

# LOW CARBON METHANOL THE FUTURE

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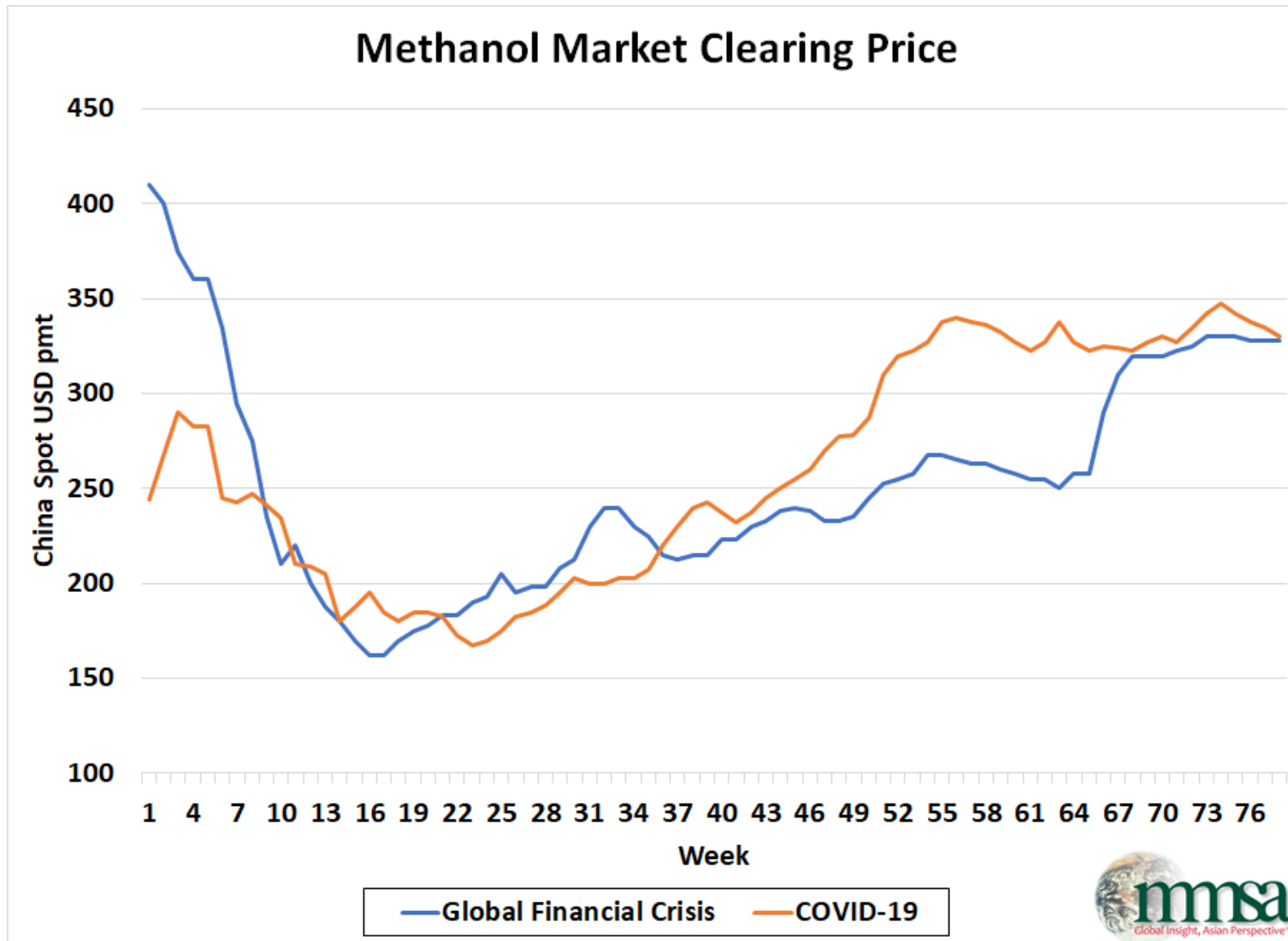
- The first 100 years of commercial methanol production are almost complete
  - The industry is in good shape highly investable
  - Demand growth is compounding and new supply is challenged to keep up.
  - Average methanol prices will support reinvestment. Developers can afford to be bold.
- Decarbonisation policies will dominate the next 20 years or more
  - Evolution not revolution is the way forward for our industry.
  - New conventional technology methanol plants must be low-carbon on the flowsheet.
  - Reinvestment by existing producers is essential.
- A new era of methanol production technology is upon us
  - Some technology will take time to fully commercialise
  - Competition for feedstock and renewable energy will be a challenge.
  - Economics will drive the pace of development as was the case with grey methanol.



- Data and analysis, not guesswork
- Clear statements of assumptions
- Top down and bottom up
- The past is a useful guide to the future
- Exercise experience and good judgement
- Avoid the unpredictable
- Accept and learn from the times when you are wrong



