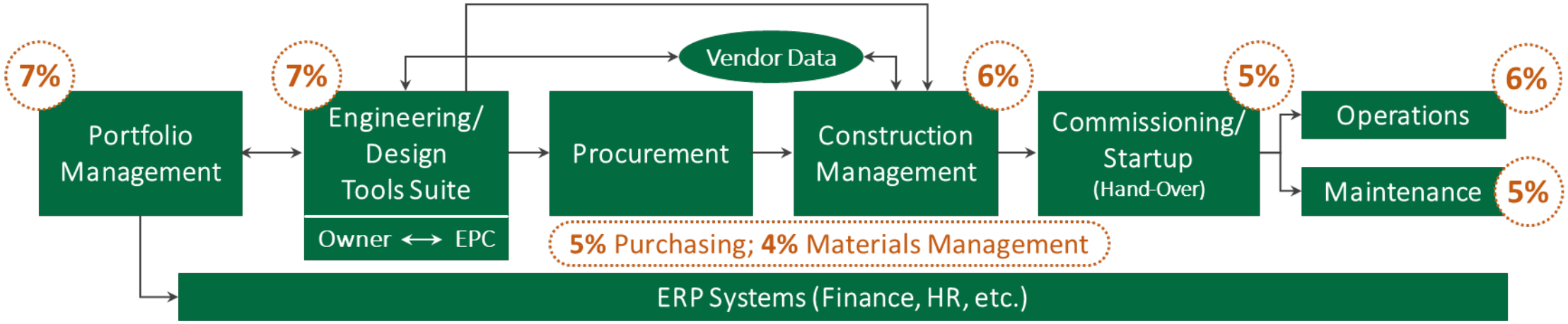


Key Support Systems

Document Management	Project Controls	Performance Metric Systems	ERP Systems
Project Management	Data Management	Data Exchange/Interfaces	Digital Twins

We Are Fragmented on Our Digitalization Focus

IPA survey: 185 digitalization projects are **dispersed** across the entire project life cycle



Key Support Systems

8% Document Management	8% Project Controls	7% Performance Metric Systems	4% ERP Systems
7% Project Management	9% Data Management	7% Data Exchange/Interfaces	5% Digital Twins

Data Interoperability Industry Challenges

Key Word in the Space Is *Fragmentation*

Fragmentation In:	Seen As:
Supply Chains	100s of Vendors per Owner
Software Applications	100s of Software Apps
Digitalization Approach and Focus	Fragmented Focus on Sections of Project Lifecycle
Data Standardization Efforts	Multiple Standards Efforts
Standards Bodies	No Centralized Voice in ISO Efforts

Declining Engineering Capability in Owner and EPC Firms

Digitalization Is a Part of Many Solutions Being Worked on by Industry

Desired Industry Results	Spend Less	Move Faster	Improve Hand-Off to Operations		
Levers to Pull	Reduce the Cost of Equipment and Bulks	Improve Engineering & Construction Productivity	Bring Tighter Controls—Make Project Status More Visible	Gather Facility Data From Applications as Project Progresses	
Solutions Being Worked on	Repeatable/Standard Designs	Modular Construction	Advanced Work Packaging	Cost and Schedule Integration	Digital Twin and Digital Ecosystems

All of These Desired Solutions Require More Robust Data Interoperability Than the Capital Project Industry Has Today

