

# STRATAS ADVISORS

A HART ENERGY COMPANY

## Information on Asia-Pacific Fuel Quality Standards and their Implications for New Zealand

February 2015

UPSTREAM | MIDSTREAM | DOWNSTREAM | FUEL & TRANSPORT

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## Appendix

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1. Countries with gasoline sulfur limit of 10 ppm

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Asia Pacific, Middle East & U.S. West Coast

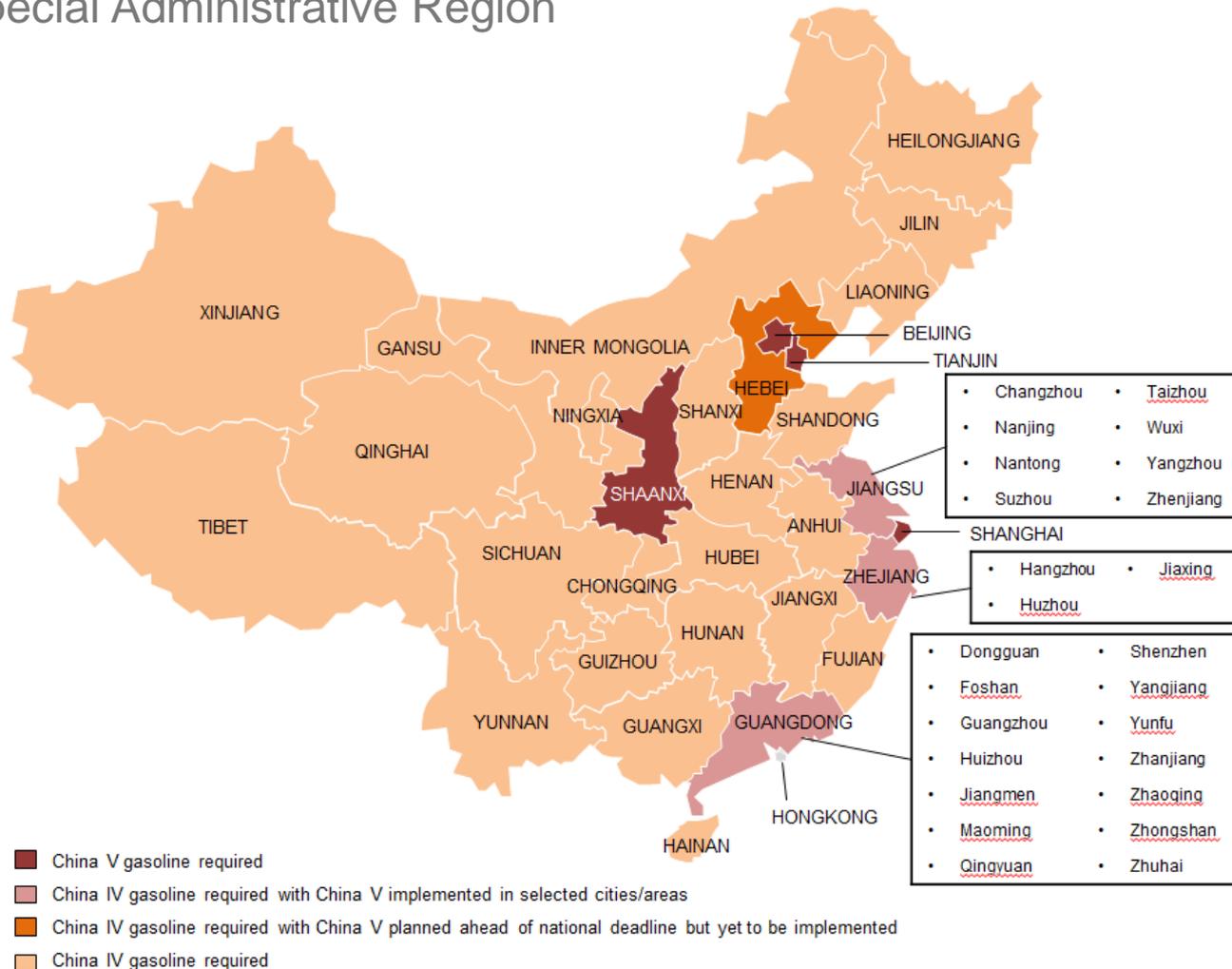
# Asia Pacific (1/2)

Only three countries currently require 10 ppm max sulfur gasoline nationwide

- Japan
  - Voluntarily supplied since January 2005, ahead of implementation deadline by 3 years (i.e. Jan. 1, 2008)
- South Korea
  - Implemented since Jan. 1, 2009
- Taiwan
  - Implemented since January 2012

# Asia Pacific (2/2)

China requires 10 ppm max sulfur gasoline in selected cities, including Hong Kong Special Administrative Region