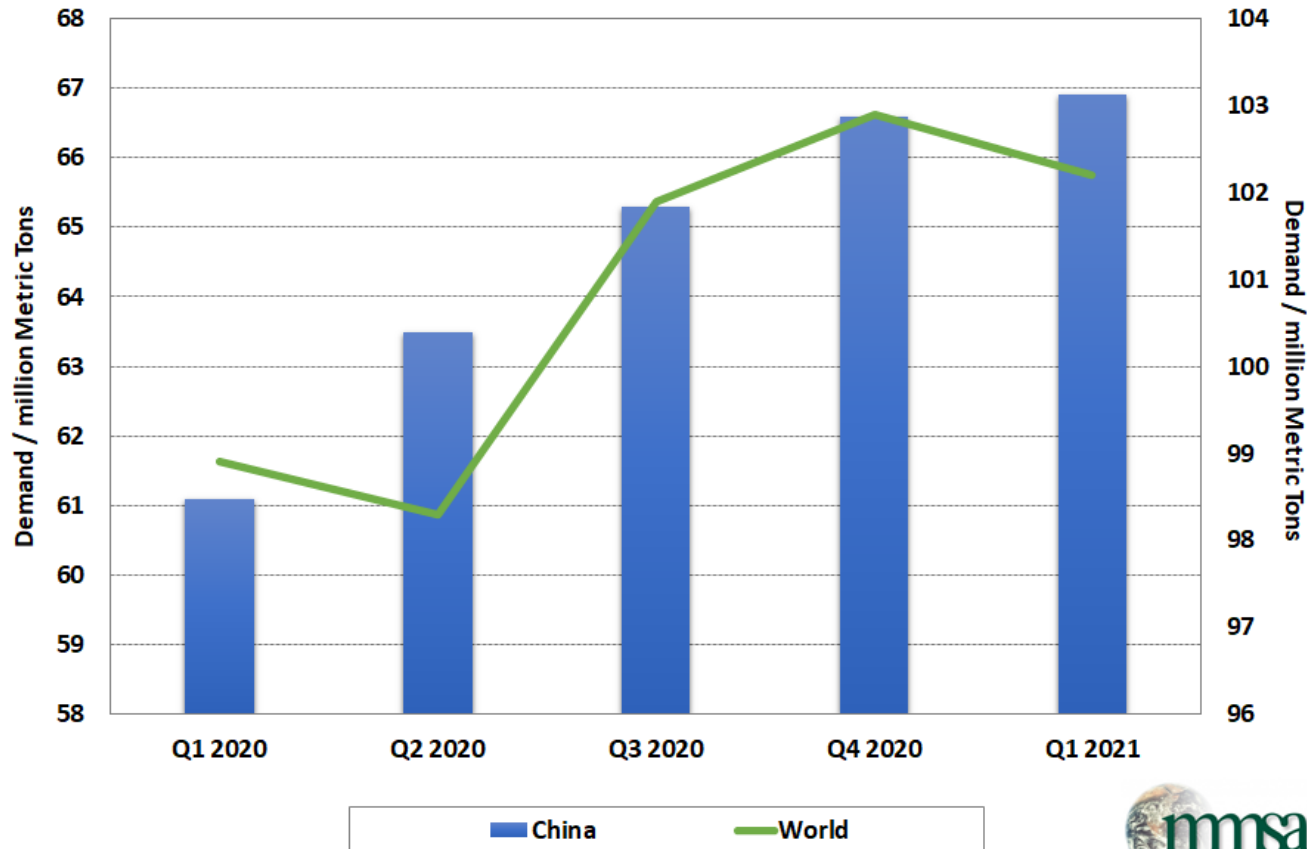
# The past is always a useful guide to the future



- This chart shows the China import price over the same number of weeks following the GFC and COVID outbreak
- The methanol industry is highly efficient at rebalancing short and long markets.
- Difficult to predict any type of recovery at the bottom of the cycle.
- Difficult to see a correction coming at the top of the cycle.
- Prices are driven off marginal economics and always trend back towards reinvestment levels.

# Global demand impacts from COVID reversed quickly

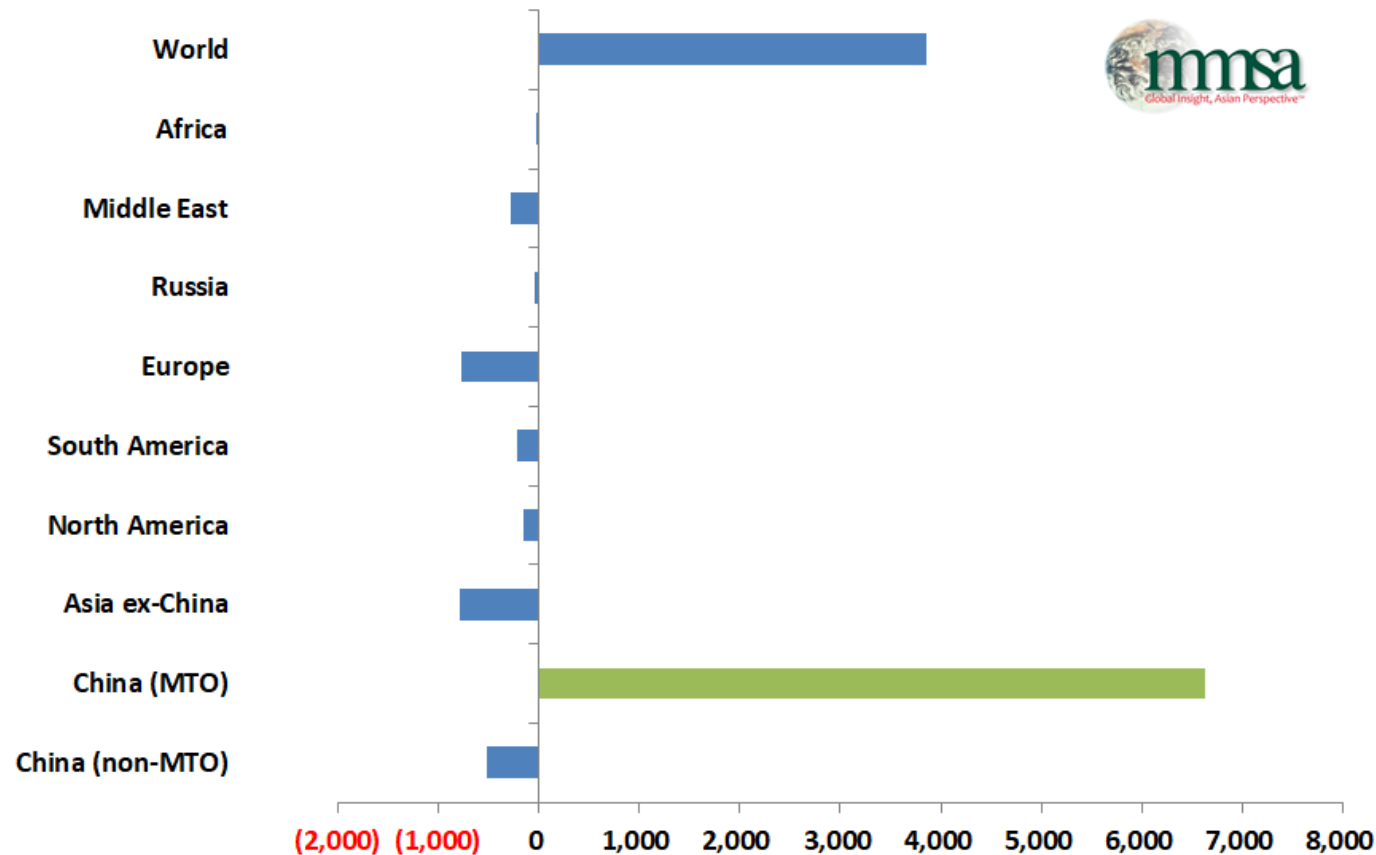
## 2020 Demand per MMSA Quarterly Forecasts



