



IHS Markit®

# Navigating Choppy Waters | Prospectus

**A Multi-client study on marine bunker fuel in a low sulfur, low carbon world**



# Contents

Introduction .....	3
Study scope .....	4
Key questions addressed.....	6
Deliverables .....	7
Proposed table of contents .....	8
Methodology .....	11
Project team .....	12
Our expertise .....	15
Contact information .....	16

# Introduction

## IMO 2020 bunker specification change

### The most disruptive impact on oil markets from a planned event?

In 2009, IHS Markit released a multi-client study which asserted that a bunker fuel specification change could result in huge disruption to the global oil markets, particularly global crude and refined product. In 2014 a follow up assessment maintained this point of view. Then in 2016, the international Maritime Organization (IMO) announced plans to reduce its global bunker fuel specification from 3.5% to 0.5% sulfur in maritime bunker fuel, effective January 2020. In response, IHS Markit predicted that not only would there be insufficient time for the shipping industry and/or refining industry to prepare for this change, but also that a significant disruption to oil markets was likely, resulting in tight gasoil markets and excess high sulfur fuel oil. Today, IHS Markit continues to project that an oil market disruption is very likely, due to insufficient scrubber installation on ships and a lack of refinery projects. This view has now been broadly accepted by the industry, with even futures markets now anticipating the forthcoming pricing disruption in 2020.

Navigating Choppy Waters will provide further ground-breaking insight into the potential market impacts by examining the key uncertainties surrounding the adoption of the IMO bunker fuel sulfur rules and quantify the regional bunker fuel quality balances. The magnitude and duration of the global disruption will be estimated using a Monte Carlo-style theory and probabilistic impact analysis based on regional residual supply and disposition modelling and a ship and refining industry scenario analysis.

By leveraging insights and analysis conducted by world leading industry experts and databases from both IHS Markit Energy and Maritime & Trade teams, this study will provide supply, demand and trade forecasts for new bunker fuels over the 2019-2025 period. This will build on, rather than duplicate, the core IMO analysis currently available through the IHS Markit Refining & Marketing subscription service. The information and analysis provided in this study will not be available through existing IHS Markit subscription services.

The key content of the study will be:

- Provide a probabilistic impact analysis on the market
- Examine the impact on regional trade and supply of low-sulfur & high-sulfur bunker fuels in the key bunkering hubs
- Assess other key unknowns relating to the transition
  - Blending of new 0.5% fuel
  - Impact on VGO and lubricant markets
  - Impact on shipping costs
  - Influence of CO2 ship emission reduction targets

# Study Scope

The study will primarily focus on a deep-dive into 2 key aspects of the IMO 2020 transition:

**Regional residual supply and disposition modelling:** Using the IHS Markit base case, we will provide regional balances of low sulfur (LS) and high sulfur (HS) fuel supply, demand and trade in the IMO transition period.

- IHS Markit will use our global refinery capacity database and regional refinery models to forecast compliant fuel supply. We will also use our maritime database, bunker fuel demand data and ship tracking data to model demand in order to create a trade forecast.
- We will forecast bunker fuel consumption in the Top 10 global ports, which accounts for about 75% of global bunker fuel consumption. We will analyse the supply and trade of 0.5%S bunker fuel (LS Bunker) and high-sulfur bunker fuel (HS Bunker). This analysis will be based on supply-chain analysis, port infrastructure, regional refining crude slates, utilization and capacity.
- For each of the Top 10 bunker hubs we will provide an overview of storage and logistics, at a high level, and assess any potential supply bottlenecks for bunker fuels using our oil infrastructure database EDIN.
- The modeling will include regional supply/demand balances for other impacted oil products, including inland fuel oil, gasoil and feedstocks trade flows.

**Ship and Refining Industry Scenario Analysis:** scenario analysis of the key variables which will define the magnitude and duration of the IMO 2020 impact on oil and shipping markets. Principle scenarios will be compliance level and scrubber uptake, but also refinery project delays, HS fuel oil storage and potential regulatory transitional measures intended to smooth the transition. To quantify the influence of the key variables, the IHS Markit base case crude oil price (around \$70 Dated Brent) would be used for all Scenarios.