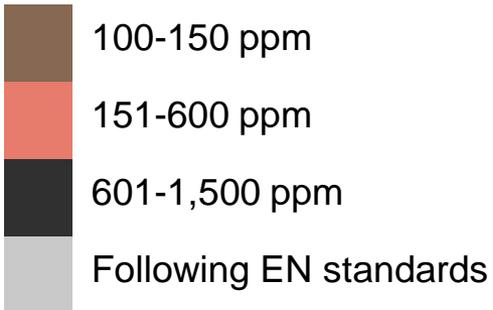


# Middle East

None currently requiring 10 ppm sulfur gasoline



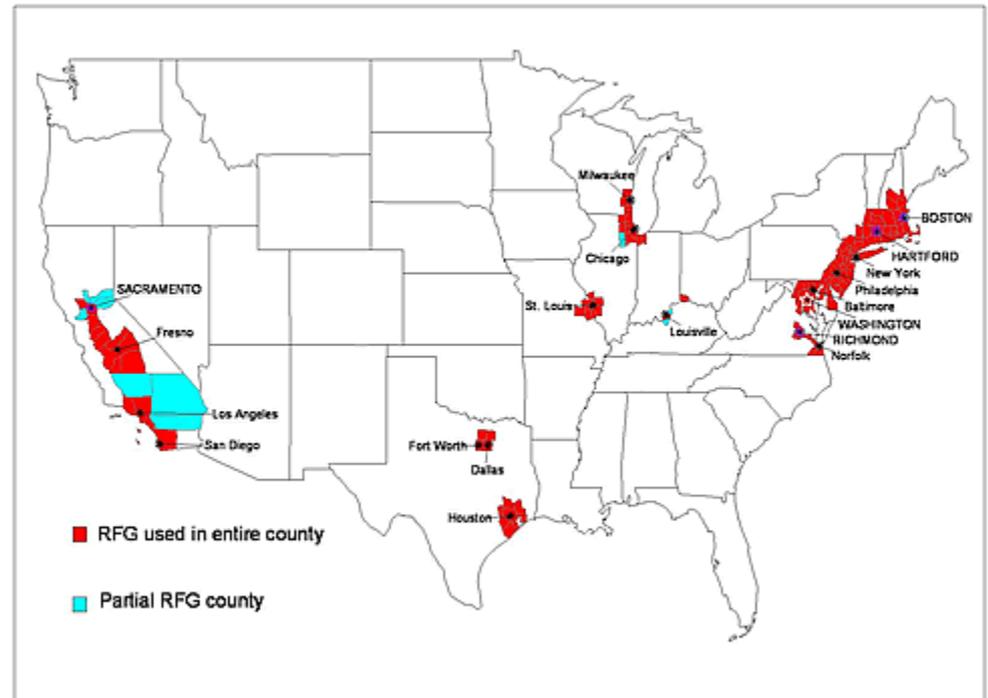
## Legend:



# U.S. West Coast

RFG program applies to gasoline sold year-round in counties with severe ozone pollution including California

## Areas in the RFG Program



Source: U.S. EPA, April 2012

CaRFG Phase 3 <sup>(1)</sup>	Sulfur, ppm, max
Flat <sup>(2)</sup>	20
Average <sup>(3)</sup>	15
Cap <sup>(4)</sup>	30

Source: California ARB

### Notes:

- 1) Effective date October 2012.
- 2) Under this primary compliance option, all batches of gasoline must meet these requirements.
- 3) Under this alternative compliance option, these requirements must be achieved as a volume-weighted average. DALs or cap limits per batch may be agreed upon with California's Air Resources Board (ARB).
- 4) All gasoline in California must meet these limits at all points in the supply chain.
- 5) U.S. EPA released a boutique fuels list that it is required to compile and publish under provisions of the EPACT. EPACT requires EPA, in consultation with the U.S. Department of Energy (DOE), to determine the total number of fuels approved into state clean air plans (also called State Implementation Plans or SIPs) as of Sept. 1, 2004 and to publish a list of these fuels, including the states and Petroleum Administration for Defense District (PADDs) in which they are used.



2. The timeframes in which other countries are planning to move to 10 ppm sulfur gasoline

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Asia Pacific, Middle East & U.S. West Coast

# Asia Pacific

Four countries have plans for 10 ppm max sulfur gasoline

2014	2015	2016	2017	2018	2019	2020	2021
<b>China<sup>1</sup></b> 50 → 10 ppm	<b>China<sup>2</sup></b> 50 → 10 ppm	<b>China<sup>2</sup></b> 50 → 10 ppm	<b>China<sup>2</sup></b> 50 → 10 ppm	<b>China</b> 50 → 10 ppm	<b>India<sup>1,4</sup></b> 50 → 10 ppm	<b>India<sup>4</sup></b> 50 → 10 ppm	<b>Vietnam</b> 50 → 10 ppm
<b>India<sup>3</sup></b> 150 → 50 ppm	<b>India<sup>1,4</sup></b> 150 → 50 ppm	<b>Vietnam</b> 500 → 50 ppm	<b>Singapore</b> 50 → 10 ppm				
		<b>India<sup>1,4</sup></b> 150 → 50 ppm	<b>India<sup>4</sup></b> 150 → 50 ppm				

■ Confirmed  
■ Proposed

## Notes:

- (1) Select cities
- (2) Continuing implementation of 10 ppm max sulfur gasoline in major cities and provinces such as Guangdong, Hebei, Jiangsu, and Zhejiang provinces (see [map](#) in slide 5).
- (3) Currently requires 150 ppm max sulfur gasoline nationwide with 50 ppm implemented in 39 cities with population of more than one million people.
- (4) Proposed road maps for 50 ppm and 10 ppm max sulfur gasoline in “Auto Fuel Policy and Vision 2025” is currently under review and subject to changes by the Ministry of Petroleum and Natural Gas

# Middle East

Only three countries planning for 10 ppm sulfur gasoline in the next 3-4 years



**Note:**

- Confirmed
- Proposed

# U.S. West Coast

Nationwide focus on reducing gasoline sulfur to 10 ppm and vehicle emissions, boosting efficiency

2014	2015	2016	2017	2018	2019	2020
U.S. EPA Tier 3 final rule promulgated	California LEV III emissions standards in effect	U.S. Tier 3 emissions standards start for MY 2017 vehicles	U.S. Tier 3 gasoline sulfur reduction to 10 ppm implemented	U.S. CAFE standard review for MY2022 - 2025	U.S. CAFE standard review continues	U.S. EPA proposes changes to CAFE requirements
	California E10 certification gasoline in use	U.S. Tier 3 early compliance credits for gasoline sulfur reductions				U.S. Tier 3 small-refiner exemption ends
		U.S. Tier 3 – E10 certification fuel for emissions				



