

Shell - A business perspective of Real-Time Operations

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Definitions & cautionary note

Reserves: Our use of the term “reserves” in this presentation means SEC proved oil and gas reserves.

Resources: Our use of the term “resources” in this presentation includes quantities of oil and gas not yet classified as SEC proved oil and gas reserves. Resources are consistent with the Society of Petroleum Engineers (SPE) 2P + 2C definitions.

Discovered and prospective resources: Our use of the term “discovered and prospective resources” are consistent with SPE 2P + 2C + 2U definitions.

Organic: Our use of the term Organic includes SEC proved oil and gas reserves excluding changes resulting from acquisitions, divestments and year-average pricing impact.

Shales: Our use of the term ‘shales’ refers to tight, shale and coal bed methane oil and gas acreage.

Underlying operating expenses are defined as operating expenses less identified items. A reconciliation can be found in the quarterly results announcement.

The companies in which Royal Dutch Shell plc directly and indirectly owns investments are separate legal entities. In this presentation “Shell”, “Shell group” and “Royal Dutch Shell” are sometimes used for convenience where references are made to Royal Dutch Shell plc and its subsidiaries in general. Likewise, the words “we”, “us” and “our” are also used to refer to Royal Dutch Shell plc and its subsidiaries in general or to those who work for them. These terms are also used where no useful purpose is served by identifying the particular entity or entities. “Subsidiaries”, “Shell subsidiaries” and “Shell companies” as used in this presentation refer to entities over which Royal Dutch Shell plc either directly or indirectly has control. Entities and unincorporated arrangements over which Shell has joint control are generally referred to as “joint ventures” and “joint operations”, respectively. Entities over which Shell has significant influence but neither control nor joint control are referred to as “associates”. The term “Shell interest” is used for convenience to indicate the direct and/or indirect ownership interest held by Shell in an entity or unincorporated joint arrangement, after exclusion of all third-party interest.

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Company profile

- Shell is an international energy company with expertise in the exploration, development, production, refining and marketing of oil and natural gas, as well as in the manufacturing and marketing of chemicals.
- We are active in more than 70 countries
- Worldwide in 2017, we employed an average of 86,000 people.
- Our fuel retail network has around 44,000 service stations
- In 2017, we produced 3.7 million barrels of oil equivalent per day (crude oil and natural gas combined).
- In 2017, we:
 - Generated earnings* of \$12.1 billion
 - Made \$24 billion of capital investment**
 - Spent \$992 million on R&D
- Royal Dutch Shell plc is a UK company, with its headquarters in the Netherlands
- We are listed on the stock exchanges of Amsterdam, London and NY



*On a current cost of supplies basis attributable to Royal Dutch Shell plc shareholders. CCS earnings attributable to shareholders for 2017 were \$896 million lower (2016: \$1,042 million lower) than income attributable to shareholders. See page 225 of the 2017 Annual Report and Form 20-F for definition and reconciliations.

** Capital investment is defined as capital expenditure and investments in joint ventures and associates, as reported in the "Consolidated Statement of Cash Flows", plus exploration expense, excluding exploration wells written off, new finance leases and investments in securities, adjusted to an accruals basis.