- MMSA 2020 demand forecast revised upwards each quarter during the year as the industry rebalanced quickly.
- Low methanol prices coupled with exceptional demand for polyolefins stimulated marginal MTO production.
- Changes in consumer spending in Europe and North America stimulated demand for wood panels, furniture and packaging.

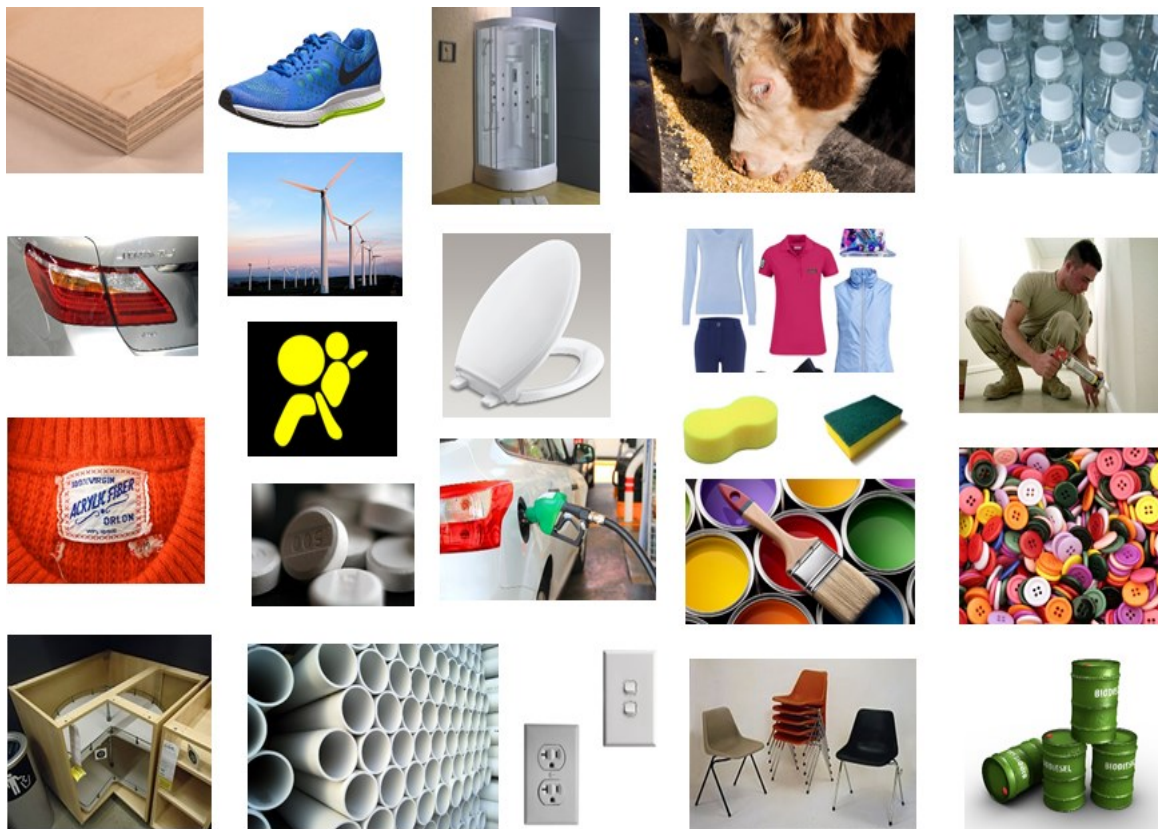
# 2020 demand still grew as expected despite the catastrophic economic blow from COVID

