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ENERGY MARKET OUTLOOK

OPTIMIZING INTERNAL & INDUSTRY STANDARDS FOR COST

IADC – SOUTHEAST ASIA - AGM

IHS Engineering

Addressing strategic challenges with interconnected capabilities

We deliver on the promise of The New Intelligence

IHS Markit provides leaders from multiple industries with the perspective and insights they need to make the best choices and stay ahead of their competition.



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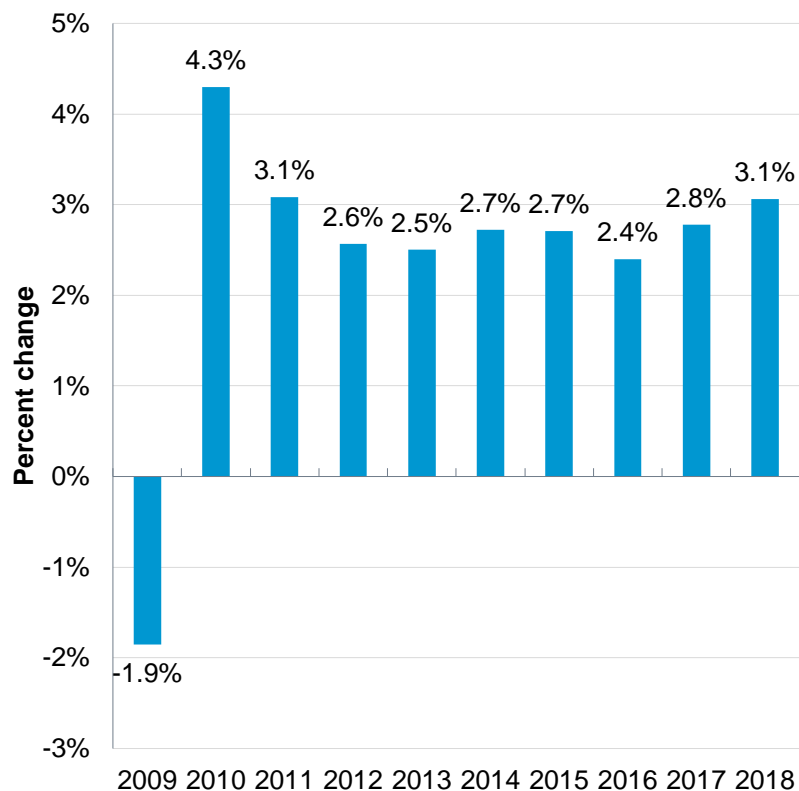
Key messages for the global economy

World economic growth will remain subdued, amid political uncertainty

- **United States.** US real GDP rose at a 2.9% annual rate in 3Q 2016—its strongest gain in eight quarters. US payroll employment increased by 161,000 in October, slightly below the average of 179,000 for the past six months. With labor productivity growth reviving, a slowdown in job growth is not surprising. A tightening labor market is beginning to benefit workers: average hourly earnings rose 2.8% year-on-year in October, their fastest gains since mid-2009. Growth in consumer spending and business fixed asset investment—including in the mining and petroleum sectors—will help support a modest pick-up of annual US GDP growth in 2017.
- **Economic implications of the US presidential election.** Before the election, IHS Markit developed a scenario that incorporated the key elements of Donald Trump's fiscal proposals. (This did not address trade or immigration policies). The IHS Markit Trump scenario shows a large increase in the US budget deficit, since his proposed budget revenues are reduced substantially. This boosts near-term growth and inflation, compared with our baseline. But it also raises interest rates (because of more government borrowing) and puts upward pressure on the dollar—both of which cut growth and inflation in the outer years, compared with the baseline.
- **China.** China's real GDP rose 6.7% year-on-year in 3Q 2016, the same growth rate as in 1Q and 2Q 2016. Yet given China's already elevated debt levels, the government cannot maintain aggressive monetary easing to boost growth. While fundamentals suggest that China's GDP growth should trend down, the current momentum in the economy should temper the rate of deceleration in the next few quarters.
- **Eurozone.** Political uncertainty is seen hampering eurozone growth in 2017. Elections will occur in France, Germany, and the Netherlands. The UK's process of leaving the EU could heighten uncertainty and periodically upset financial markets. The upside for eurozone growth is being constrained by significant banking sector problems and structural impediments in a number of countries (notably Italy and France). Additionally, public and private sector debt levels remain high in several countries.

Non-OECD Asia is key driver of world GDP growth

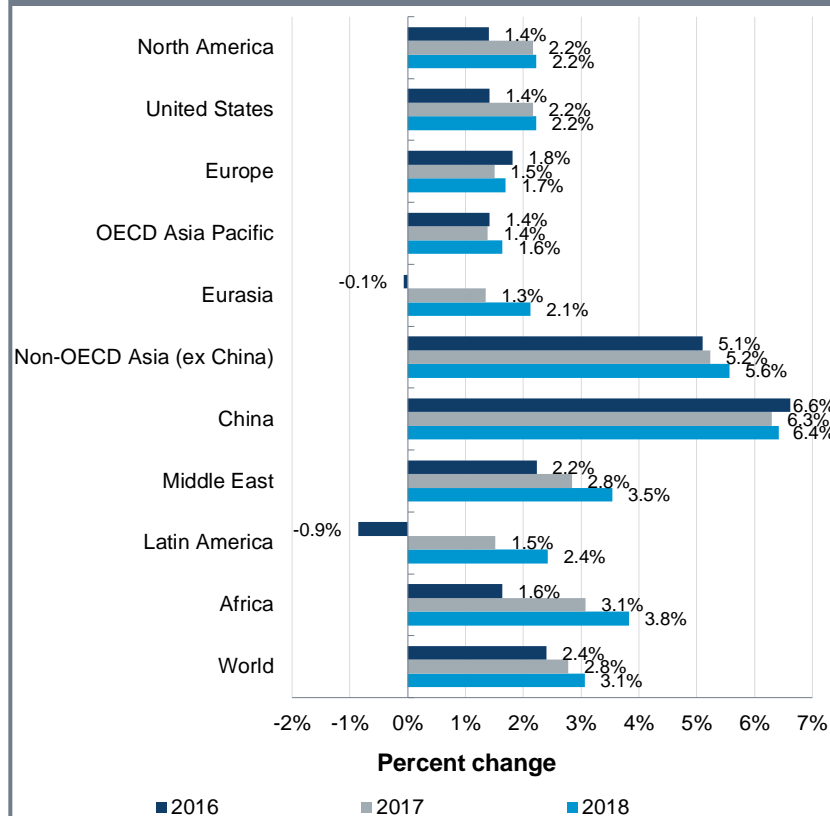
World real GDP growth rates, 2009–18



Source: IHS

© 2016 IHS

Regional real GDP growth rates, 2016–18



Notes: North America includes the United States and Canada. Latin America includes Mexico.