IPA

Desired Industry Results	Spend Less	Move Faster	Improve Hand-Off to Operations

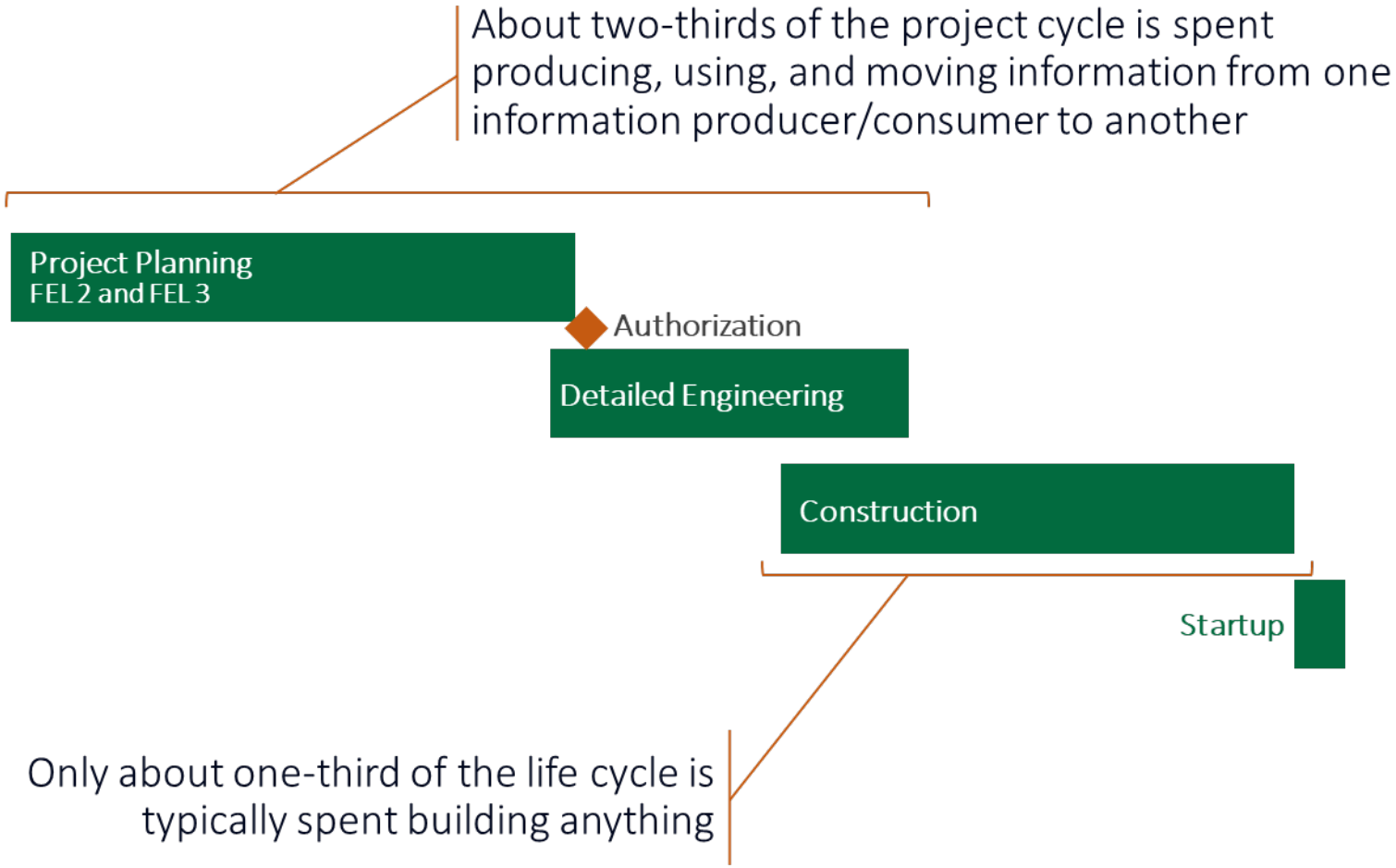
Levers to Pull	Reduce the Cost of Equipment and Bulks	Improve Engineering & Construction Productivity	Bring Tighter Controls—Make Project Status More Visible	Gather Facility Data From Applications as Project Progresses

Solutions Being Worked on	Repeatable/Standard Designs	Modular Construction	Advanced Work Packaging	Cost and Schedule Integration	Digital Twin and Digital Ecosystems
Requirements	Object Oriented Data Structures Plug and Play 3D Models Robust Supply Chains	Compressed, Optimal Layouts Robust 3D Models Construction-Driven Sequencing Rigid Clash Detection	Multi-Perspective Packages Within the Model Synchronized Engineering and Construction Models Real Time Material Availability Data Robust 3D	Standard Cost and Schedule Data Structures ERP Integration Real Time Data Collection and Visualization	Clarified Engineering and Maintenance Data Definitions Robust Model Management Post Project Data Maintenance (As-Built Maintenance)

All Solutions Require Increased Data Interoperability

A Project Is the Flow of Information

People produce/consume information; people do projects



Pennsylvania Chemicals Project

Shell Project Director, Chris Howell

Bechtel Senior Project Manager, John Platt

Engagement 2 – A Culture of Innovation

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How do we make sure we are solving the right problems? How connected are our solution development teams with our people executing the work processes? How connected are they with our project management teams identifying performance issues?