3. The regional supply and demand outlook from 2014 to 2030 by sulfur content, identifying regional refineries with 10 ppm production capability

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Asia Pacific, Middle East & U.S. West Coast

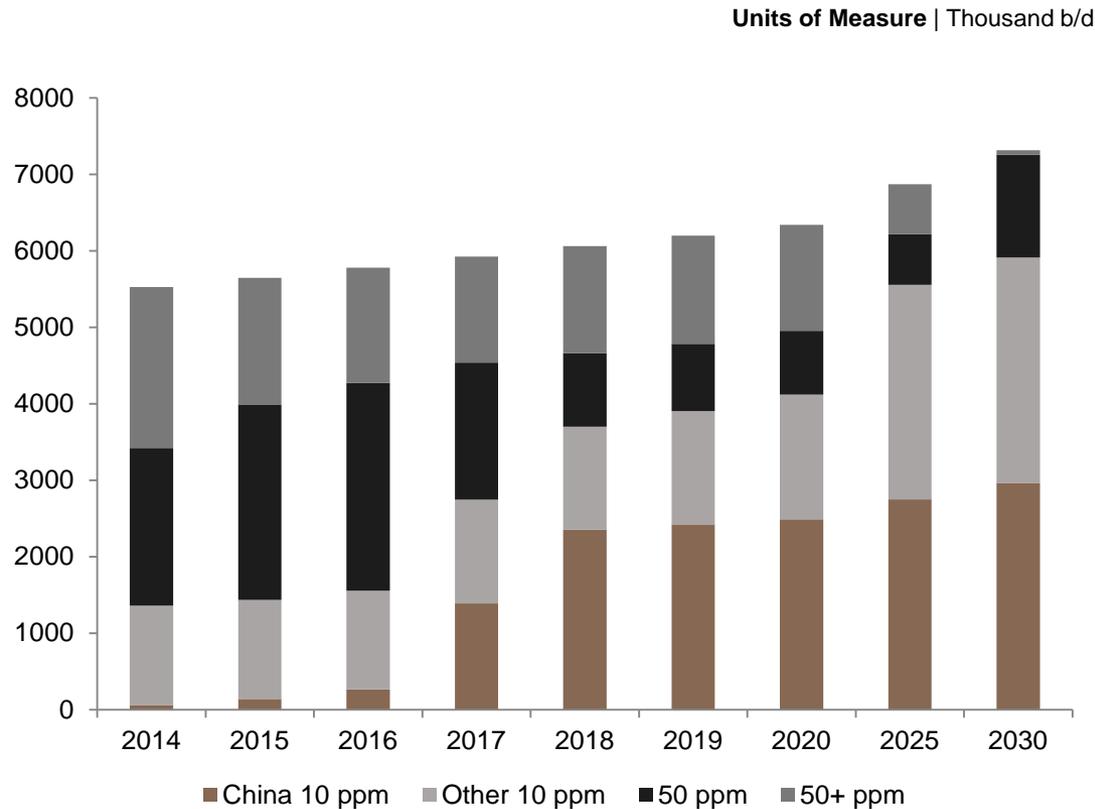
# Supply Demand Outlook

## Asia-Pacific

- For this assessment Asia-Pacific includes the countries of the Asian continent plus the Oceania countries. It extends as far west as Pakistan and does not include any portion of Russia
- Asia-Pacific gasoline demand 5,500 thousand b/d in 2014, increasing 15% by 2020 and additional 15% by 2030.
- Asia-Pacific is a net gasoline exporter and exports are expected to remain relatively stable through 2030.
- 10 ppm gasoline demand 25% of total in 2014, growing to 65% by 2020 and 81% by 2030.
- China and Japan account for over 80% of 10 ppm gasoline demand
- Six Asia-Pacific countries currently capable of 10 ppm production, 9 countries capable of 10 ppm production by 2020.
- Asia-Pacific exports (from the region) of 10 ppm gasoline projected to grow from zero in 2014 to 50 thousand b/d in 2020 and 135 thousand b/d (2% of total gasoline production) in 2030
- India (primarily Reliance) by far largest potential source of 10 ppm gasoline

# Asia-Pacific Gasoline Demand by Sulfur

Major movement towards 10 ppm gasoline



- Rapid growth in 10 ppm gasoline after 2016.
- China major driver of 10 ppm demand growth
- Threefold increase in 10 ppm gasoline demand by 2020

# Assumed schedule for 10 ppm Gasoline Sulfur for Asia-Pacific

Schedule for countries without specific plans identified in section 2. These are included in volume estimates in Asia-Pacific Demand by Sulfur slide

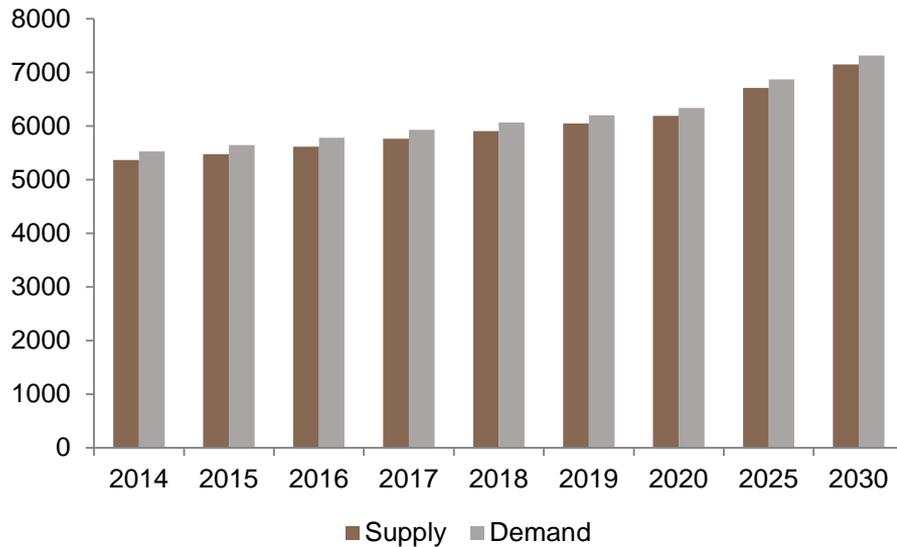
Country	10 ppm Schedule
Australia	Between 2020 and 2025
Vietnam	Between 2020 and 2025
Thailand	Between 2020 and 2025