For each scenario, the study will provide:

- Global fuel oil balance detailing major sources of supply/demand in year 2020 and, as needed, subsequent years.
- A regional price outlook for key refined products and crude oils, and will compare this with our base case price and margin forecast
- Refinery margin impact analysis using at least four different refinery configurations in each of the key regions of USGC, NWE, Med and Asia, intended to provide a view on the stronger and weaker refining assets in each region during the IMO period

Probabilistic analysis:

- IHS Markit will use the outputs of the scenario analysis, and combine these using Monte Carlo type probabilistic analysis.
- This will provide a probability distribution of the range of potential outcomes on product prices and refinery margins.
- This ultimately allows an indicative assessment of business risk created by the IMO transition.

Inputs	Outputs
<ul style="list-style-type: none"> <li>– Refinery margin and throughput</li> <li>– Bunker fuel price, required annual quantity and scrubber installation cost</li> </ul>	<ul style="list-style-type: none"> <li>– Refinery profitability</li> <li>– Annual bunker fuel purchase cost</li> <li>– Scrubber installation payback</li> </ul>

Additionally, the study will provide insight on:

- Discussion on refining and ship owner strategies for achieving the bunker fuel rules
- Latest data on ship scrubber technology, availability, cost and timing of installation and scrubbing economics and installation payback using the scenario analysis. Overview of open and closed scrubber technology.
- Summary of current global legislation and discussion on potential future legislation (and possible delays). Compliance outlook including waivers, LS Bunker available and other sanction relief mechanisms being considered.
- Quantify how storage of HS fuel oil might address some oversupply during transition period. Discuss role of market timing structure and flat price risk in estimating the suitability of this option.
- Provide IHS Markit view on influence of crude oil quality and crude production response to IMO 2020.
- Initial assessment of refinery blending components for the new formulations of 0.50%S bunker fuel and discussion on their potential compatibility, handling and other fit-for-use issues.
- Potential impact on global lubricant market as a result of VGO market tightening as some VGO is used to supply the bunker fuel market.
- Potential impact on shipping operating costs, global freight rates, shipping economics, scrubber demand and accelerated ship scrapping using the scenario analysis output.
- High-level review of the recent CO2 emission reduction targets, set by the IMO for 2030 and 2050, known available methods to compliance and influence on ship owner strategies for the 2020 bunker fuel sulfur transition.



# Key Questions Addressed

Navigating Choppy Waters will provide answers to the following key questions:



- Where will supply of the new 0.5% sulfur bunker fuel be sourced?
- How will bunker fuel trade change?
- Will there be sufficient logistics to support the new trade?



- What level of non-compliance is expected?
- How might changes in the IMO legislation, enforcement and compliance impact the oil market?



- Are scrubbers a sustainable solution?
- How will changes in scrubber uptake influence the level of disruption in the oil market?



- How might crude oil prices and production economics be impacted?
- Will there be an excess of residual/HSFO in 2020? For how long and where will this go?



- What are the range of potential outcomes for the IMO impact on the oil market, refinery margins and business?
- What is the probability distribution of the range?



- Are refineries making sufficient investments to supply 0.5% sulfur fuel?
- What would be the impact if some of these projects were delayed?
- How might the new 0.5% sulfur grade be blended?