ⓘ Start presenting to display the poll results on this slide.

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How do you pilot and scale a new solution while de-risking impact to project performance?

How do you rollout a new tool to a workforce that is adverse to new tech (or tech in general)?

ⓘ Start presenting to display the poll results on this slide.

Strategy

See

Full visibility of the activity in all parts of the construction site

Measure

Measure performance and progress accurately

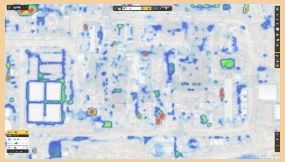
Predict

Predict outcomes and adjust present actions accordingly

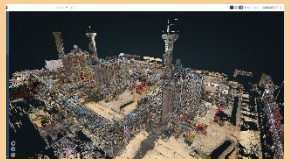
Foundation: ability to find project information quickly

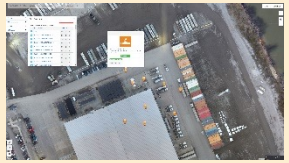
“Continuous improvement is better than delayed perfection”
Mark Twain

Strategy in Action


Flood Model (Bentley)


Scaffold Tracking (iHawk)


Dim. Control (VEERUM)

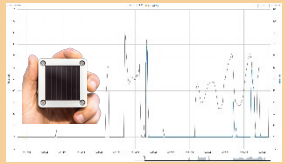

Track & Trace (SiteSense)

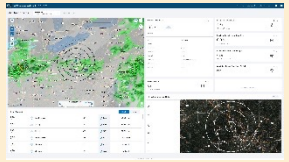

Universal Plant Viewer


4D Planning (SynchroPro)

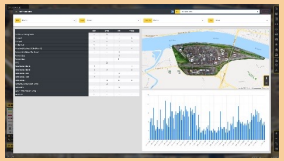

Workface Planning


Tracking (PowerBI)

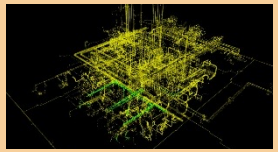

Wireless Instrumentation

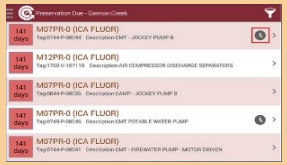

Weather (IBM)

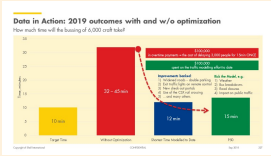

Ground 360 (HoloBuilder)


Traffic Analytics


Photogrammetry (Acute3D)


QTY Installed (Doxel.AI)


Preserve


Logistics Sims (FlexSim)

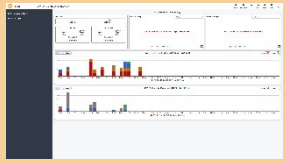

Site Imagery (iHawk)

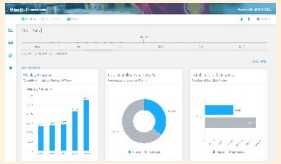

4D & Time-Lapse (L-Vision)

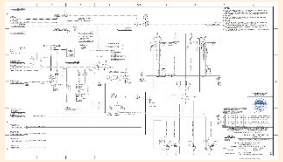

Site Master Plan (iHawk)


Utilization (MachineMax)


SmartTorque (Cumulus)


T-Pulse


Perf. Prediction (Doxel.AI)


Dynamic Simulator

SEE (“A”)

- Improved site coordination
- Visual evidence of construction progress
- Increased awareness of remote teams
- Reduced exposure of team to live activity
- Existing quality issues spotted