**Methanol Demand Growth, 2020E v 2019, By Region**  
(-000- Metric Tons) - MMSA 2Q2021 Update



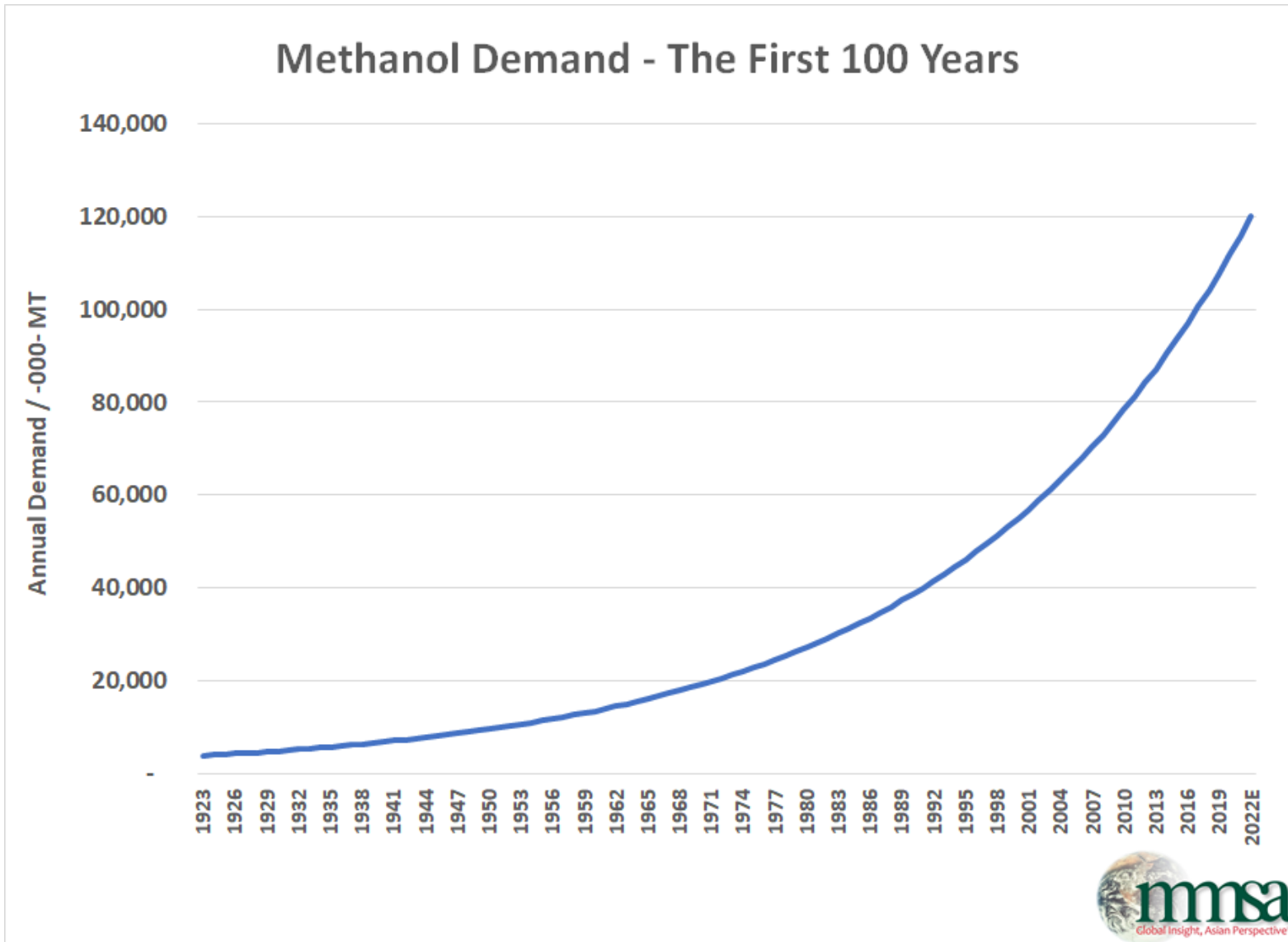
- Almost 4 million tonnes of new demand created despite the catastrophe on the world economy
- Commodity behaviour – low prices stimulate marginal demand, high prices destroy it.
- Exceptional demand seen for medical equipment, packaging and wood based products for home improvements.
- This more than offset losses into transport fuels i.e. MTBE and biodiesel

# Methanol is fundamental to the global economy



- More than 100 million tons of global demand.
- Most demand is for chemical intermediates and fuel additives.
- Established chemistry and applications, substitution not envisaged
- Demand expected to grow in line with global GDP, approximately 2-3 percent per annum
- 3 percent growth adds 3 – 4 million tons of new demand each year on average over time.