Source: 2017 Annual Report and Form 20-F

Shell IT strategic themes



EVERYTHING
TO CLOUD



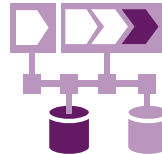
INFORMATION FROM
DATA & ANALYTICS



COLLABORATION
ACROSS ALL
(MOBILE) DEVICES



CONTROLS, LEGAL,
REGULATORY &
CYBER DEFENCE

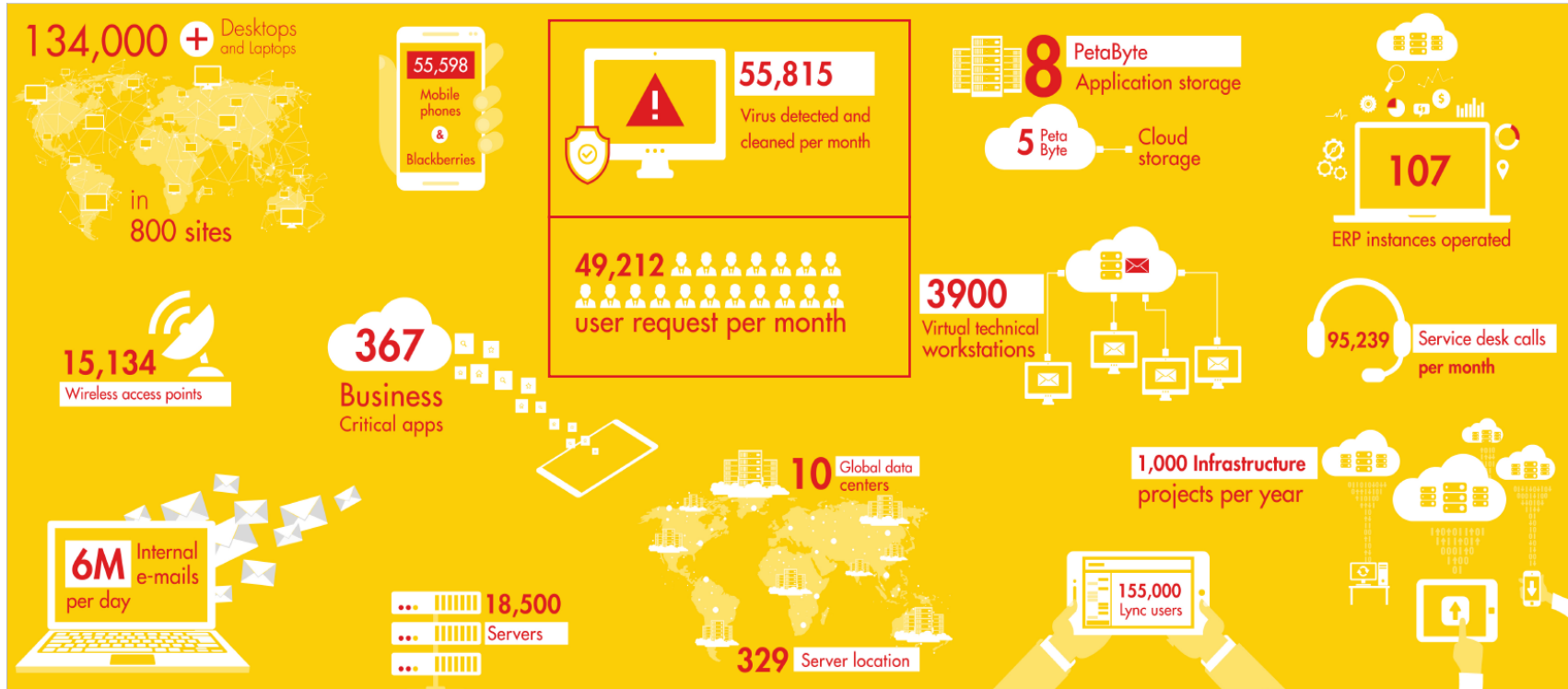


BUSINESS PLATFORMS
GUIDE INVESTMENT
DECISIONS

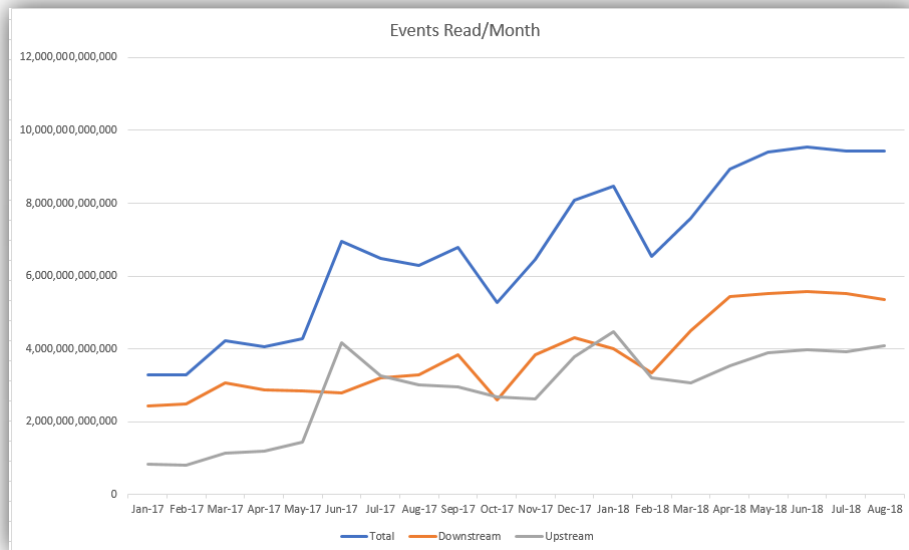


DIGITALISATION AND