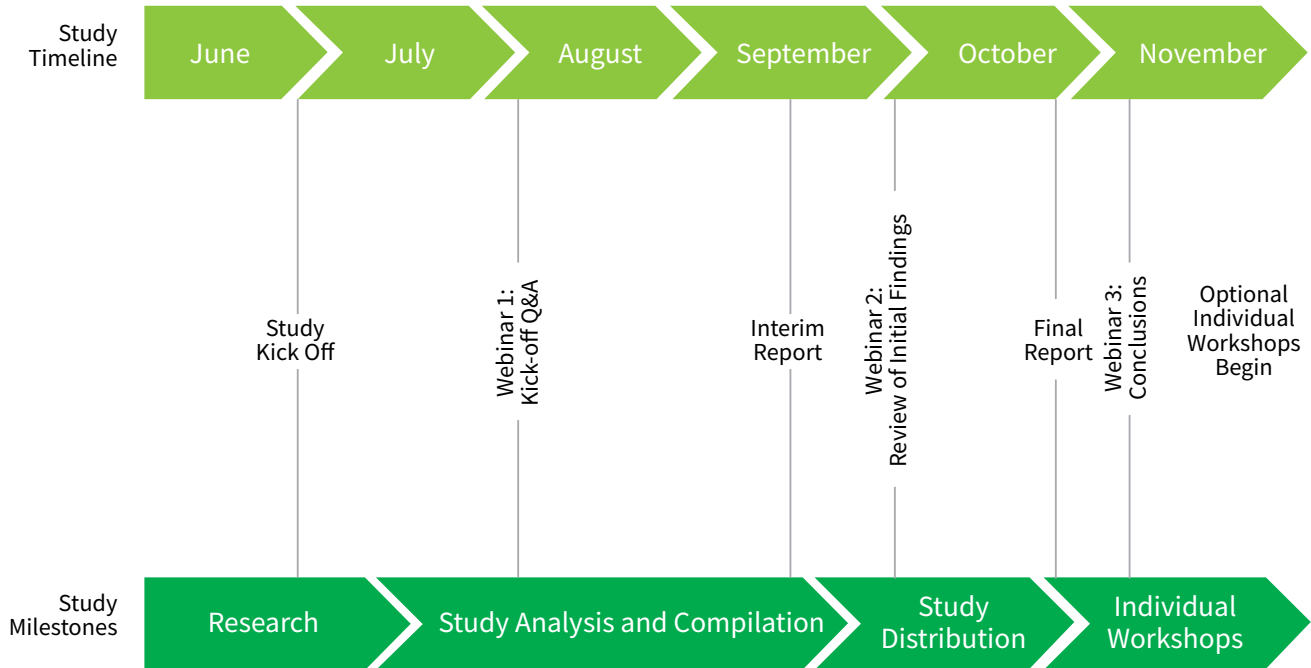


- Could the recent shipping GHG emission reduction targets impact scrubber installation decisions?
- How will IMO changes impact bunker fuel prices and freight rates around the world?



- Might IMO transition affect the vacuum gasoil and lubricants market?
- Does LNG still have a role to play in the transition?

# Study Deliverables and Timeline





# Proposed Table of Contents

Please note that the table of contents below is subject to change depending on the findings of the analysis, the table shown below is how we envisage the study content.

**Section 1 Introduction**

**Section 2 Executive summary and key messages**

**Section 3 Bunker fuel supply, demand and trade analysis**

3.1 Demand for shipping and bunker fuel

GDP, industrial production and international trade

Significance of waterborne trade

Vessel fleet outlook – newbuilds and demolitions

Slow steaming and fuel economy

Baseline bunker fuel demand, historical 2000-2018 and outlook for 2019-2025

3.2 Today's bunker fuel supply chain

Legislation, ISO standards and commercial grades

Key participants in the supply chain

Consumption of marine gasoil and marine fuel oil 2000-2018

Overview of key bunker fuel hubs – consumption, supply, trade and infrastructure

Singapore

ARA

Fujairah

Main hubs in North East Asia – Busan and Hong Kong

Main Mediterranean cluster – the Gibraltar Strait

Main hubs in America – Panama, Houston, New York, and LA

3.3 Compliance options from 2020 onwards

Legislative overview, remaining uncertainty, and significance for the transition

Scrubbers: technology, key suppliers, uptake to date, pros & cons, outlook

LNG and other alternative fuels: uptake to date, pros & cons, outlook

Marine gasoil and other compliant fuels

Non-compliance spans beyond the colloquial notion of cheating

IHS Markit's base case assumptions

3.4 Who will supply the new compliant fuels and will HSFO be available?

A multitude of grades within a wide standard

Company announcements and ECA experience

Announced capital projects

Company intentions to supply 0.50%S bunker fuel

Flash back to 2014-2015 – The ECA transition

IHS Markit modelling of the global refining system

Crude slate changes

Unit utilization

Assessment of the residue surplus

Supply analysis of the key bunker fuel hubs

Potential new bunker hotspots, availability issues and export powerhouses



### 3.5 Clearing the fuel oil surplus

Refiners taking steps to minimize HSFO output

The emergence of a coker feed market

What is possible with storage

Let's all make bitumen and pave roads

Temporary home in power generation

### 3.6 Collateral damage – what is the impact on other feedstocks and refined products?

High sulfur gasoil – to export or to bunker?

Vacuum gasoil – caught between a cracker and a bunker barge

Low sulfur straight run – the ideal bunker fuel that happens to be a lovely feedstock

### 3.7 Trade of 0.5% sulfur and high-sulfur fuel oil post-2020

## **Section 4 Scenario analysis of the IMO transition market impact**

4.1 Basecase – definition, logic and forecasted oil market impact on both bunker fuel prices and refining margins, in the period 2019-2025, using 3 benchmark refineries in 3 regions – USGC, ARA and Singapore. The time period 2019-21 will be split into quarters, for the rest annual period will be used