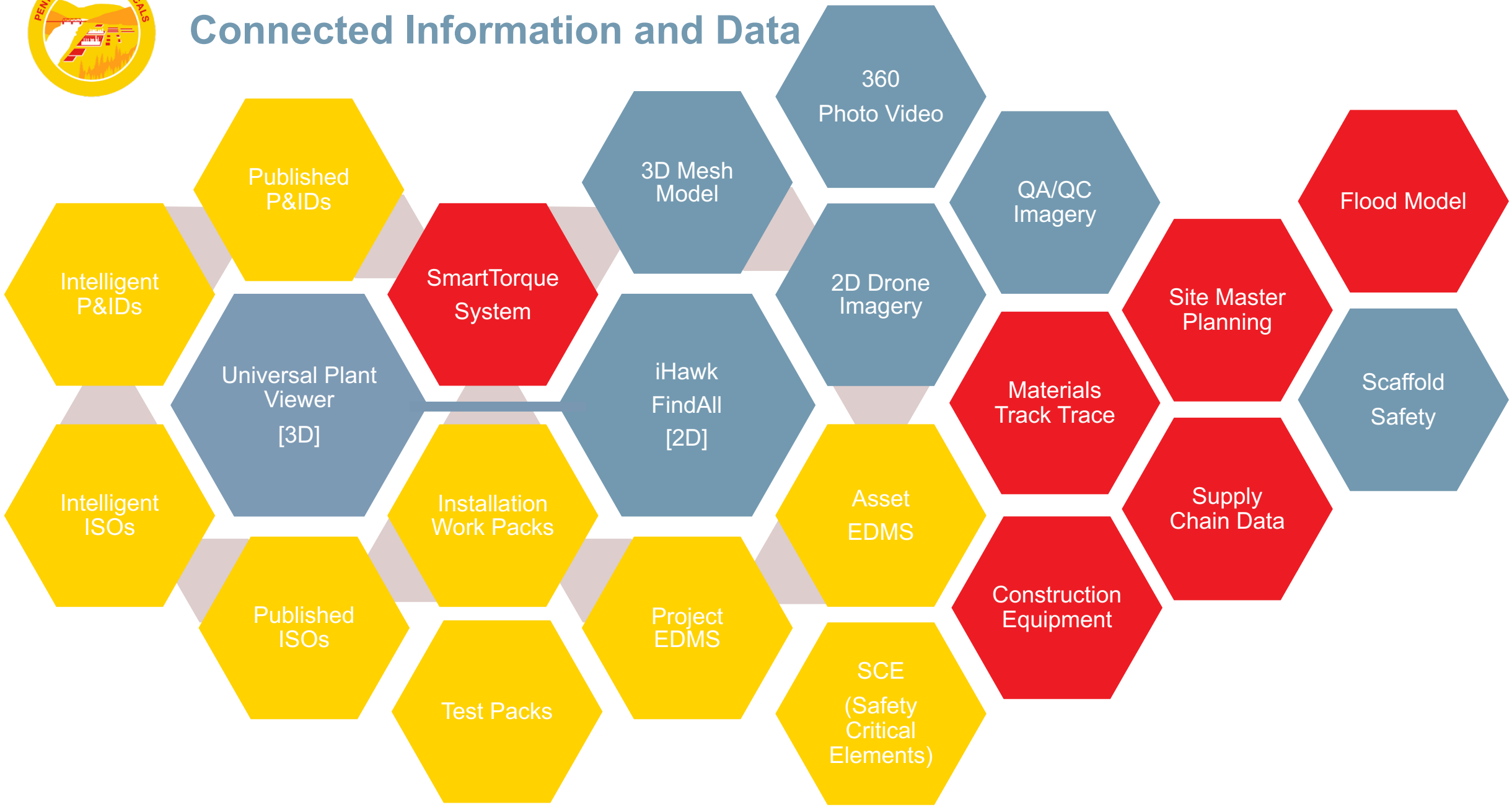
MEASURE (“B”)