INTERNET OF THINGS

IT landscape in Shell



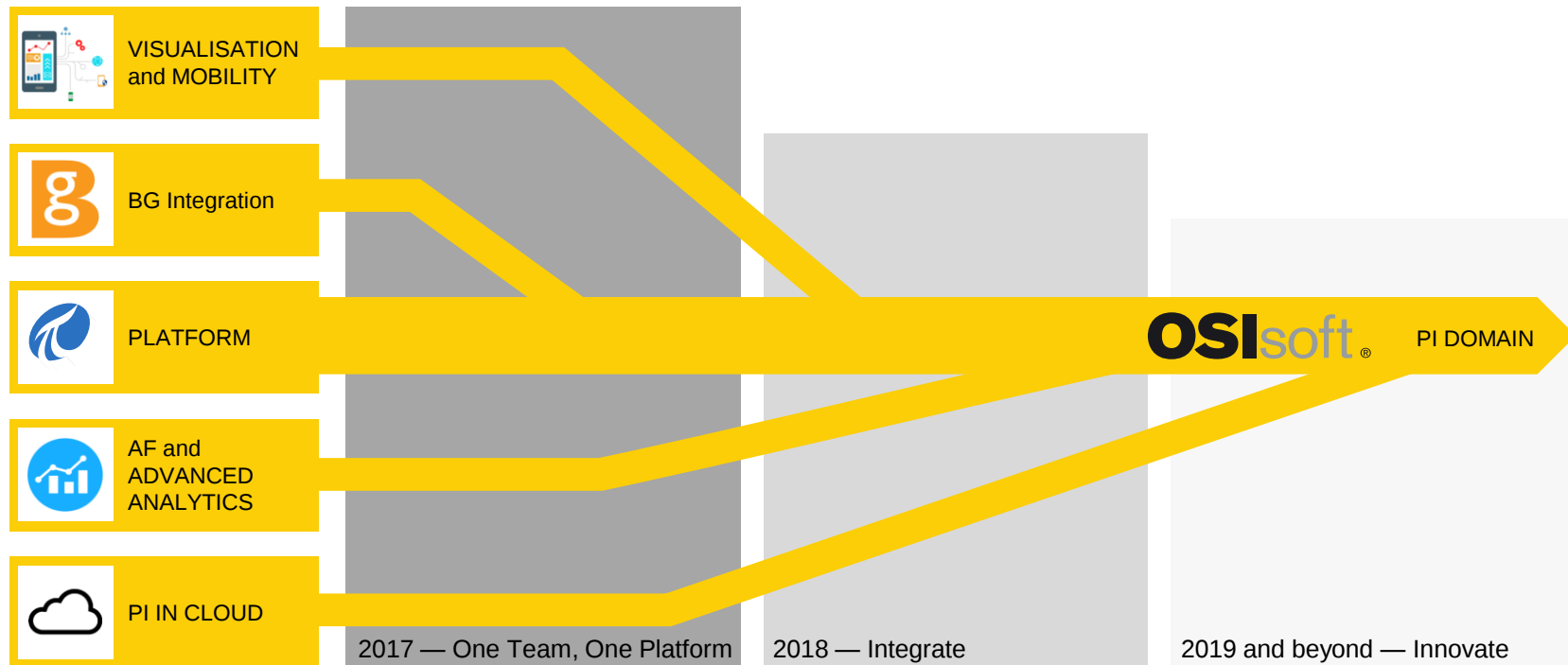
PI System in numbers



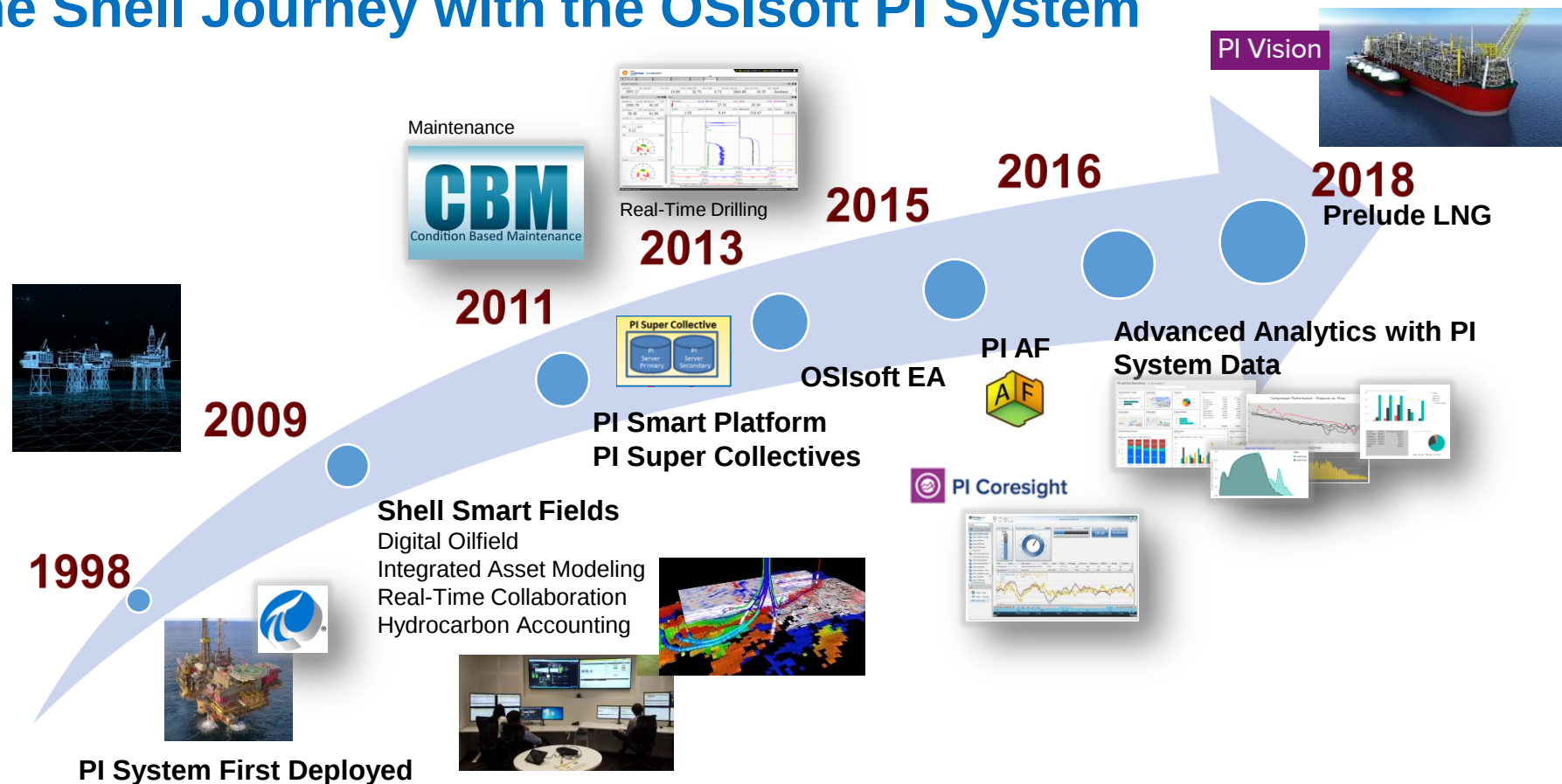
Events read from main servers last 18 months