4.2 Scenario 1 – low compliance

4.3 Scenario 2 – high compliance

4.4 Scenario 3 – higher scrubber installation prior to January 2020

4.5 Scenario 4 – higher scrubber installation rate post January 2020

4.6 Scenario 5 – lower scrubber installation rate post January 2020

4.7 Scenario 6 – delay in refinery upgrading projects

4.8 Scenario 7 – transitional measures used by IMO in implementation phase

### Notes:

- for the basecase and each scenario the price and margin forecasts will essentially cover the similar range of crudes and refined product as the IHS Markit long-term price forecasting service in both nominal and real prices:
  - approximately 15 crudes in each of the three regions: Europe, USGC and Asia
  - all the main refined products naphtha, gasoline, jet/kerosene, diesel, gasoil, 0.5% bunker, HSFO priced in USGC, ARA, Mediterranean and Singapore
  - at least four benchmark refinery margins in each of the regions to cover the range of operating refineries
- it is intended that seven will be the minimum scenarios covered but depending on the findings other scenarios might be added

**Section 5 Probabilistic analysis of the IMO transition**

- 5.1 Scenario comparison and assessment of likelihood of each
- 5.2 Probabilistic analysis – probability distribution of bunker product prices, and benchmark refinery ... margins in each region

**Section 6 Scrubber implications and options**

- 6.1 Update on scrubber technology
- 6.2 Scrubber costs and economics
- 6.3 Scrubber legislation: open v closed loop

**Section 7 New bunker fuel blending options and potential issues**

- 7.1 Background on fuel oil blending and why 0.5% might cause a problem
- 7.2 Range of different ways refiners might make 0.5%
- 7.3 Potential compatibility issue for 0.5% blending
- 7.4 What the 0.5% specifications might be
- 7.5 Implications of 0.5% on ships engines
- 7.6 Options for refiners, suppliers and buyers to reduce capability risk

**Section 8 Potential impact of IMO 2020 transition on shipping economics and freight rates**

- 8.1 Representative voyages and fuel consumption
- 8.2 Fuel prices
- 8.3 Shipping investment decision
- 8.4 Potential impact on scrappage rates
- 8.5 Potential impact on global consumables

**Section 9 Potential impact of IMO 2020 transition on global VGO and lubricant markets**

- 9.1 VGO and atmospheric residue
- 9.2 Lubricants
  - Direct competition between bunker fuel and lubricant quality VGO
  - Secondary impact of IMO on lubricant markets result from by-products
- 9.3 Gasoline/Octane
- 9.4 Propylene
- 9.5 Sulfur
- 9.6 Coke
- 9.7 Caustic

**Section 10 Potential and likelihood for LNG to smooth the IMO transition**

- 10.1 LNG
- 10.2 Methanol

**Section 11 Potential impact of long term shipping CO2 reduction targets**

- 11.1 Slow steaming – recent trends and what more is possible and being designed in current fleet
- 11.2 How achievable is the 2030 target?
- 11.3 Achieving a 50% reduction, what is required

# Methodology

IHS Markit is the industry leader in providing in-depth analysis across the oil value chain for crude oil, NGL, refining through marketing. Our fundamental supply, demand and pricing data and analysis connects crude oil and gas supply through the refining industry to end-use sectors. The proven models and methodologies used to develop the Annual Strategic Workbook (ASW) and Crude Oil and Refined Products pricing for IHS Markit clients will also be used for this study. Our long-term price outlook is updated each quarter and our long-term supply and demand outlook (ASW) each year.

In this study, our base case will use the 2018 ASW data, which was issued in May 2018, and the Q3 -2018 long term price outlooks, issued in August 2018.

The long-term IHS Markit Energy crude oil and refined products supply, demand, and price outlook employs a detailed, bottom-up methodology. The Energy Demand Model (EDM) estimates demand for each refined product in each major demand sector in each country. The crude oil production outlook for each country is prepared using the IHS Markit Energy field-level database of existing fields and fields under assessment. The supply of five major refined products (gasoline, distillate, jet/kero, naphtha, and residual fuel oil) is projected by modelling refining runs by country, refinery capacity additions and shutdowns, anticipated future crude oil slates and the estimated change in refining yields. This process is iterated until a set of consistent balances and pricing is achieved.

IHS Markit projects long-term fuel demand by country and region, using fundamental models for key sectors such as transportation, industry, energy and residential/commercial. Projections for road transportation fuels demand take into account our outlook for GDP, fleet size and mix, changes in fuel economy, projected changes in population and vehicle miles travelled, as well as sales and scrappage rates. Other fuels are related to primary input drivers such as GDP, efficiency trends, population growth, passenger air miles, and freight ton-miles. Our modelling employs estimates of short-term and long-term demand elasticities and fuel switching related to end-user energy prices.