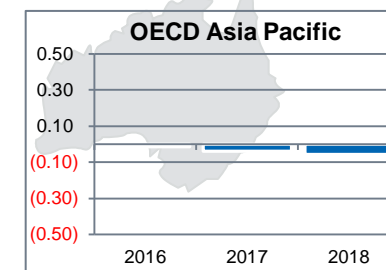
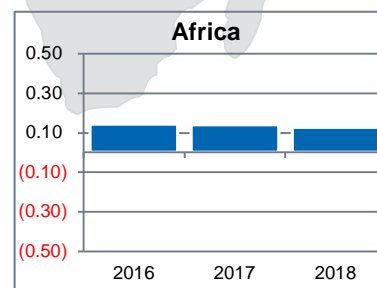
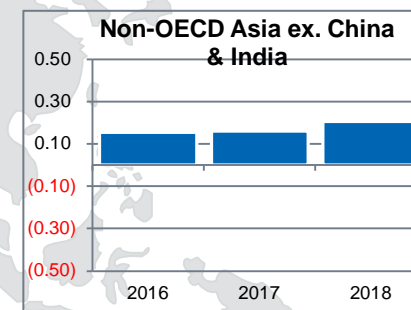
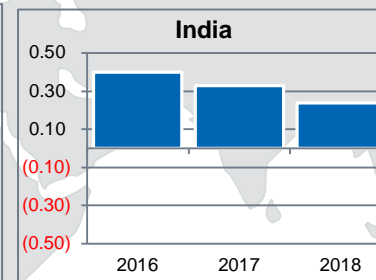
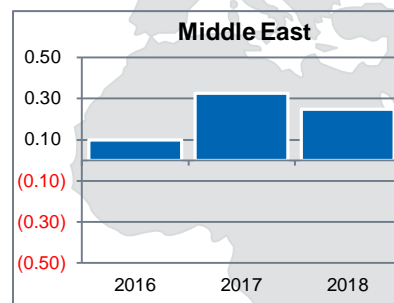
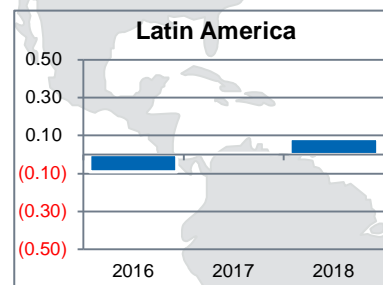
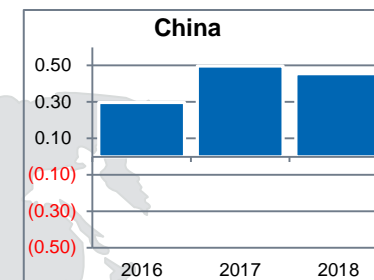
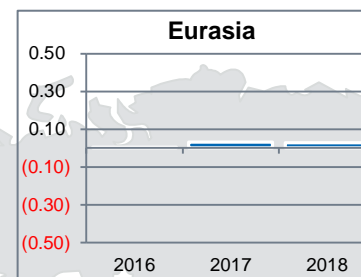
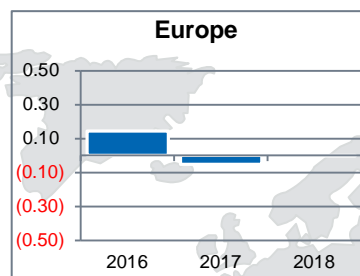
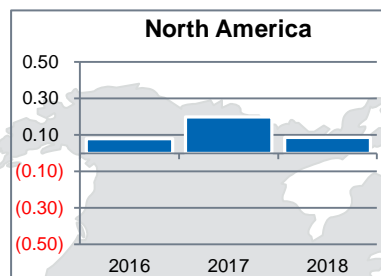
Source: IHS

© 2016 IHS

Note: Data based on IHS Economics 14 October release.

World oil “demand map”

Changes in oil (liquids) demand by region (volume change from previous year in million barrels per day)



Global oil demand growth (MMb/d)

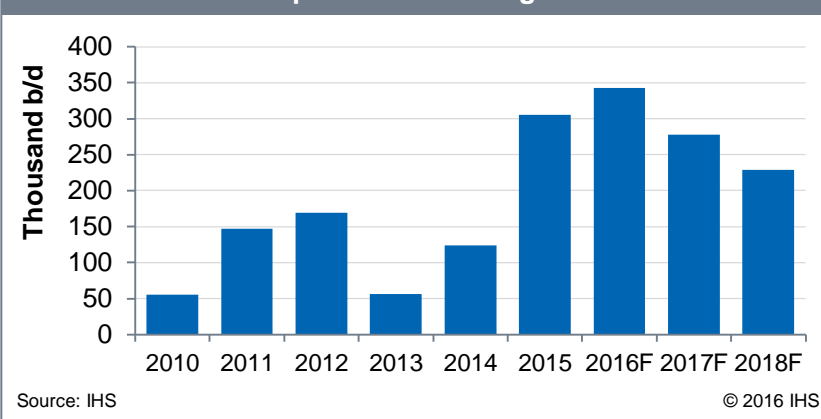
	2016	2017	2018
OECD	0.2	0.1	0.0
Non-OECD	1.0	1.5	1.4
Total world	1.2	1.6	1.4

Notes: Mexico is included in Latin America.
Data in table may not add up due to rounding.
Source: IHS