# A commodity that grows at pace with the global economy

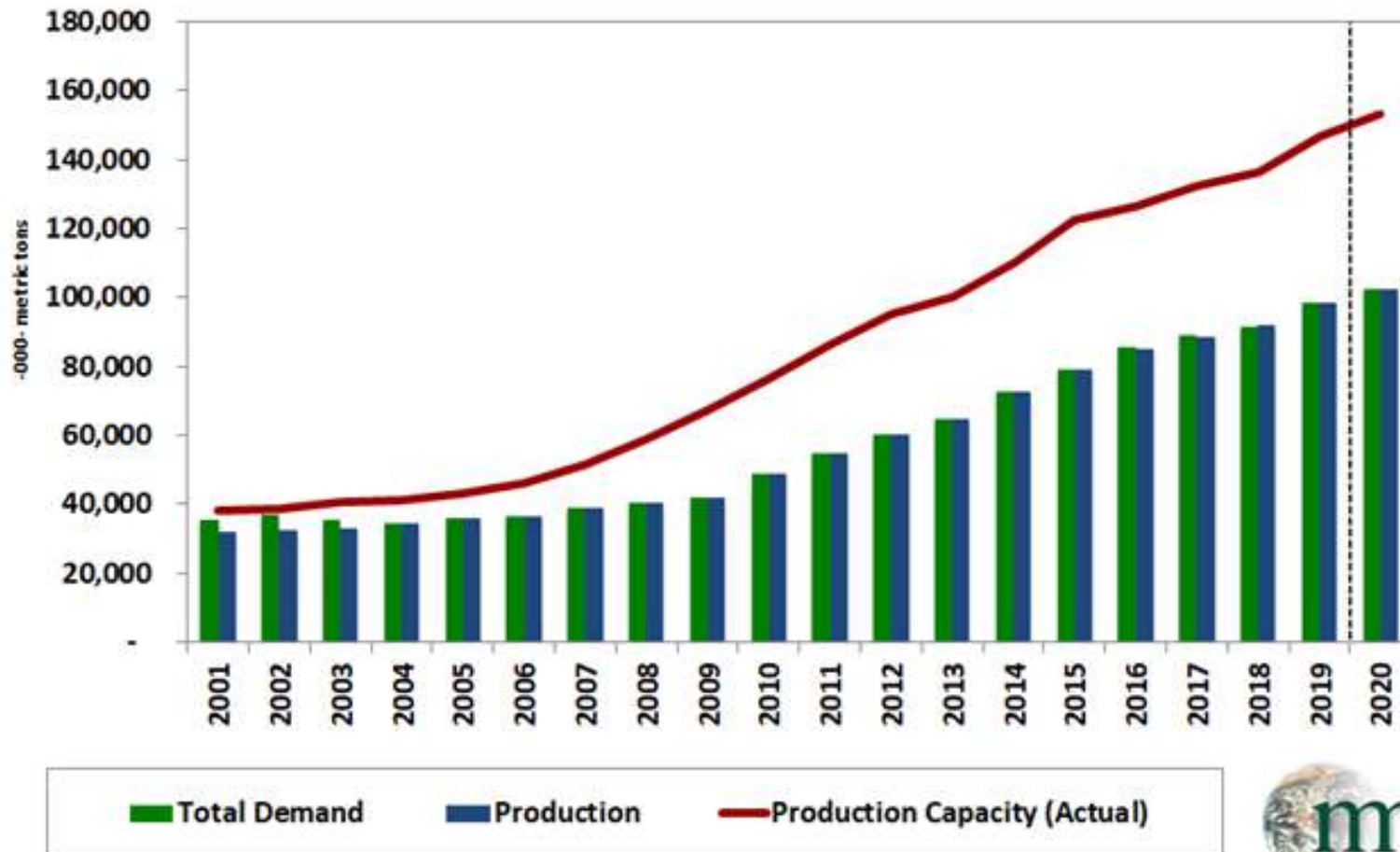


- The first industrial sized methanol process developed in Germany in 1923.
- The industry now has 300 methanol plants supplying demand of 120 million tons annually, by 2022.
- Methanol is now a true commodity, intrinsically linked to global economic output.
- Compounding effect sees demand growth accelerate.



# Double GDP growth over the last 20 years

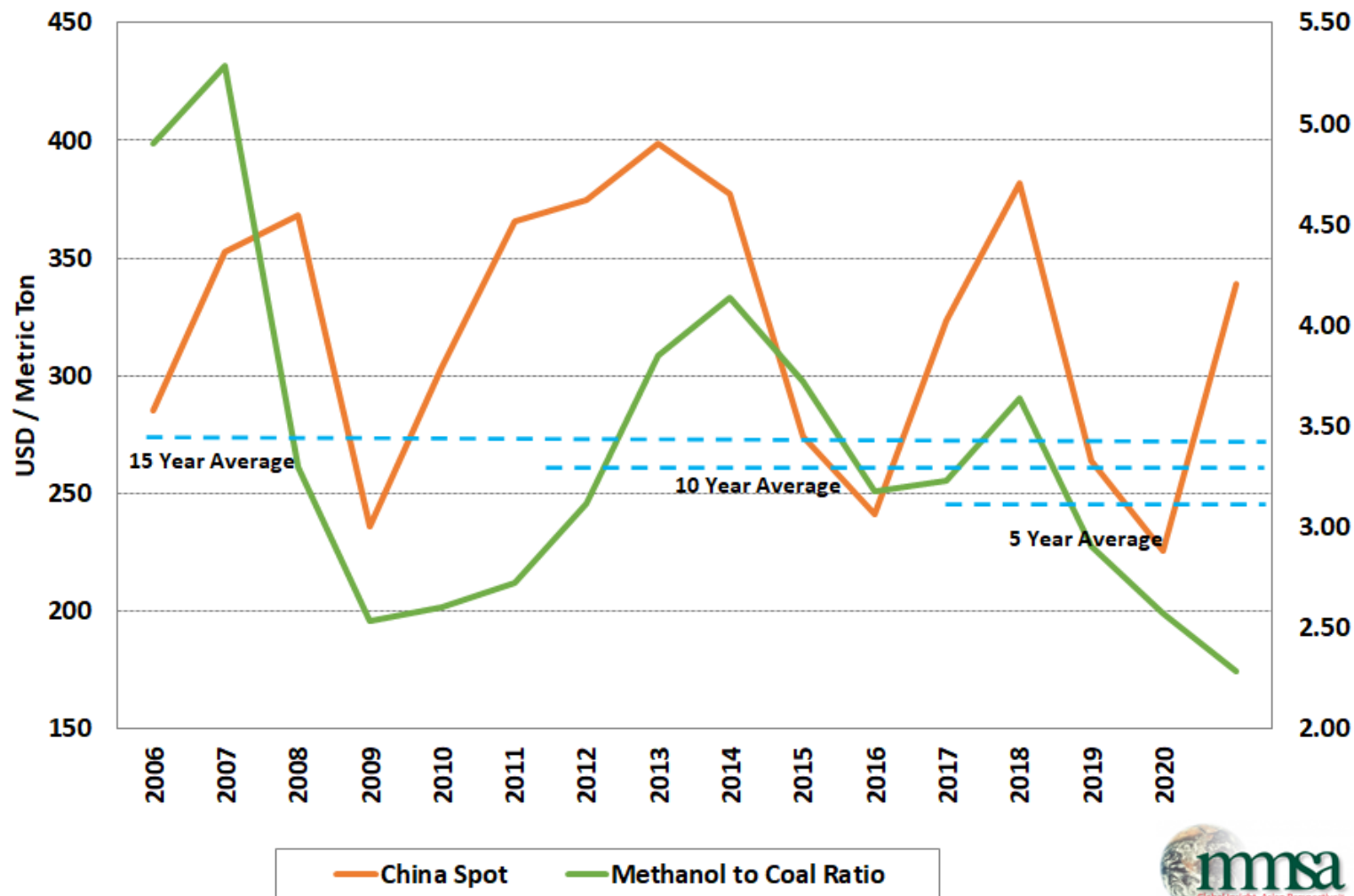
## Methanol Supply and Demand - World 2001 - 2020



- Uncharacteristic high growth for a commodity, driven by substitution demand
- High oil prices and China's own strategic priorities led to the emergence of MTO and widespread use of methanol as a fuel.
- This new demand is well established and will grow organically in line with the economy before maturing.