# Asia-Pacific Gasoline Supply Demand

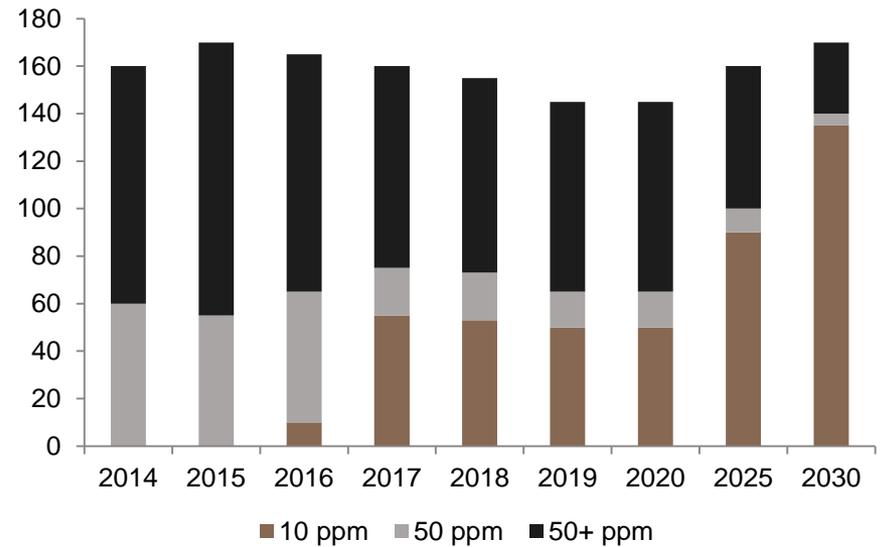
Relatively stable – increasing low sulfur exports

Units of Measure | Thousand b/d

### Supply/Demand



### Exports by Sulfur\*



\* Net exports to countries outside Asia-Pacific region

Source: Stratas Advisors

# Asia-Pacific Supply Demand for Export Countries

Asia-Pacific Countries 10 ppm gasoline capable in 2014: Figures are 2014 exports, not necessarily 10 ppm exports