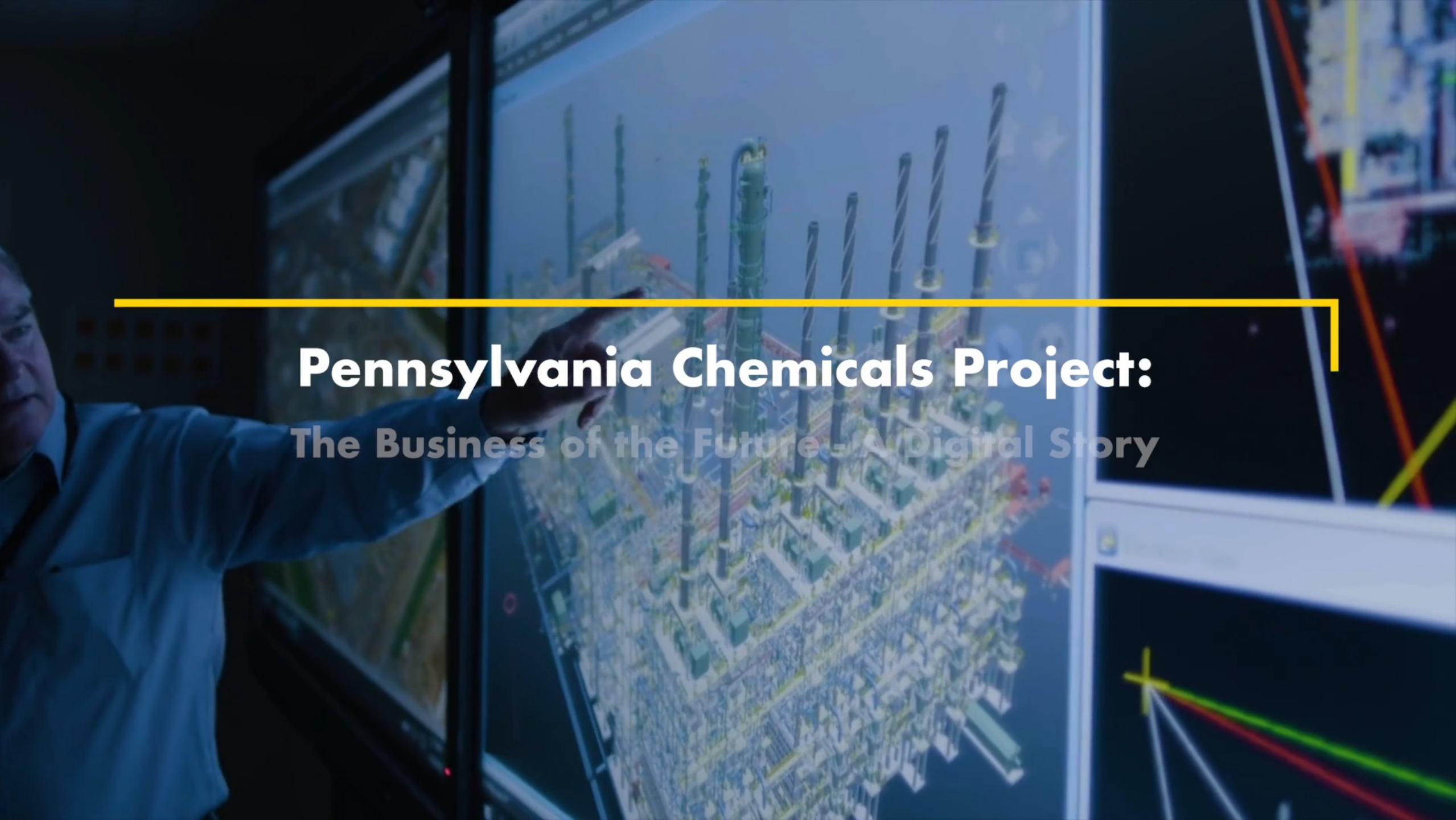
- Better quality decisions through data insights and KPIs
- Shared Truth between Shell and the EPC
- Measured Plan vs Actual analysis
- Existing quality issues detected