# Methanol prices are a function of feedstock costs and production economics

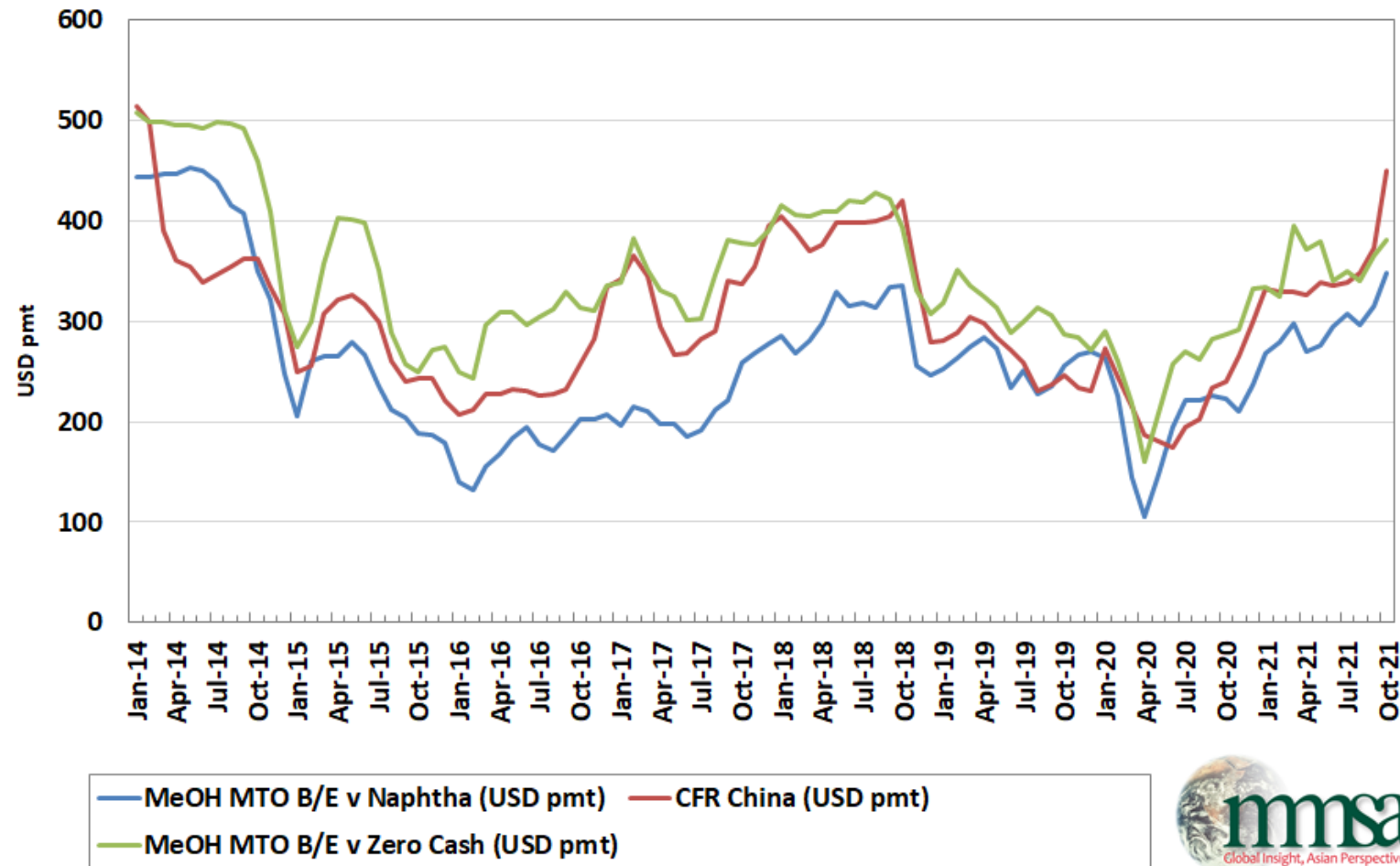
## Methanol vs Coal Prices



- Chinese coal-based methanol plants dominate the upper half of the industry cost-curve.
- Coal-based methanol plants are the marginal suppliers and methanol prices cycle with coal prices.
- Coal to methanol price ratio coming down as technology improves and costs come down.