Units of Measure | Thousand b/d

## India

Supply	750
Demand	430
Exports	320

## Japan

Supply	930
Demand	930
Exports	0

## South Korea

Supply	325
Demand	200
Exports	125

## Taiwan

Supply	250
Demand	175
Exports	75

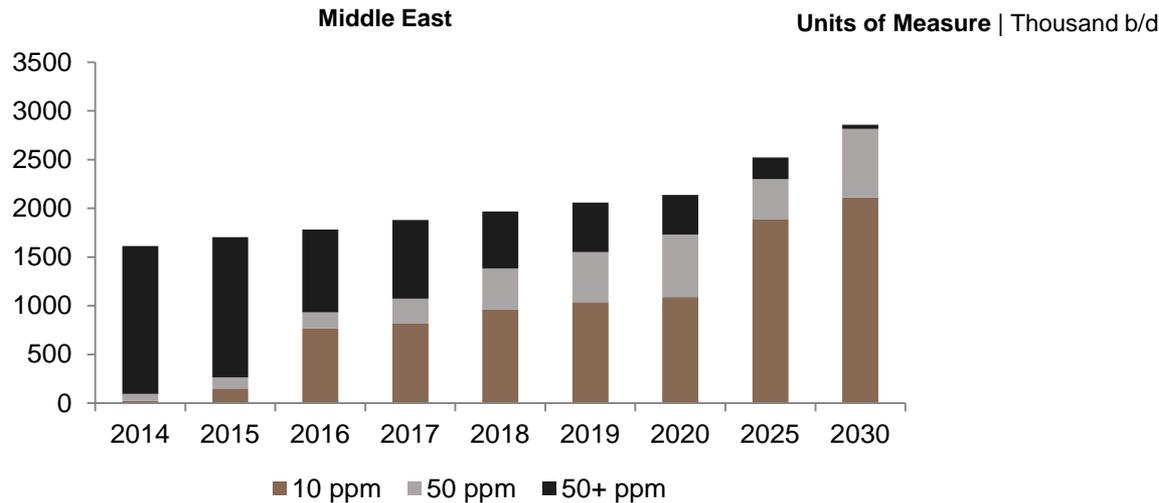
# Supply Demand Outlook

## Middle East – U.S. West Coast

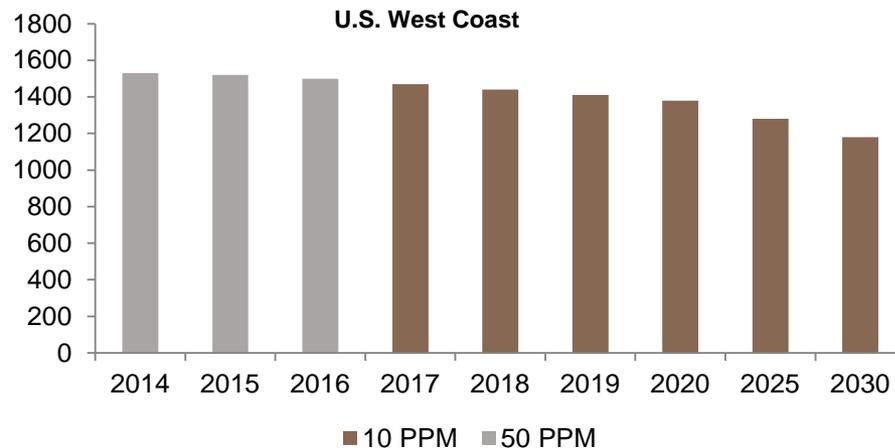
- Middle East is a net gasoline importer. This will reverse by 2016 and exports will climb to 150 thousand b/d by 2020 and 320 thousand b/d by 2030.
- Middle East 10 ppm gasoline demand <2% of total in 2014, growing to 51% by 2020 and 74% by 2030.
- Five Middle East countries currently capable of 10 ppm production and one other by 2020
- Middle East exports (from the region) of 10 ppm gasoline projected to grow from zero in 2014 to 60 thousand b/d in 2020 and 310 thousand b/d (10% of total gasoline production) in 2030
- No net exports from the U.S. West Coast, although the region has capability to export small volumes of 10 ppm. 10 thousand b/d of 10 ppm exports forecast for 2017 through 2030.

# Middle East and U.S. West Coast Gasoline Demand by Sulfur

As in case of Asia, major movement to 10 ppm gasoline post 2016



- Increase in 10 ppm gasoline primarily driven by Saudi Arabia
- Current 10 ppm requirement primarily Israel. Some small volume in Iran and Saudi
- U.S. West Coast market all going to 10 ppm in 2017
- Declining gasoline demand forecast for U.S.

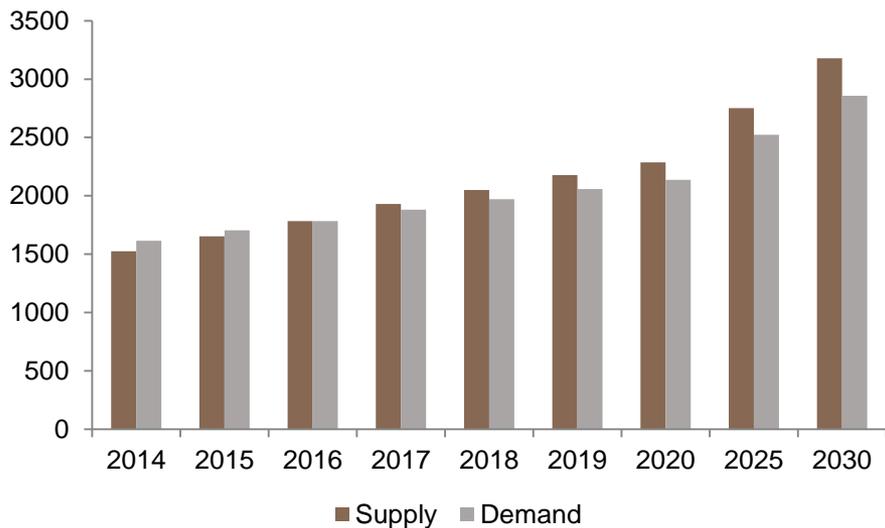


# Middle East Gasoline Supply Demand

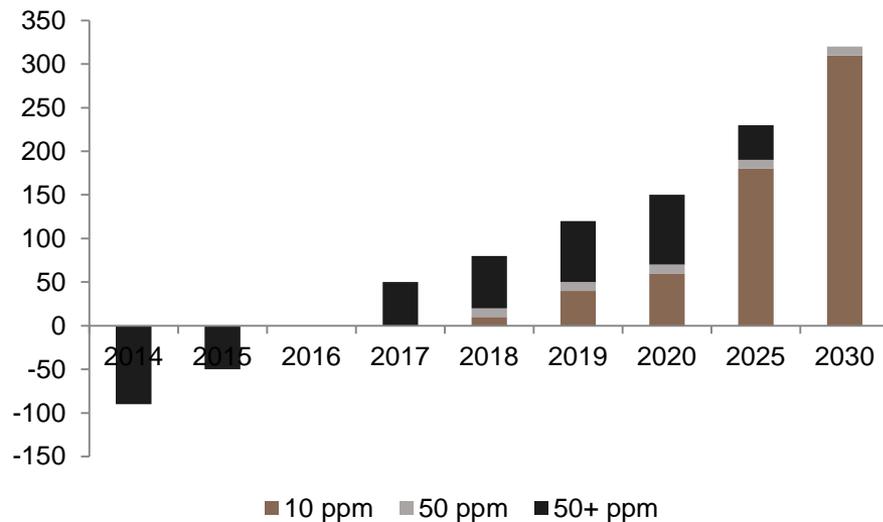
Currently net importer – ultimately large exporter

Units of Measure | Thousand b/d

### Supply/Demand



### Exports by Sulfur



Source: Stratas Advisors

# Middle East and U.S. West Coast Supply Demand 2014 Export Countries

Middle East and U.S. West Coast Countries 10 ppm gasoline capable in 2014: Figures are 2014 exports, not necessarily 10 ppm exports