- Availability, performance and Stability.
- Data Quality
- Advanced Analytics in Azure
- Migration from legacy
- Security

PI System Roadmap



The Shell Journey with the OSIsoft PI System



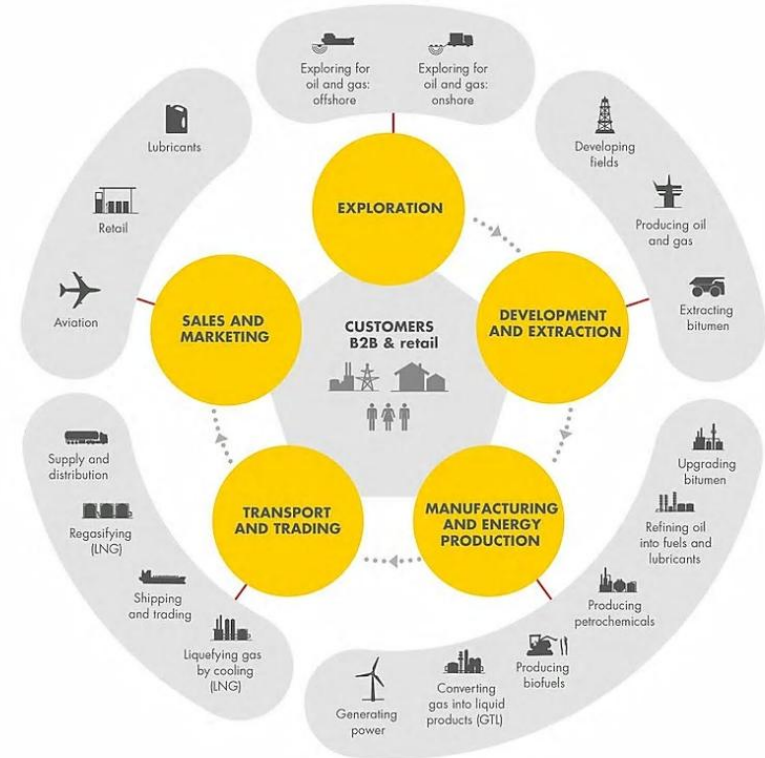
Shell Business and Strategy

Our ambition:

- Thrive in the energy transition
- World-class investment case
- Strong license to operate



Investment priorities & strategic intent



Cash Engines - Upstream and Integrated Gas

Zero trips from critical equipment, drastic reduction of unscheduled deferment, & reduction of maintenance cost



- Improve Availability in Upstream, Integrated Gas and Downstream Manufacturing
- Optimize our recovery and Utilization
- Reduce Unit Operating Cost and maximise profit margin

Digitalisation is a strategic priority for Shell

SHELL CONTEXT

FOCUS

- Digital technologies have a substantial impact on our industry
- Digital technologies address current business challenges

IS NOT

- New
- An outcome
- One off thing
- Only in the future

INDUSTRY DEFINITION*

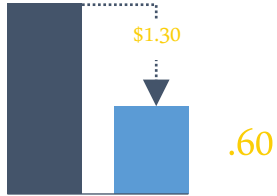
“The use of Digital technologies to change a business model and provide new revenue and value-producing opportunities”

*Industry definition has been sourced from Gartner

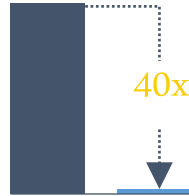
Digital is not new ... but availability of technology, data and capabilities is key