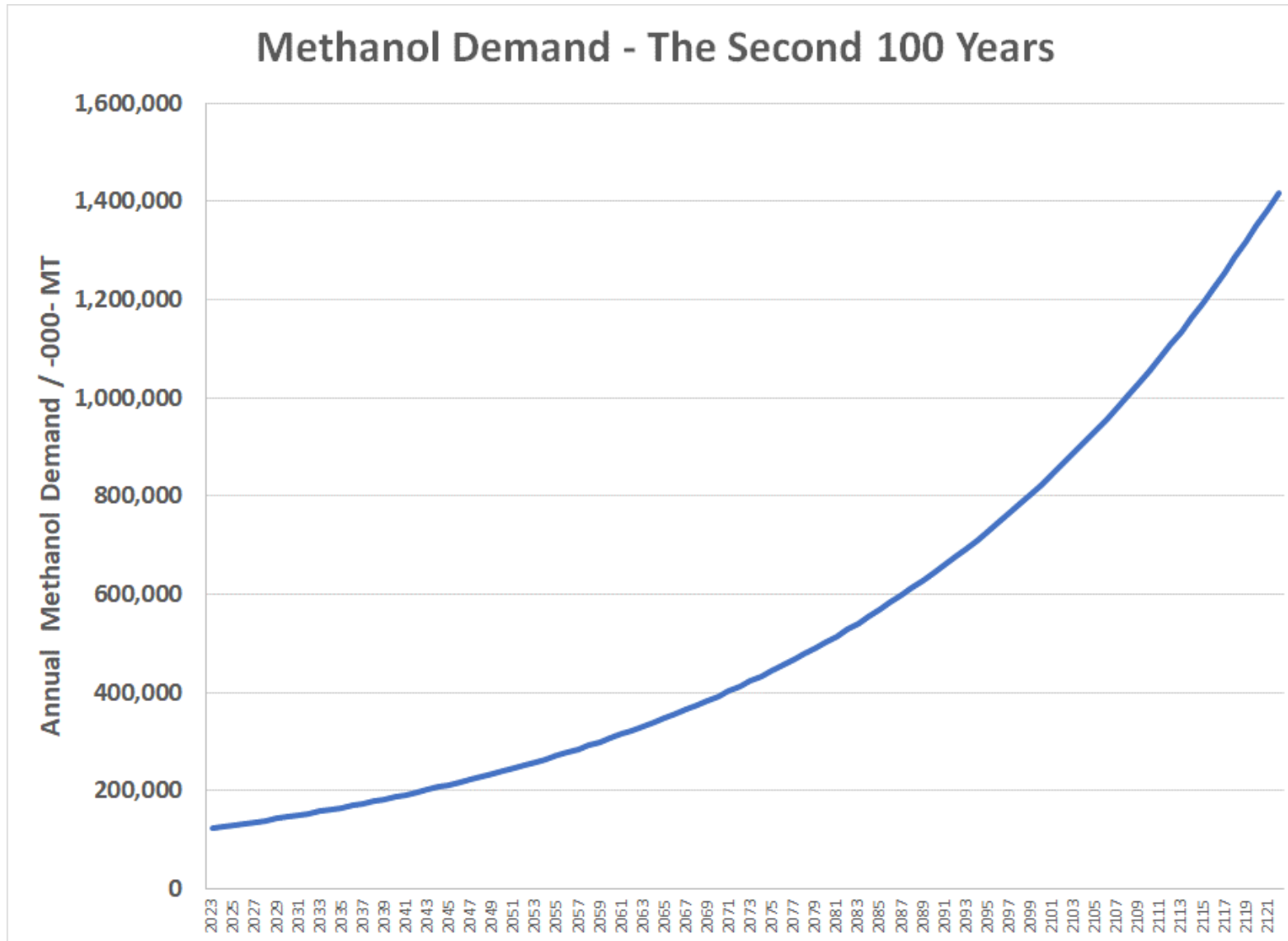
# A similar picture emerging with olefins – prices becoming increasingly linked to MTO economics

## Methanol Prices: CFR China, Breakeven, Naphtha Equivalence



- MTO accounts for approximately 20 percent of Chinese olefins production.
- Non-integrated plants are the marginal suppliers
- Latent MTO capacity and low cost debottlenecking opportunities keep methanol prices positive relative to naphtha.

# Growth in line with global GDP inflation – 2.5%

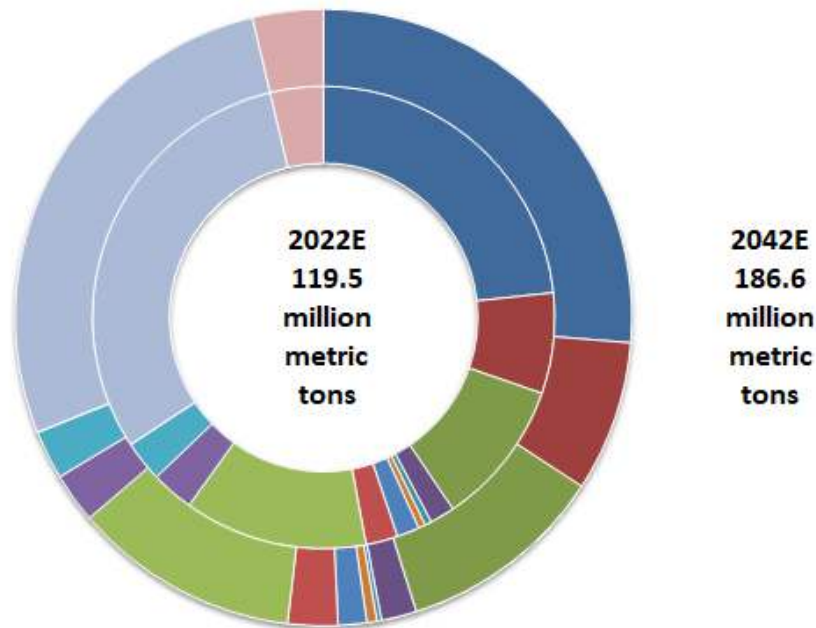


- Forecast shown is based on assumption of 2.5 percent growth each year; above the long term MMSA forecast
- All things being equal and using past growth, and GDP forecast growth as a guide to the future
- Compounding effect sees demand continue to grow exponentially.
- Demand reaches 200 million tons by 2042, 300 million tons by 2060 and 1.4 billion tons by the bi-centennial.
- Does this seem unreasonable ?