**Units of Measure** | Thousand b/d

Oman	
Supply	67
Demand	60
Exports	7

US West Coast	
Supply	1560
Demand	1530
Exports	30

# Countries with 10 ppm Gasoline Production Capability\*

Asia-Pacific: Countries in **Red** have no 10 ppm Export Capability

Current	By 2020	Beyond 2020
<ul style="list-style-type: none"><li>• Japan</li><li>• South Korea</li><li>• Taiwan</li><li>• <b>China</b></li><li>• India</li><li>• <b>Thailand</b></li></ul>	<ul style="list-style-type: none"><li>• Japan</li><li>• South Korea</li><li>• Taiwan</li><li>• <b>China</b></li><li>• India</li><li>• <b>Thailand</b></li><li>• Singapore</li><li>• <b>Philippines</b></li><li>• <b>Vietnam</b></li></ul>	<ul style="list-style-type: none"><li>• Japan</li><li>• South Korea</li><li>• Taiwan</li><li>• China</li><li>• India</li><li>• <b>Thailand</b></li><li>• Singapore</li><li>• <b>Philippines</b></li><li>• <b>Vietnam</b></li></ul>

\* Some small volume of 10 ppm may occur such as China to Hong Kong. Sustained exports not likely

# Countries with 10 ppm Gasoline Production Capability

Middle East and US West Coast: Countries in **Red** have no 10 ppm Export Capability

## Current

- **UAE**
- **Saudi Arabia**
- Oman
- **Qatar**
- **Iran**
- U.S. West Coast

## By 2020

- **UAE**
- Saudi Arabia
- Oman
- Qatar
- **Iran**
- **Kuwait**
- U.S. West Coast

## Beyond 2020

- **UAE**
- Saudi Arabia
- Oman
- Qatar
- **Iran**
- **Kuwait**
- U.S. West Coast



4. An assessment of the potential impact of a 10 ppm sulfur standard on supply availability in New Zealand

Asia Pacific, Middle East & U.S. West Coast

# Country Outlook for 10 ppm Gasoline

## Asia-Pacific

- India Reliance refinery has 24 thousand b/d FCC gasoline desulfurization, 300 thousand b/d FCC feed hydroprocessing, 85 thousand b/d alkylation.
- India Essar has 12 thousand b/d FCC gasoline desulfurization
- Actual 10 ppm capability for Reliance/Essar will depend on number of factors including quality requirements for non-10 ppm fuel. The capacity listed show that some range of 10 ppm capacity exists in any case.
- India currently exports about 80 thousand b/d 30 ppm gasoline to Americas
- Taiwan has 164 thousand b/d FCC gasoline desulfurization – sufficient capacity to meet 10 ppm with all Taiwan production
- South Korea has 146 thousand b/d FCC gasoline desulfurization – sufficient capacity to meet 10 ppm with all South Korea production
- Japan produces 100% 10 ppm gasoline and has declining internal demand
- Singapore is installing 24 thousand b/d FCC gasoline desulfurization and is assumed to expand to meet export quality needs
- China expanding FCC gasoline desulfurization for 100% 10 ppm production

# Estimated Range of 10 ppm Gasoline Export Capability

Gasoline volumes available for export from Asia-Pacific countries

Units of Measure | Thousand b/d

Export Country	Base 2014	2017	2020	2025
• India	• 70 -120	• 100 -150	• 150 -200	• 270 -310
• Taiwan	• 20 - 40	• 20 - 50	• 20 - 55	• 20 - 55
• South Korea	• 25 - 75	• 30 - 80	• 30 - 80	• 30 - 80
• Japan	• 0 - 10	• 0 - 30	• 0 - 45	• 0 - 45
• Singapore.	• 0 - 0	• 0 - 30	• 20 - 40	• 20 - 40
• China	• 0 - 0	• 0 - 0	• 0 - 50	• 20 - 50
• Total	• 115 - 245	• 150 - 340	• 220 - 470	• 360 - 580

# Country Outlook for 10 ppm Gasoline

## Middle East and U.S. West Coast

- Saudi export refinery expansions designing for ultra-low sulfur product exports
- U.S. West Coast will be 100% 10 ppm gasoline capable by 2017. Gasoline demand is declining.