Technology is becoming faster and cheaper over the past ten years

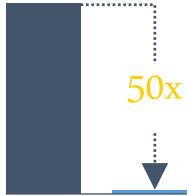
COST OF SENSORS



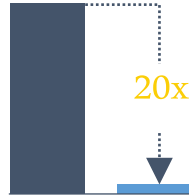
COST OF BANDWIDTH



COST OF PROCESSING POWER



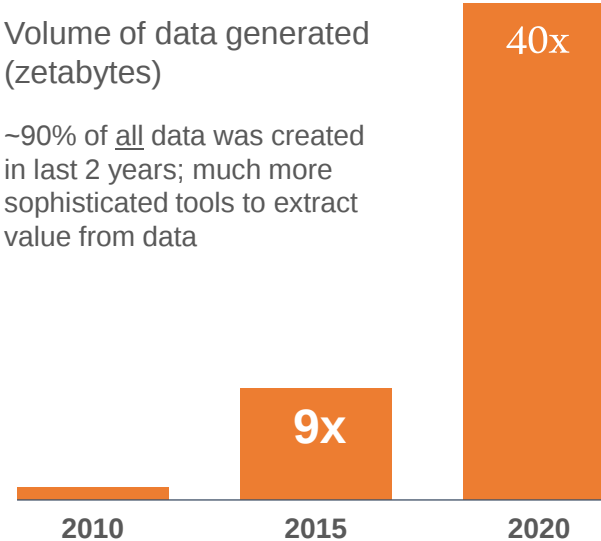
COST PER MB OF CLOUD INFRASTRUCTURE



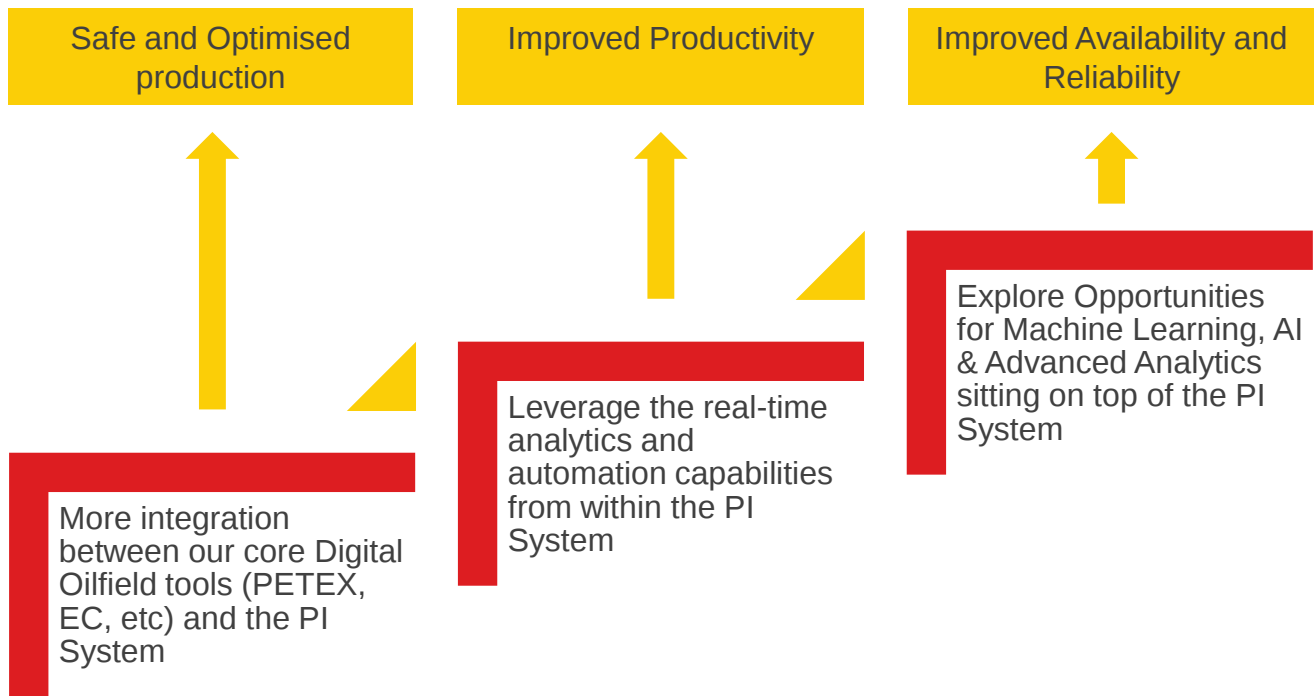
Data is growing exponentially

Volume of data generated (zetabytes)