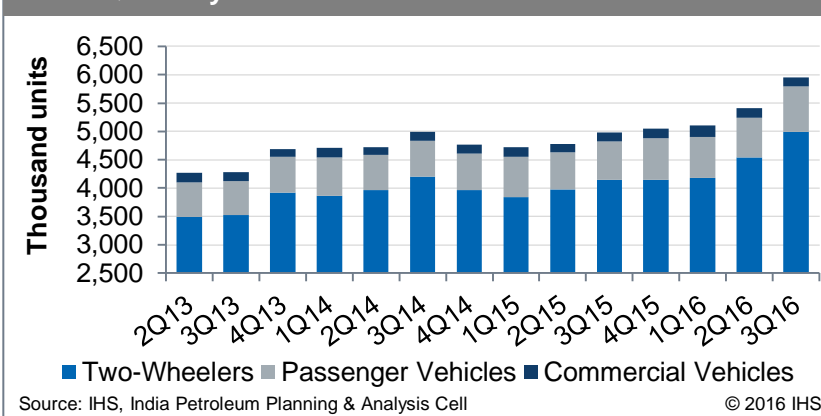
India helps lead global oil demand growth

- India remains an outlier among the world's largest markets, maintaining both strong economic growth and robust refined product demand growth. On an annual basis, we expect Indian refined product demand to grow by upwards of 340,000 b/d in 2016. By next year, India will have surpassed Japan as the second largest demand market in Asia and third largest in the world. In 2017-18, we anticipate that India's demand growth will remain robust, albeit decelerate as the comparison base increases.
- Two factors are likely to be key in determining the magnitude and make up of India's demand profile in the short term—continued service sector-led economic growth and government investment in major infrastructure projects.
 - The service sector is expected to retain its role as the growth engine of India's economy, supporting demand growth for consumer-oriented fuels, specifically gasoline and on-road diesel, as well as LPG.
 - Ongoing and announced plans to improve and expand India's underdeveloped roads, airports, and railways are likely to stoke growth in consumption of industrial fuels, especially non-road gasoil and petroleum coke.

Annual India refined product demand growth



India: Quarterly vehicle sales



OPEC agrees to trim and cap output for first half of 2017, Russia follows

After 10 months of negotiations, OPEC formally agreed at a meeting in Vienna on 30 November 2016 to cut its oil output by 1.2 MMb/d for the first half of 2017. It expects Russia and other countries to make complementary cuts soon. OPEC will reconvene on 25 May 2017 in Vienna with the intention of rolling over the output agreement for another six months.

- Saudi Arabia, OPEC, and Russia finally clinched the deal that eluded them in April in Doha and in September in Algiers.
- Prices broke out of the \$40–50 range because of reduced supply from OPEC and some non-OPEC producers.
- Iraq, now OPEC's second-largest producer after Saudi Arabia, is finally back in OPEC's allocated output system after 26 years

US election: Donald Trump's vision of full throttle oil development suggests upside for US production

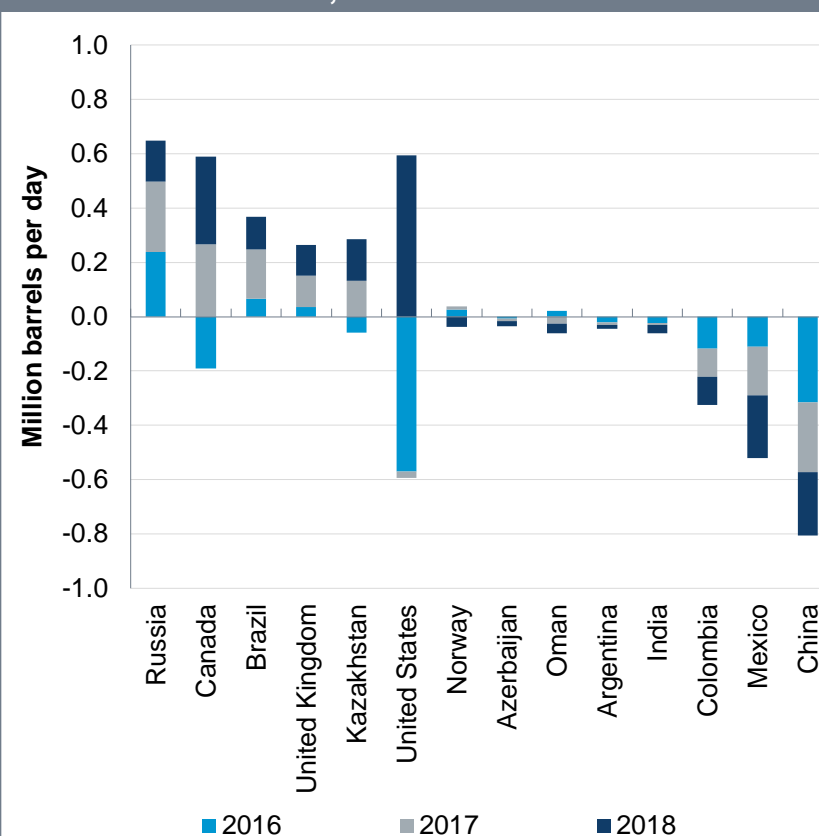
- On the whole, oil prices have been relatively steady in the days following the surprise election of Donald Trump as US president on 8 November.
- Trump's election will lead to many changes on both the geopolitical and economic front and oil will not be left out. His energy program is full of generalities, but less regulation is the overriding theme of his pronouncements to date, including fewer hurdles for pipeline construction, and the potential opening of public lands to exploration and production.
 - The energy vision on his [website](#) notes a desire to “declare American energy dominance a strategic economic and foreign policy goal of the United States; to “unleash” untapped oil reserves; and to “open onshore and offshore leasing on federal lands.”
- The Trump administration is likely to take a less skeptical attitude toward unconventional drilling techniques and the role of oil in the economy.
- Donald Trump's vision of full tilt development could lead to higher than expected US oil production.
- But it will take much time for President Trump and his cabinet to evolve policies that will characterize his administration and the resulting uncertainty will in the interim add turbulence to the global economic outlook.