# Estimated Range of 10 ppm Gasoline Export Capability

Middle East and U.S. West Coast: Little near term capability

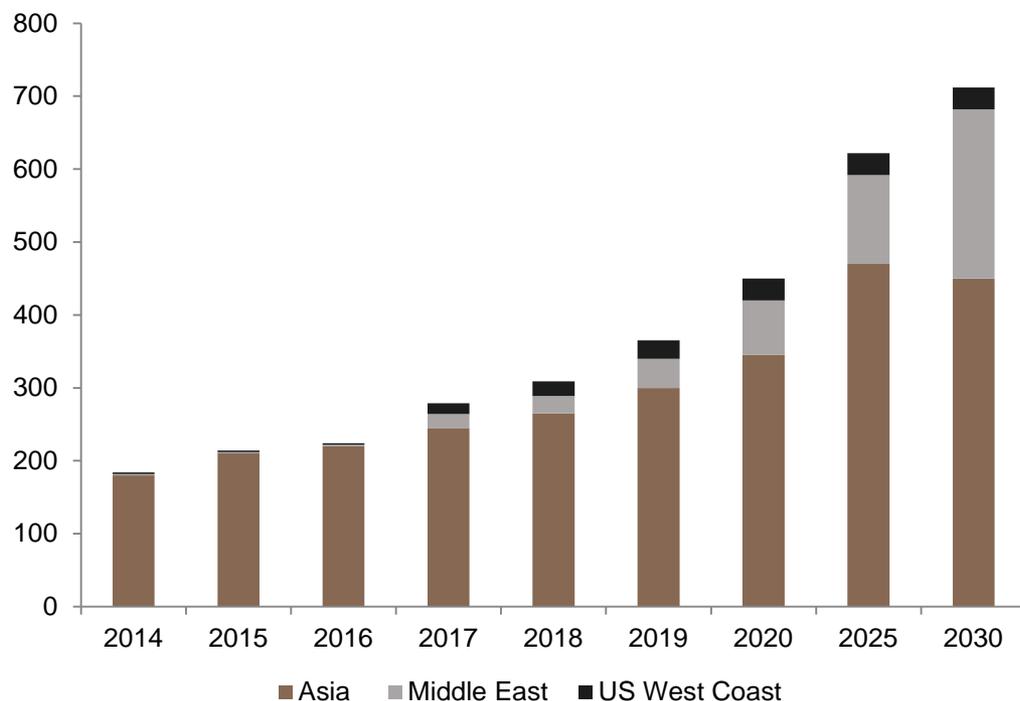
Units of Measure | Thousand b/d

Export Country	Base 2014	2017	2020	2025
• Saudi Arabia	• 0 - 0	• 0 - 10	• 30 - 80	• 220 - 275
• Oman	• 0 - 4	• 0 - 13	• 0 - 25	• 20 - 60
• Qatar	• 0 - 0	• 0 - 15	• 0 - 15	• 0 - 15
• Total	• 0 - 4	• 0 - 38	• 30 - 120	• 240 - 350
• .				
• U.S. West Coast	• 0 - 5	• 0 - 30	• 10 - 60	• 10 - 60

# Potential 10 ppm Gasoline Supply: Export Countries

High potential to more than cover incremental needs

Units of Measure | Thousand b/d



- Asia-Pacific will dominate supply potential
- India is major source: initially more than 50% of total. Much of current India low sulfur going to U.S. where market is shrinking
- Initially minimal supply from Middle East
- Small potential from U.S.

# Conclusion

What are the main takeaways from the study results?

- Asia-Pacific:
  - Only three countries Japan, South Korea and Taiwan currently require 10 ppm sulfur gasoline
  - Four countries of China, India, Singapore and Vietnam have plans to require 10 ppm sulfur gasoline in the next 6 years
  - Overall regional balance will remain relatively constant
  - Rapid growth in 10 ppm demand dominated by China
  - India has large capability to supply 10 ppm gasoline
  - Significant near term volume available from Taiwan and South Korea
  - All the above have installed gasoline desulfurization capacity
- Middle East:
  - None of the countries currently require 10 ppm sulfur gasoline (some small volumes produced, primarily in Iran)
  - Three countries of Kuwait, Saudi Arabia and U.A.E. have plans to require 10 ppm sulfur gasoline in the next 3 years
  - Currently importer – no significant 10 ppm export available
  - Some small supply available around 2017. Longer term significant supply capability
  - Region will emerge as incremental global gasoline supply source
- U.S. West Coast:
  - U.S. Tier 3 regulations requiring annual average sulfur limit of 10 ppm (from 15 ppm) by 2017
  - Small volume of 10 ppm available after 2017
- Potential impact on New Zealand:
  - Requirements relatively small compared to India potential supply
  - Other supply sources in Asia can supplement, even in near term