~90% of all data was created in last 2 years; much more sophisticated tools to extract value from data

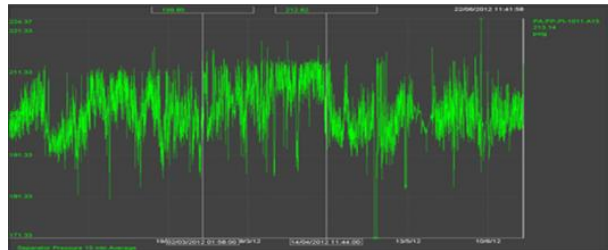
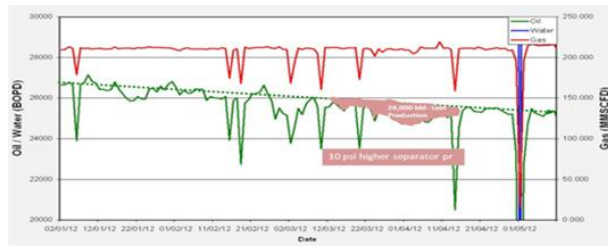


Leveraging the PI System at the heart of our Digitalization Roadmap



Integration with Digital Oilfield Tools

- PI System integration with Digital Oilfield (DoF) tools helped our Production Engineers increase production in 1st year of deployment
- Change Management and focus on improving ways of working is key to make this work!



Case Study: Impact of compressor suction pressures on well performance

GAP model predicted a loss of 500 boe/d due to 10 psig increase in separator pressure

Compressor-turbine system performance was evaluated using process simulation model

Review of Engine wash frequency

Frequent anti-foulant injection in compressor

More integration
between our core
Digital Oilfield tools
(PETEX, EC, etc)
and the PI System

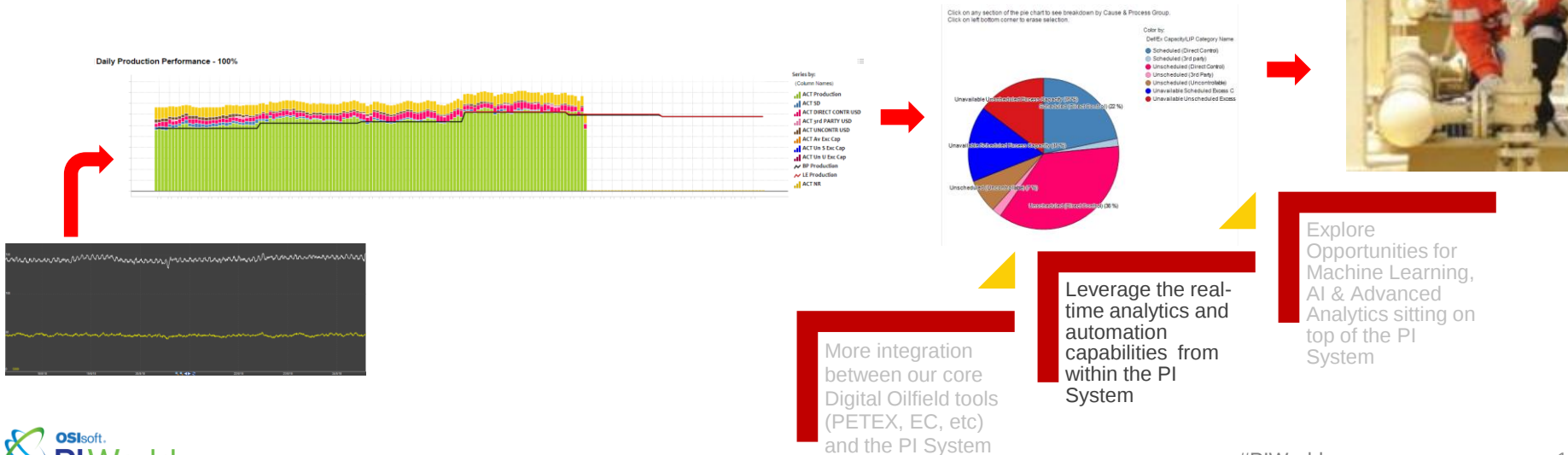
Leverage the real-
time analytics and
automation
capabilities from
within the PI
System