Note: For a discussion of possible implications of the election of Donald Trump, please see IHS Energy *Weekend Briefing* [Trump's Energy Vision: More Rigs and Less Regs - Weekend Briefing 11 November 2016](#). Also, IHS Energy will be hosting a webinar on 16 November, [The Election of Donald J. Trump: What Does it Mean for Energy?](#).

Key messages for non-OPEC crude oil supply: United States and Canada to set the pace for growth

- United States crude oil production is continuing to show resilience in the face of lower prices as growth in Permian tight oil output partly offsets declines elsewhere. As noted earlier, we have raised the expected output trough by about 0.3 MMb/d and we now see average 2017 output as flat with 2016 instead of a roughly 0.2 MMb/d decline in last month's report.
- Canada will also be a key source of production growth in the period to 2018 (see next slide).
- Total non-OPEC crude production will decrease by 1.3 MMb/d in 2016, but then increase 0.4 MMb/d and 0.6 MMb/d respectively in 2017 and 2018.

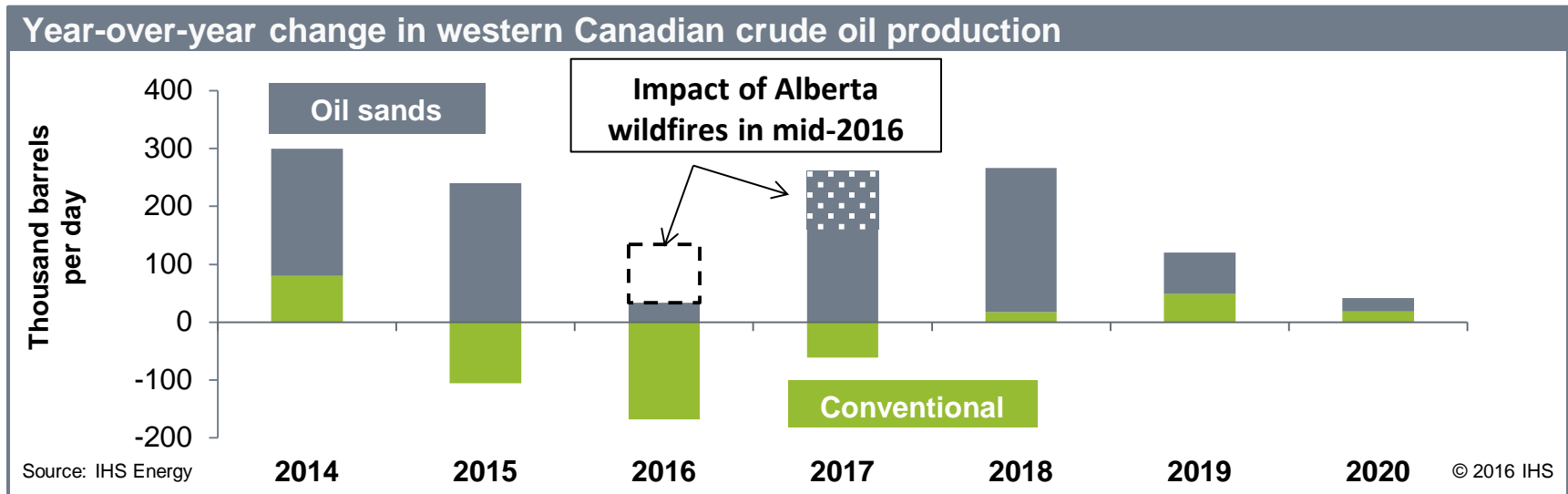
Annual change in crude oil production for selected non-OPEC countries, 2016–18



Source: IHS

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Canada to be key contributor to world production growth in 2017-18 as oil sands projects come online