PREDICT (“C”)

- AI/ML applied to detect developing patterns
- Construction issues are anticipated and resolved proactively

Connected Information and Data

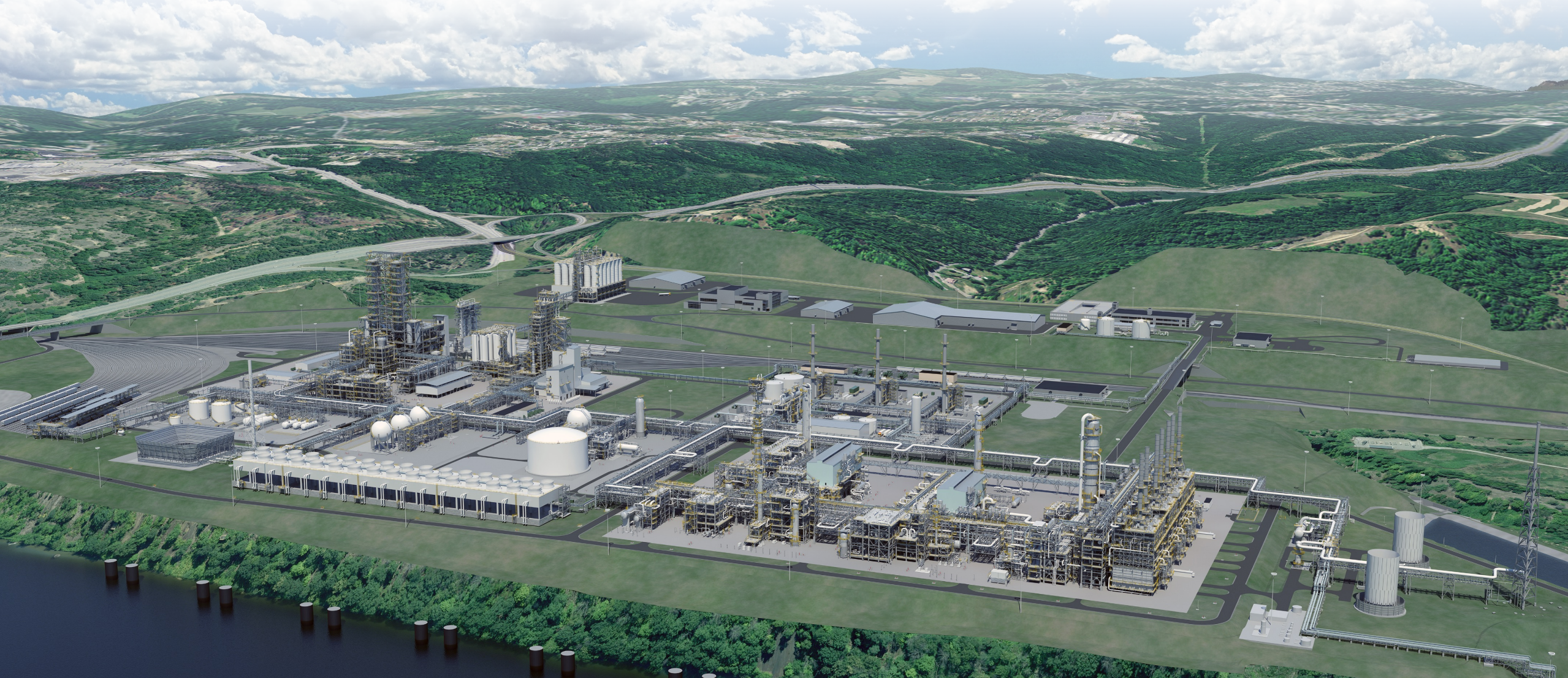


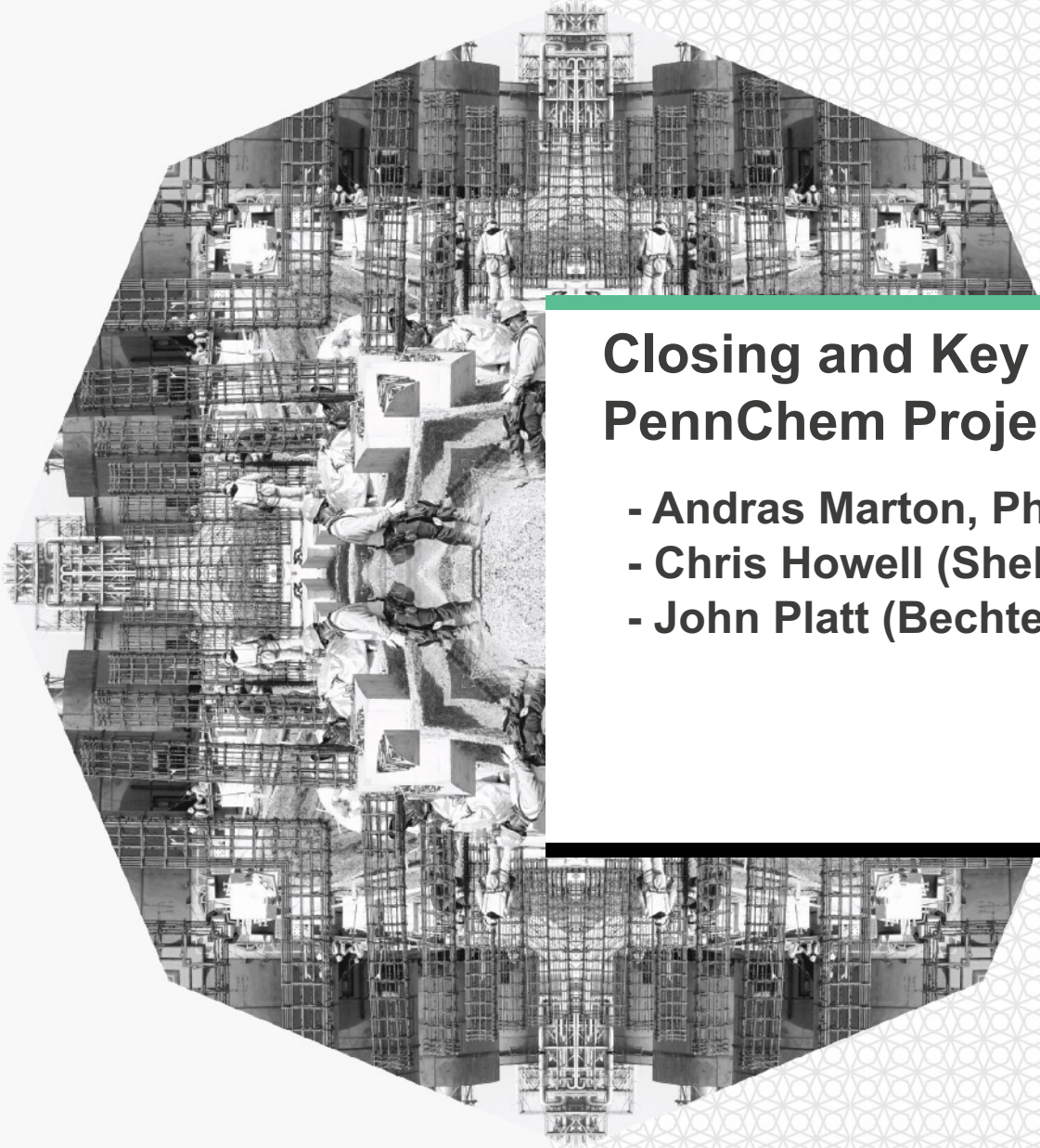


Pennsylvania Chemicals Project:

The Business of the Future - A Digital Story

Closing and Key Learnings





Closing and Key Learnings from the PennChem Project

- Andras Marton, PhD (IPA)
- Chris Howell (Shell)
- John Platt (Bechtel)

Upcoming Events

- **2022 ECC PerspECCtives Conference**
  - September 7-10, 2022
  - JW Marriott Hill Country, San Antonio, TX
  - Conference Sponsors Only Session: **Wednesday, September 7**