In this study, the long-term pricing outlooks for each scenario will be used as input for the probabilistic modelling and will use Oracle Crystal Ball™ software to assist with the analysis.

For our focus on bunker fuel, we will utilise existing bespoke models of global residue supply and demand balance.

For the supply analysis, we will use our Refinery Cost & Margin Analytics (RCMA) tool as well as our global refinery capacity database. The RCMA tool includes modelling of more than 500 global refineries, representing more than 90% of global refinery capacity, combined with IHS Markit pricing analytics. These tools will be used to assess which refineries have the ability and economic incentive to produce the new 0.5% sulfur bunker fuel.

Our bunker fuel demand analysis, and shipping economic and voyage analysis, will use IHS Markit Maritime & Trade's comprehensive ship database (which holds ownership and technical data on the world's fleet, and from which IMO numbers are assigned) and ship position product, AISLive. The latter uses live AIS messages transmitted by vessels. Aside from this product, IHS Markit holds historical vessel positions which can be used to provide analytical insight on the trading patterns of the world fleet. AIS (Automatic Identification System) is designed as an aid to navigation: ships over 299 tonnes are required by SOLAS (safety of life at sea) regulations to transmit basic details every six seconds. IHS Markit captures this data worldwide using a network of more than 1700 ground receivers and through data collected by satellites by partners.

For this study, we will create new bunker fuel supply, demand and trade models focussing specifically on the new bunker fuel grades.

# Project Team



## Spencer Welch

### Project Manager

Spencer worked for BP and Petroplus for 17 years before joining IHS Markit. Since then he has been involved in consulting and research, most recently leading the Global refining & marketing short-term price forecasting team and currently an Executive Director leading the Oil Midstream & Downstream consulting team for Europe/CIS/Africa.



## Kurt Barrow

### Project Advisor

Kurt is currently Vice President, leading the Global Oil Midstream and Downstream (OMD) research team. He began his career at the Exxon Baytown Refinery in various engineering and planning roles before spending six years working for Purvin & Gertz in Singapore. He has a long history with the IMO bunker fuel change having been heavily involved in both the 2009 and 2014 studies.



## Sandeep Sayal

### Project Advisor

Sandeep is based in Houston and also has a long history with the IMO transition. He is Vice President leading the OMD Annual Strategic Work team which provides the long-term supply, demand and trade analysis for crude oil and refined products. Prior to IHS Markit he had various positions with major downstream oil and gas companies.



## Avital Johanan

### Project Advisor

Avital is Executive Director of IHS Maritime and Trade, currently leading the Analysis and Forecasting team which provides long and short term forecasts of the shipping market, supply and demand analysis and deep industry expertise. Avital has been with IHS Markit for 13 years in various analyst, commercial and leadership roles.



## Daniel Evans

### Project Advisor

Daniel is currently Vice President with the OMD team, leading the Refining & Marketing team. He began his career with PFC Energy. Prior to joining IHS Markit he worked for Statoil in corporate strategy, framing the strategic investment context for senior management.



## Victor Shum

### Project Manager

Mr. Shum is a Vice President leading the IHS Markit Oil Midstream and Downstream consulting practice in Asia Pacific. Based in Singapore since 1999, he has extensive experience working with senior management teams on strategy, acquisitions and operational solutions. He began his career with Amoco Oil in the U.S.



## Premasish Das

### Project Advisor

Premasish Das, Executive Director, IHS Markit, leading the Downstream research team for Asia. He has over 18 years of industry experience in both refining and petrochemicals. Prior to joining he worked for ExxonMobil at Singapore refinery and also National Organic Chemical Industries Limited in India.



## Stephen Jew

### Scenarios Lead

Stephen began his career with UOP prior to joining IHS Markit. He was responsible for the global oil long-term price forecasting models, before becoming the Global refinery & marketing short-term forecasting lead.



## Hédi Grati

### Supply & Demand Lead

Hédi began his career with Exxon-Mobil before joining IHS Markit. Both with Exxon-Mobil and since joining IHS Markit Hédi has been heavily involved in bunker fuel market analysis. He is currently responsible for our Global long-term price forecasting models.



## Dalibor Gogic

### Maritime Lead

Dalibor joined IHS Markit in 2013, Dalibor is the lead analyst on the fleet capacity forecast. Before joining IHS Markit Dalibor was a shipping analyst at Worldscale Association in London.