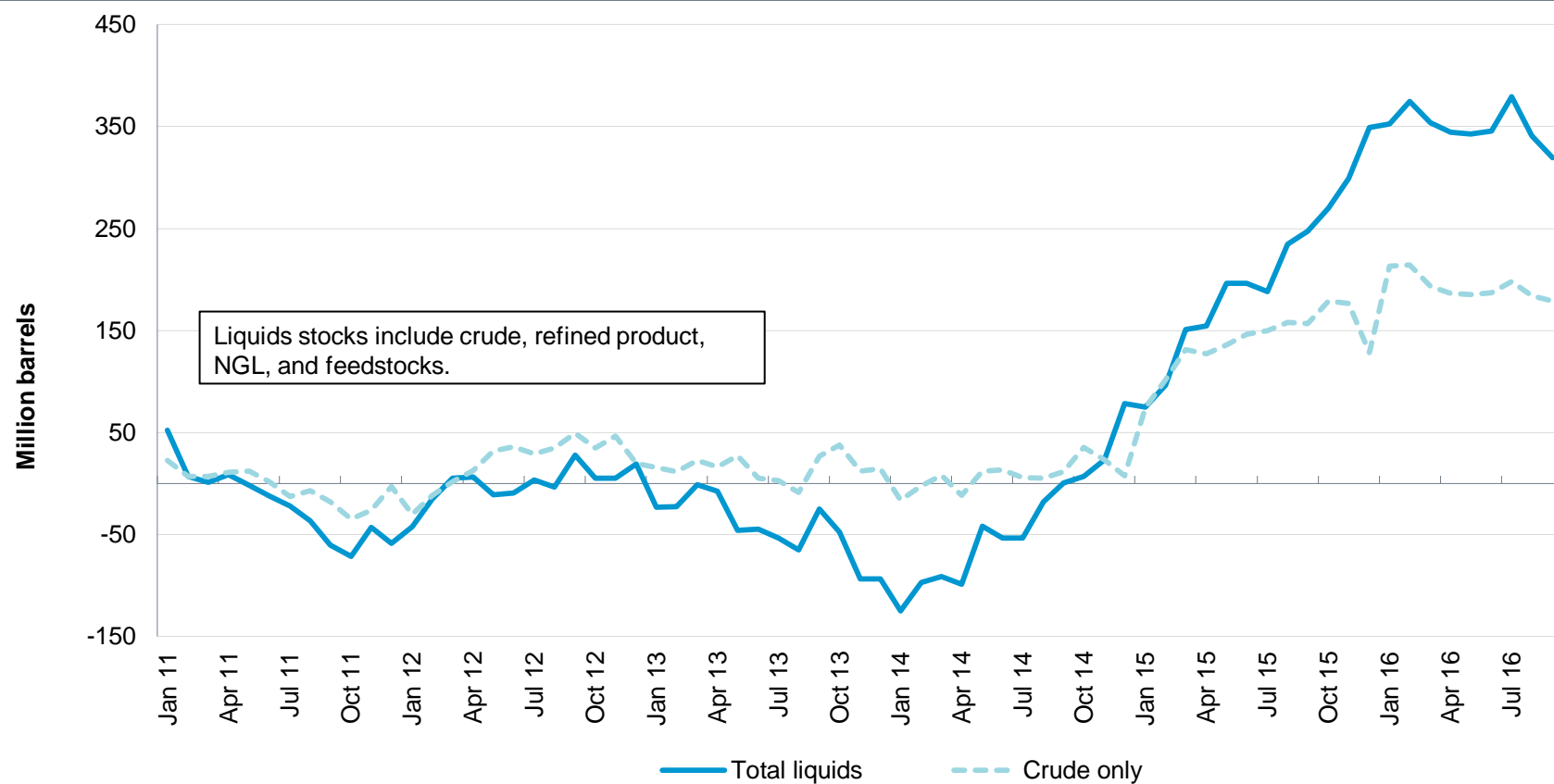


- IHS projects that Canada's total crude oil production will rise by more than 500,000 b/d in 2017-18.
- Oil sands projects sanctioned before the oil price collapse of 2014-15 are the key source of this growth.
- Also, declines in conventional production – which is generally more price-sensitive than large, capital-intensive oil sands projects— will exert less of a drag on total production growth than they did in 2015-16.
- In a sign that a freeze in new, large capital commitments in the oil sands may be beginning to thaw, Canadian Natural announced earlier this month that it would re-start development of its Kirby North project. The project's targeted capacity is 40,000 b/d with first oil targeted for 2020.

OECD total industry inventories remain high

Elevated stock levels will restrain upward price movements

OECD industry stocks relative to 5-year average



Notes: Data are monthly.
Source: International Energy Agency, IHS

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Global Standards are Critical

In today's global business environment having access to the right information and knowledge at the right time often means the difference between staying ahead of your competition and struggling to stay alive.

..... Neil Reeve, Shell Technical Standards Manager



Shell Global Solutions International BV

Company Benefits from Standards

- **Cost Reduction - Increase Business Efficiency**
- **Simplify design and procurement; Variety Control**
- **Interchangeability of equipment**
- **Promote stable and global market**
- **Improve Technical Integrity**
- **Safety, Health and protection of the Environment**
- **Maximize availability, minimize lost revenue**
- **Establish a Common Technology Base**
- **Technology transfer / Sharing best practice / Remove barriers to trade**
- **Support Legislation where linked**
- **Safety and Environmental Regulations (e.g. Process Safety Mngt, US)**
- **Procurement Legislation (e.g. European Directives)**



Shell Global Solutions International BV

What is Driving Up Costs in Engineering?

Some Sobering Statistics...

\$38B

Unnecessary cost of equipment purchases due to suboptimal internal standards

100%

Increase in engineering hours required when using internal standards vs. industry standards

50%

of engineering workforce eligible for retirement in next five years

8.2

years for a new hire to step into the shoes of a retiring engineer

30%

of total R&D spend is wasted duplicating research and work previously done

13

unique data sources are used to find answers to each engineering challenge

42%

of time spent seeking information — time that could be used to solve problems.