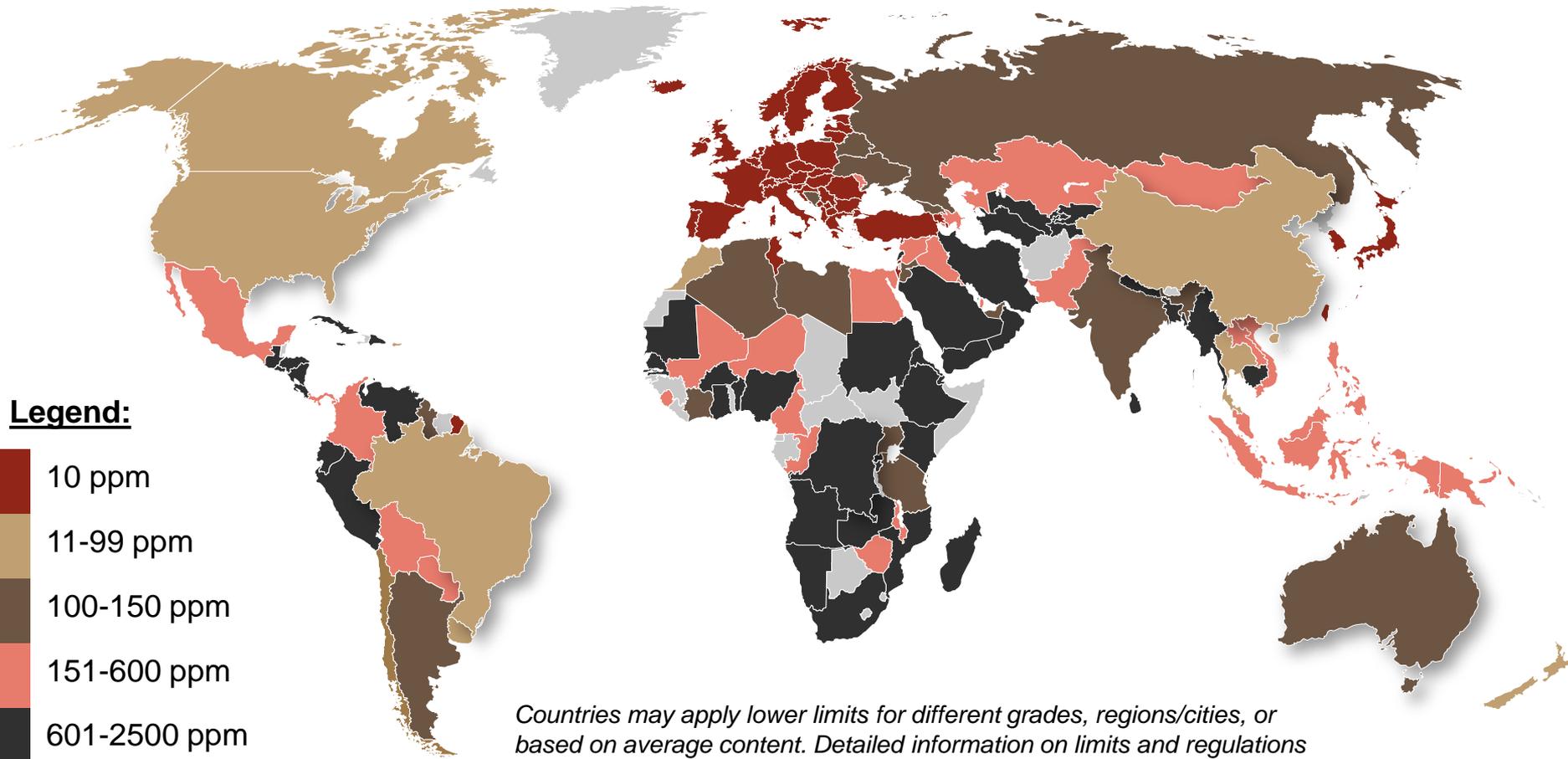
## Appendix

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### Maximum Gasoline Sulfur Limits, 2014 and 2020

# Max Sulfur Limits in Gasoline, 2014

Longer time line to set 10-50 ppm sulfur limits in the developing world



## Legend:

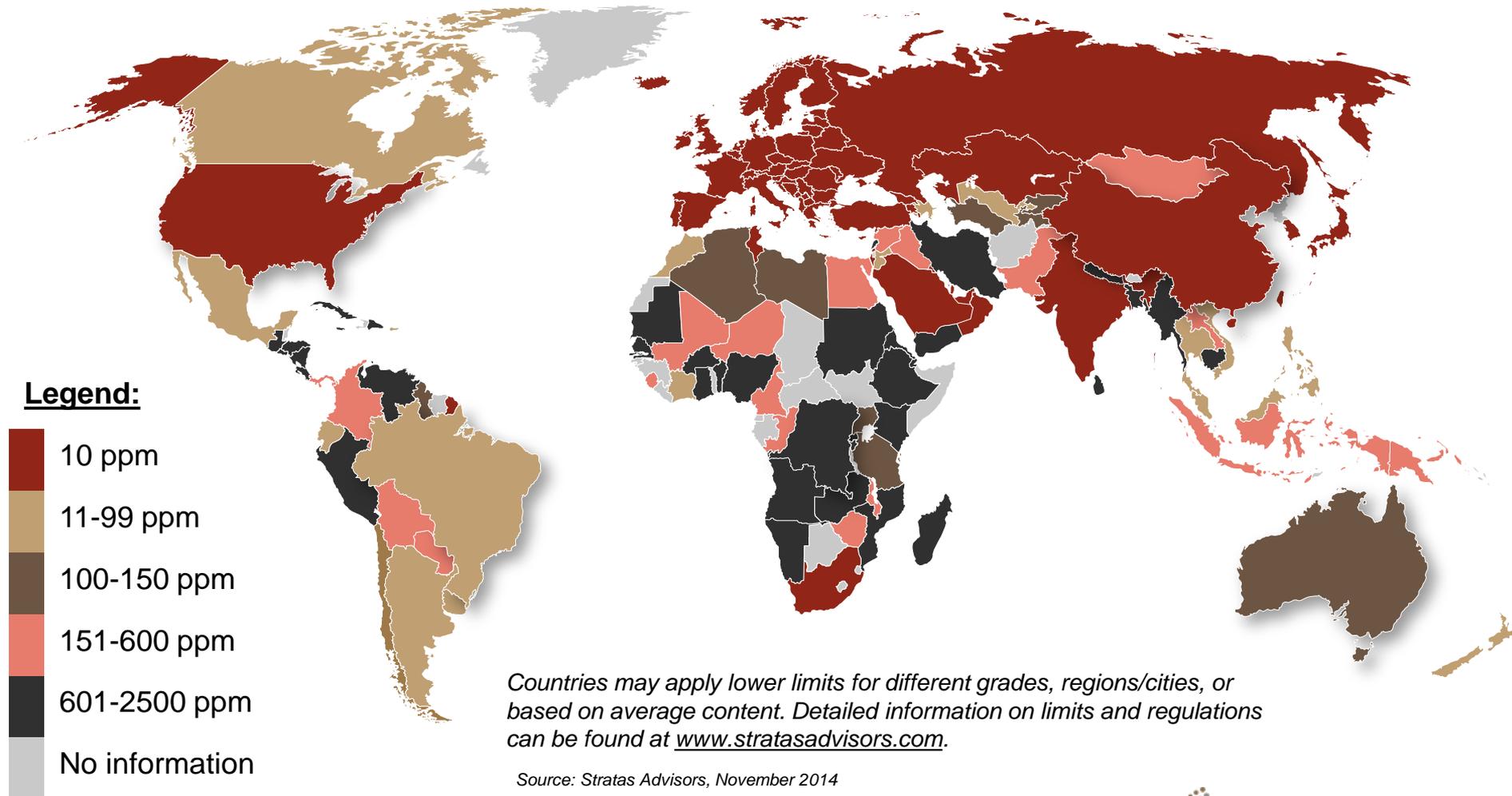
- 10 ppm
- 11-99 ppm
- 100-150 ppm
- 151-600 ppm
- 601-2500 ppm
- No information

*Countries may apply lower limits for different grades, regions/cities, or based on average content. Detailed information on limits and regulations can be found at [www.stratasadvisors.com](http://www.stratasadvisors.com).*

*Source: Stratas Advisors, November 2014*

# Max Sulfur Limits in Gasoline, 2020

China, India, South Africa, Ukraine and the U.S. to implement 10 ppm by this time



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We can help you develop a deeper understanding of the developments that are shaping the future of oil & gas. Our support includes customized consulting that is focused on a client's specific strategic objectives, competitive challenges and asset base. Additionally, we offer support through subscription services and comprehensive market studies.

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