## Krispen Atkinson

### Maritime Lead

Krispen joined IHS Maritime in 2005 and is recognized as a shipping industry expert. He has led the Ports & Terminal team, New Construction and Ships in Service departments and contributed as a subject matter expert in Maritime research & analysis projects.



## Ronan Graham

### Team Member

Ronan Graham is a Senior Analyst within the IHS Markit Oil Midstream and Downstream and is based in Paris. He leads the IHS Markit quarterly IMO publication. Prior to joining IHS Markit, Ronan was a policy analyst at the European Gas Network in Brussels, Belgium.



## Ben Nevarez

### Team Member

Ben Nevarez is a consultant in the Midstream Oil and NGLs team at IHS Energy. He joined IHS Markit in 2014. Prior to joining IHS Markit, Ben worked in investment operations for Invesco, where he was primarily responsible for valuing and pricing the company's commodity-based swaps.



## Matthew Chew

### Team Member

Matthew Chew focuses on the crude oil and refined product market for Asia and the Middle East and has 10 years of experience in the oil and energy industry. Before joining IHS Markit, he worked for Platts, Singapore Petroleum and ExxonMobil.



## Anurag Trivedi

### Team Member

Anurag is a Director with the OMD Middle East Consulting team. He brings in more than 21 years of Oil Industry experience, primarily focused on the Middle East. Prior to joining IHS in 2017, he has held multiple industry and consulting roles with many downstream players across the regions.

## Our Expertise

Energy industries and markets are complex and constantly changing. IHS Markit can help you navigate market uncertainties and make critical business decisions.

We have an unrivaled ability to bring together the complete 360-degree view of the economy, energy industry and related global businesses markets from several thousand experts around the world. Our 300 economists and integrated research and analysis in the upstream, oil markets, midstream, NGL, downstream, power, autos, maritime, chemicals, financial and other markets provide the foundation for our comprehensive views.

In the Oil, Mid-Downstream (OMD) space, we provide in-depth analysis across the oil value chain for crude oil, NGL, refining through marketing for both the short and long-term forecasts for all major global markets and all major products and sectors. Companies use this information to formulate their corporate long and short-term strategies, understand the signposts to watch related to commodity price forecasts and trade balances to manage their risks as it pertains to the crude, NGL and refining markets.

Connecting and creating the IHS Markit view within the OMD space is a team of over 80 professionals around the globe who provide thoughtful research papers, PowerPoints and data tables at the country-level up to the global-level. Delivered through our on-line portal Connect, deliverables for each subscription provide:

- Details and executive-level summaries on market statistics, policy, regulatory, infrastructure, company strategies, project investments and pricing. We have the most granular supply/demand/trade analysis and the most robust and comprehensive pricing and margin forecasting.
- Tactical (e.g. week-to-week & month-to-month) and other longer-term analysis for strategic planning
- Direct access to our global experts





# Contact Information

For enquiries regarding this study, please contact:

**SPENCER WELCH**

Project Manager

**E** [Spencer.Welch@ihsmarkit.com](mailto:Spencer.Welch@ihsmarkit.com)

**HÉDI GRATI**

Director

**E** [Hedi.Grati@ihsmarkit.com](mailto:Hedi.Grati@ihsmarkit.com)

**STEPHEN JEW**

Director

**E** [Stephen.Jew@ihsmarkit.com](mailto:Stephen.Jew@ihsmarkit.com)

For more information [www.ihsmarkit.com/imo2020](http://www.ihsmarkit.com/imo2020)

---

**CUSTOMER CARE**

**NORTH AND SOUTH AMERICA**

**T** +1 800 447 2273

+1 303 858 6187 (Outside US/Canada)

**EUROPE, MIDDLE EAST AND AFRICA**

**T** +44 1344 328 300

**ASIA PACIFIC**

**T** +604 291 3600

**E** [CustomerCare@ihsmarkit.com](mailto:CustomerCare@ihsmarkit.com)

## About IHS Markit

IHS Markit (Nasdaq: INFO) is a world leader in critical information, analytics and solutions for the major industries and markets that drive economies worldwide. The company delivers next-generation information, analytics and solutions to customers in business, finance and government, improving their operational efficiency and providing deep insights that lead to well-informed, confident decisions. IHS Markit has more than 50,000 key business and government customers, including 85 percent of the Fortune Global 500 and the world's leading financial institutions. Headquartered in London, IHS Markit is committed to sustainable, profitable growth.