56%

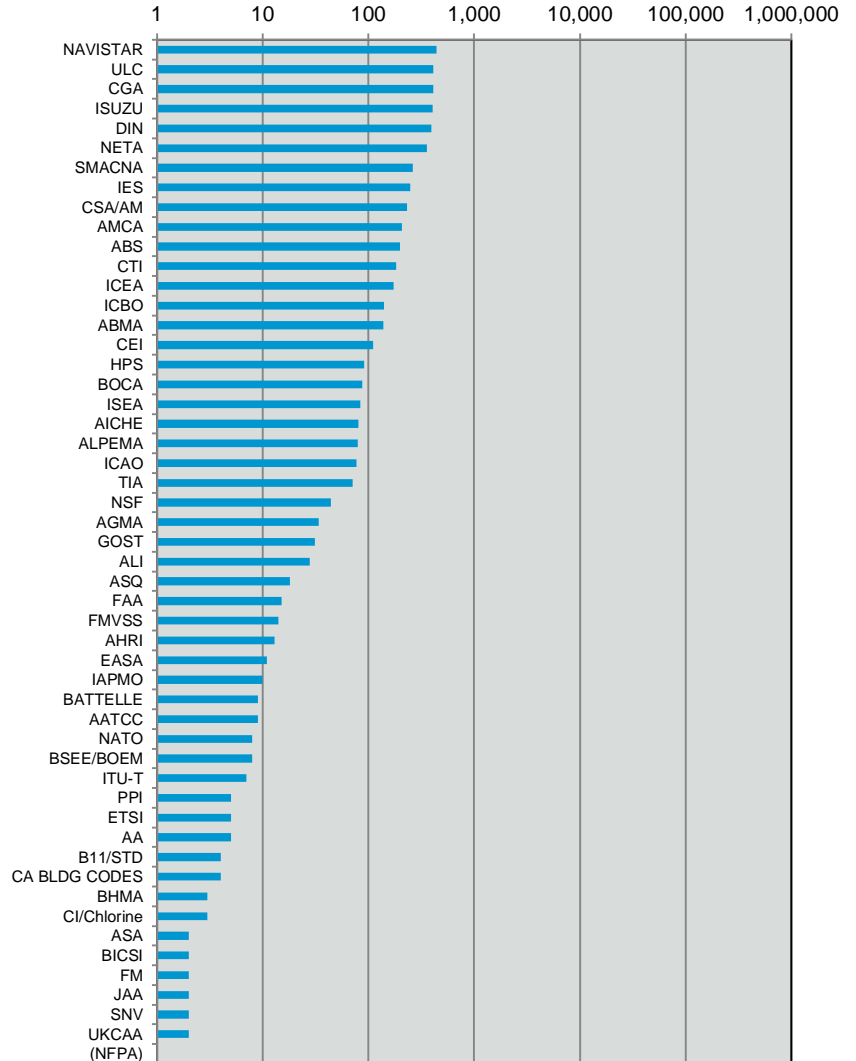
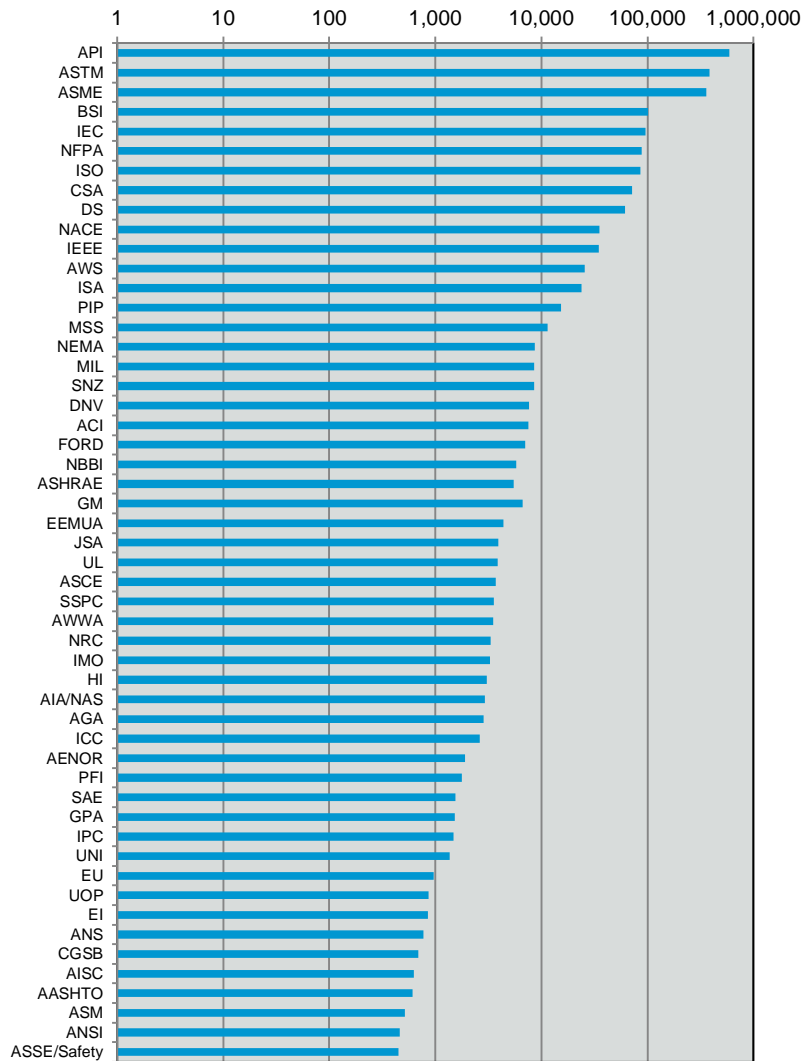
of the time workers can't find the information required to do their jobs

Optimize Internal & Industry Standards



Standards usage in the oil & gas industry

Large number of standards bodies, significant usage across them



Managed Standards Information is Critical

Growing number of standards & regulations, plus continued revisions and updates:

ASTM issued over 600 new, revised, and reaffirmed standards in the first 3 months of 2016 alone

API maintains an inventory of more than 1,000 standards, recommended practices and technical recommendations. More than 20% of these are updated each year.

And these are just two of the dozens of standards developing organizations providing relevant standards for Oil & Gas



The image shows a screenshot of a website with a list of "New Approved ASTM Standards". The list includes items like A283/A283M, B240, B32, B542, B69, B6, B775, B792, B793, B833, B857, and B860, each with a brief description and a link to the standard. Overlaid on this is a document titled "Operation, Inspection, Maintenance, and Repair of Drilling and Well Servicing Structures". The document is identified as "API RECOMMENDED PRACTICE 4G, FOURTH EDITION, APRIL 2012" and includes "ERRATA, SEPTEMBER 2013" and "ADDENDUM 1, AUGUST 2016". The API logo (American Petroleum Institute) is visible at the bottom of the document.

New Approved ASTM Standards

- [A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates](#) has been revised to A283/A283M-12a developed by Committee [B02.04](#), ASTM BOS Volume [02.04](#).
- [B240 - Standard Specification for Steel Castings, Carbon, Class 20](#) has been revised to B240-13 developed by Committee [B02.04](#), ASTM BOS Volume [02.04](#).
- [B32 - Standard Specification for Steel Castings, Carbon, Class 20](#) has been revised to B32-13 developed by Committee [B02.04](#), ASTM BOS Volume [02.04](#).
- [B542 - Standard Specification for Steel Castings, Carbon, Class 20](#) has been revised to B542-13 developed by Committee [B02.04](#), ASTM BOS Volume [02.04](#).
- [B69 - Standard Specification for Steel Castings, Carbon, Class 20](#) has been revised to B69-13 developed by Committee [B02.04](#), ASTM BOS Volume [02.04](#).
- [B6 - Standard Specification for Steel Castings, Carbon, Class 20](#) has been revised to B6-13 developed by Committee [B02.04](#), ASTM BOS Volume [02.04](#).
- [B775 - Standard Specification for Steel Castings, Carbon, Class 20](#) has been revised to B775-13 developed by Committee [B02.04](#), ASTM BOS Volume [02.04](#).
- [B792 - Standard Specification for Steel Castings, Carbon, Class 20](#) has been revised to B792-13 developed by Committee [B02.04](#), ASTM BOS Volume [02.04](#).
- [B793 - Standard Specification for Steel Castings, Carbon, Class 20](#) has been revised to B793-13 developed by Committee [B02.04](#), ASTM BOS Volume [02.04](#).
- [B833 - Standard Specification for Steel Castings, Carbon, Class 20](#) has been revised to B833-13 developed by Committee [B02.04](#), ASTM BOS Volume [02.04](#).
- [B857 - Standard Specification for Shaped Wire Compact Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Supported \(ACSS/TW\)](#) has been editorially changed, available as B857-11e2 developed by Committee [B01.07](#), ASTM BOS Volume [02.03](#).
- [B860 - Standard Specification for Zinc Master Alloys for Use in Hot Dip Galvanizing](#) has been revised to B860-13 developed by Committee [B02.04](#), ASTM BOS Volume [02.04](#).