Explore
Opportunities for
Machine Learning,
AI & Advanced
Analytics sitting on
top of the PI
System

Real-time Analytics and Automation

- Use PI Data Archive and PI AF to start replacing some of the manual processes with automated tools and workflows, giving engineers and operations teams the data they need in the right way at the right time => need to get data faster out of the PI System
- Automation increases productivity and helps Engineers spend more time on translating data into meaningful information and valuable decisions

=> Significant Productivity gain



Advanced Analytics, Machine Learning & AI

- Real-time analytics for equipment and operations is providing significant bottom line value
- Multiple predictive analytics underway to predict compressors and valves failure
 - Reduce cost and increase uptime – Compressors trips / failure is one of the top Shell Operating Ventures Bad actors

Valves example:

- Valves maintenance mostly time-based:
 - Too late => unscheduled deferment, HSSE risk
 - Too early => scheduled deferment and cost
- Moving to condition-based maintenance will help reduce OPEX and deferment
- There are thousands of valves in Shell, this is where Machine Learning comes in....

Asset A



2015 control valve incident led to \$ 6 MM value loss. There are over 20.000 valves installed, how can this be prevented in the future?

More integration between our core Digital Oilfield tools (PETEX, EC, etc) and the PI System

Leverage the real-time analytics and automation capabilities from within the PI System

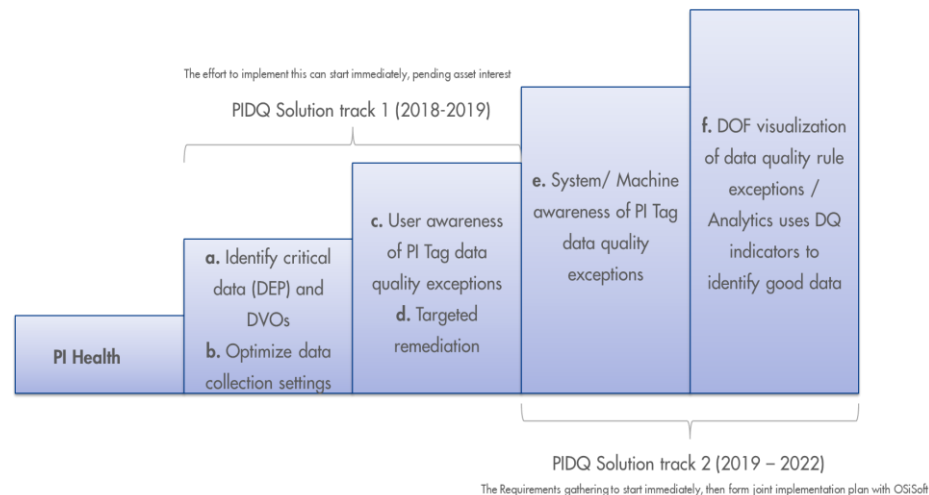
Explore Opportunities for Machine Learning, AI & Advanced Analytics sitting on top of the PI System

Data Quality

- **PI System Data Quality underpins every digital oil field and analytics initiative we have:**

⇒ Poor Data Quality inhibits our ability to turn data to information to insights e.g. Proactive Technical Monitoring and to apply machine learning algorithms to help humans focus on identified optimization opportunities.

- Currently working with OSIsoft to develop a solution that will enable us improve DQ



Value Case:

- We have proven that following the ISO 8000 standard (DQ KPIs and PDCA remediation) generated significant benefits in one of our Assets
- On average, companies estimated they were **losing an average of US \$8.2M /year** because of poor data quality. (The ROI of Data quality, Pitney Bowes, p.2)

2018 and beyond...



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the **microphone**

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name & company



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