Operation, Inspection, Maintenance, and Repair of Drilling and Well Servicing Structures

API RECOMMENDED PRACTICE 4G
FOURTH EDITION, APRIL 2012
ERRATA, SEPTEMBER 2013
ADDENDUM 1, AUGUST 2016

energy **API**
AMERICAN PETROLEUM INSTITUTE

Offshore Drilling Standards

There are more than 100 hundred standards specifically covering Offshore Drilling from multiple organisations including:

ABS, API, DNVGL, IMO, ISO, NORSOK, TH Hill.

Adoption of key standards & recommended practices ensures operations are optimized to best practices & equipment is maintained for efficient and safe operation. Leading to a safer lower cost operation.

Document Number	Title	Status
ABS 6 CORR	RULES FOR BUILDING AND CLASSING MOBILE OFFSHORE DRILLING UNITS 2016	Active
ABS 227	GUIDE FOR LAY-UP AND REACTIVATION OF MOBILE OFFSHORE DRILLING UNITS	Active
API RP 4G	Operation, Inspection, Maintenance, and Repair of Drilling and Well Servicing Structures - FOURTH EDITION; ERTA: September 2013; ADDENDUM 1, AUGUST 2016	Active
API RP 7L	Procedures for Inspection, Maintenance, Repair, and Remanufacture of Drilling Equipment - First Edition; Includes Addendum 1: 02/2006; Addendum 2: 3/2006	Active
API RP 13B-2	Recommended Practice for Field Testing Oil-based Drilling Fluids - FIFTH EDITION; ERTA 1: AUGUST 2014	Active
API SPEC 4F	Specification for Drilling and Well Servicing Structures - Fourth Edition	Active
API SPEC 7K	Drilling and Well Servicing Equipment - SIXTH EDITION; ERTA 1: May 2016; ERTA 2: August 2016	Active
API SPEC 13A	Specification for Drilling Fluids Materials - EIGHTEENTH EDITION; Effective August 1, 2010; Incorporates ERTA 1: August 2014; ERTA 2: May 2015; ERTA 3: July 2015; ERTA 4: OCTOBER 2016	Active
DNVGL-RU-OU-0101	Offshore drilling and support units	Active
ISO 13354	Petroleum and natural gas industries - Drilling and production equipment - Shallow gas diverter equipment -	Active
NORSOK D-001	Drilling facilities - Edition 3	Active
THHILL DS-1 VOL 1	Drilling Tubular Product Specification - Fourth Edition, Third Printing; Includes Addendum 2: 1/7/2015	Active
THHILL DS-1 VOL 4 ADDENDUM 4	Drilling Specialty Tools - Fourth Edition, Applies to First and Second Printing	Active

Complex and Over-Lapping World of Standards

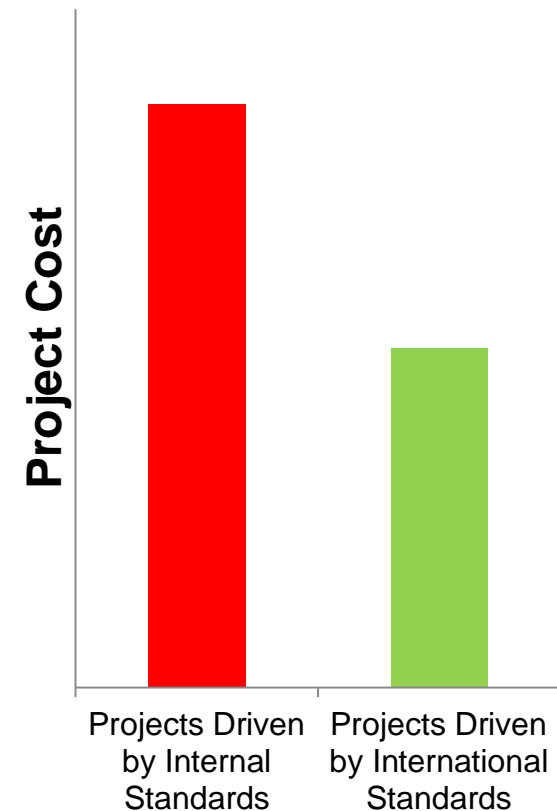
System	Related Standards
Subsea	Tree forgings - 184
	Wellheads - 501
Piping	Pipes – 384
	Fittings – 169
	Flanges – 69
	Valves – 328
Corrosion management	Induction bends - 9
	Pipe systems - 77
	Fittings/Flanges - 28
	Structural - 113
	Coating Systems - 314
Rotating equipment	ICCP - 253
	Turbine - 2059
Topside	HIPs - 261

Internal Standards Come at a Cost

To close gaps in industry standards, operators create their own internal standards.

These internal standards are incredibly valuable, but also drive increased cost:

- Bespoke requirements
- Out-of-date references
- Project engineers can't scale
- Rationale not documented and lost
- Over-engineering
- Lack of supplier feedback



Source: IHS Research

The Case for Optimizing Internal Standards: Examples of the Cost

Over-Specification:

- API standard pumps cost about 3X ANSI standard pumps, and are appropriate when pumping flammable oil. However, many internal standards call for using API pumps more broadly, even for pumping cooling water and condensate.
- Standards call for nickel alloy when 316L SS is appropriate, or tantalum when titanium is appropriate

Customization:

- Proprietary specs that require customized equipment, which can cost 5 - 10x 'off the shelf' equipment, with unclear benefit.

Lack of Consistent Standards Quality:

- Out of date references to industry standards driving unnecessary customization and rework
- Lack of clarity in deviations from referenced industry standards, creating extra engineering time on each project
- Unclear acceptance criteria: “the execution of application programs in such a manner as to avoid interfering with the basic cycle time of any application”
- Unclear origin and rationale for requirements,

Standards Optimization

- Background

“if we can use an international standard with minimum change we will”

“We don’t want to write our own standards”

“If we can reduce our standard from 100 pages to 10 we will”

Other majors are controlling costs by limiting valve selection, typically one valve per category per size (except for small bore valves). The cost implications for this are suggested to be considerable

Life cycle costs can be reduced by as much as 20% as there is less inventory to carry with spares being able to be bought in “Bulk”

Valves continue to fail costing \$000’s if not \$000,000’s to correct when plant has to be stopped even though the correct procedures for selection have been followed

Standards Optimization

- *Approach*

Optimization of internal - Valves Standard (valve selection)

- High level review at both technical and editorial perspective, and in comparison to formal standards
- Identify areas for improvement to define the use and presentation of the document as well as how others in the peer group approach valve selection
- Final report of recommendations

Standards Optimization

- *Potential Benefits*

For a typical small plant with relatively simple processing unit, costs for 4000 valves is estimated to be \$9.5 million

For a major operator with annual capital expenditure of \$2.45 billion and assuming that 7% of onshore spend and 4% of offshore spend is on valves that would give a total of \$133.5 million per year or \$667.8 million over 5 years.

The research suggests if overpaying on valves by 10-50% is correct, “Oil & Gas Major” are paying \$33.4 million per year more than they need to (\$166.9 million over 5 years) assuming an average 25% uplift

That is just the procurement saving not accounting the knock on benefits of low stocks, warehousing etc. There would be additional savings on terminals, well sites/gathering networks and downstream/petrochem plants.

Imperative: Every Operator Needs to Do 2 Things

#1: Focus on driving cost out of your own internal standards

- a) Put governance and process controls in place to ensure standards decisions are made in a business context
- b) Prioritize standards that are impacting cost
- c) Drive to industry standards where possible

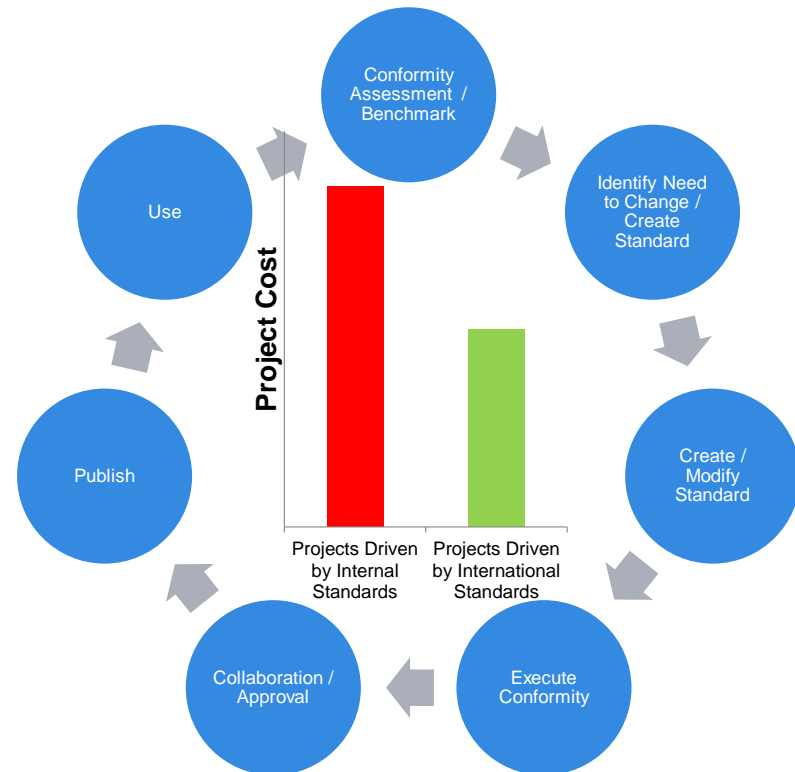
#2: Improve industry collaboration on standardization, in areas of significant industry spend, where industry standards are unavailable, conflicting or don't go far enough.

Internal Standards Potential Outcome to Improve Cost



IHS Offers Complete Solution for Internal Standards Optimization

- 1. Gap analysis** – prioritize internal standards by impact on business / financials
- 2. Conformity assessment** – identify unnecessary cost drivers, engineer them out of the standard, drive towards industry standard adoption
- 3. Turnkey management of internal standards** – hosting, publishing, updates, cross-reference with international standards
- 4. Improve visibility, usage and compliance** with internal standards





IHS Markit is revolutionizing how engineers discover and apply knowledge scattered across and outside their company
– **accelerating research, problem-solving and ideation.**





Delivering superior solutions to achieve superior results

Largest content collection

370+
standards
organizations
worldwide

1.7M+
standards,
codes and
specifications

30+
leading
technical
publishers

10K+
widely
used technical
eBooks

75M+
vetted
technical
publications

45M+
patents from
the Americas,
Europe & APAC

World-class technologies

Multi-lingual patented
semantic technology cutting
research time by 30+ %

Content Analytics
delivering insights into
market, technology &
competitive trends

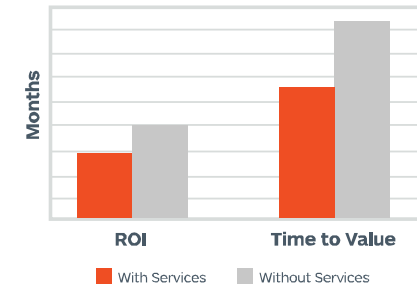
Integrated problem solving
tools enabling more rapid
problem identification
& resolution

Industry-leading expertise

600+
consulting engagements

Jumpstarting projects and
accelerating cumulative value:

Delivering Time to
Productivity 3X Faster



"IHS Services are a catalyst for innovation and are playing a key role in **advancing the research** and development efforts that contribute to our company's market-leading position."

Denis Clerc - Vice President, Innovation Airbus Defence & Space



Thank You!

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