# MMSA forecast over the same period is only slightly lower



## Methanol Use - World By Derivative

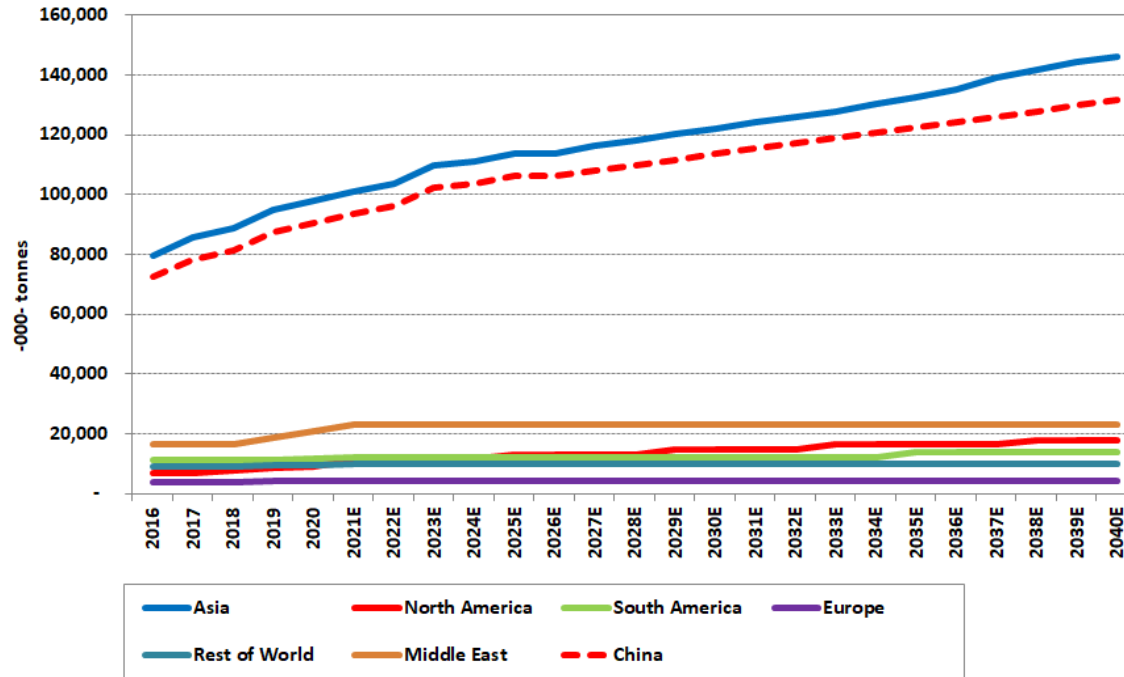


■ Formaldehyde	■ Acetic Acid	■ Methyl tert-Butyl Ether (MTBE)
■ Methyl Methacrylate	■ Dimethyl terephthalate (DMT)	■ Methanethiol (Methyl Mercaptan)
■ Methylamines	■ Methyl Chloride (Chloromethane)	■ Gasoline Blending & Combustion
■ Biodiesel	■ DME	■ Fuel Cells
■ Methanol-to-Olefins	■ Others	

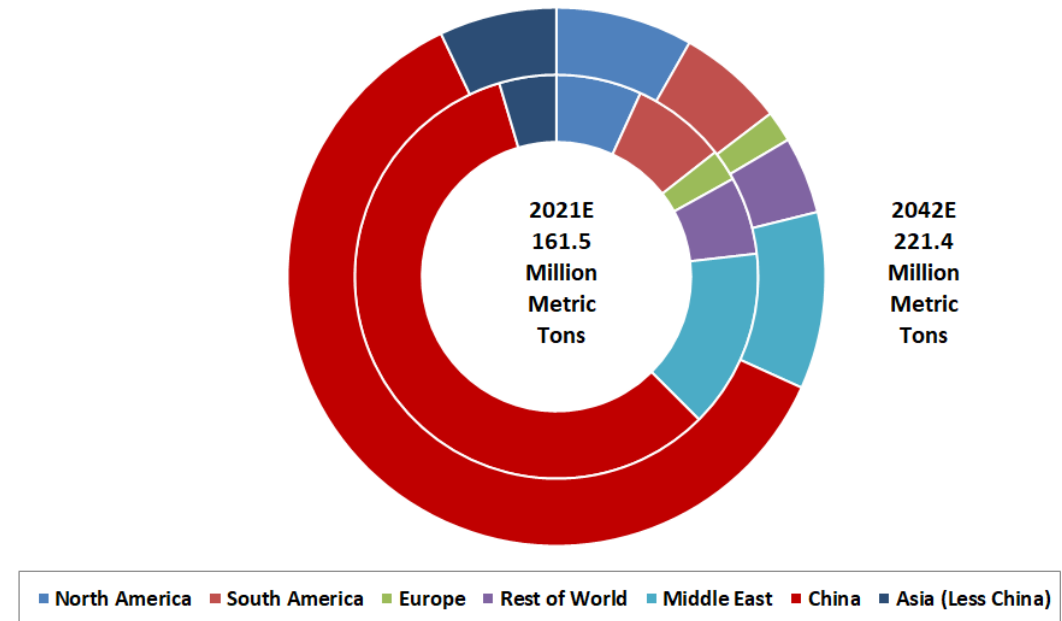
- MMSA demand growth forecast over the same period is 2.25 percent
- Demand growth calculated by assessing each methanol derivative.
- Additional global demand of 67.1 million tons, reaching 186.6 MMT by 2042.
- 37 new world-scale (1.8 million tpa) methanol plants needed in just 20 years if existing plants don't improve availability.

# The industry needs significant new capacity but over relies on China to add it.

Supply Capacity for Methanol by Region  
2016 - 2040E

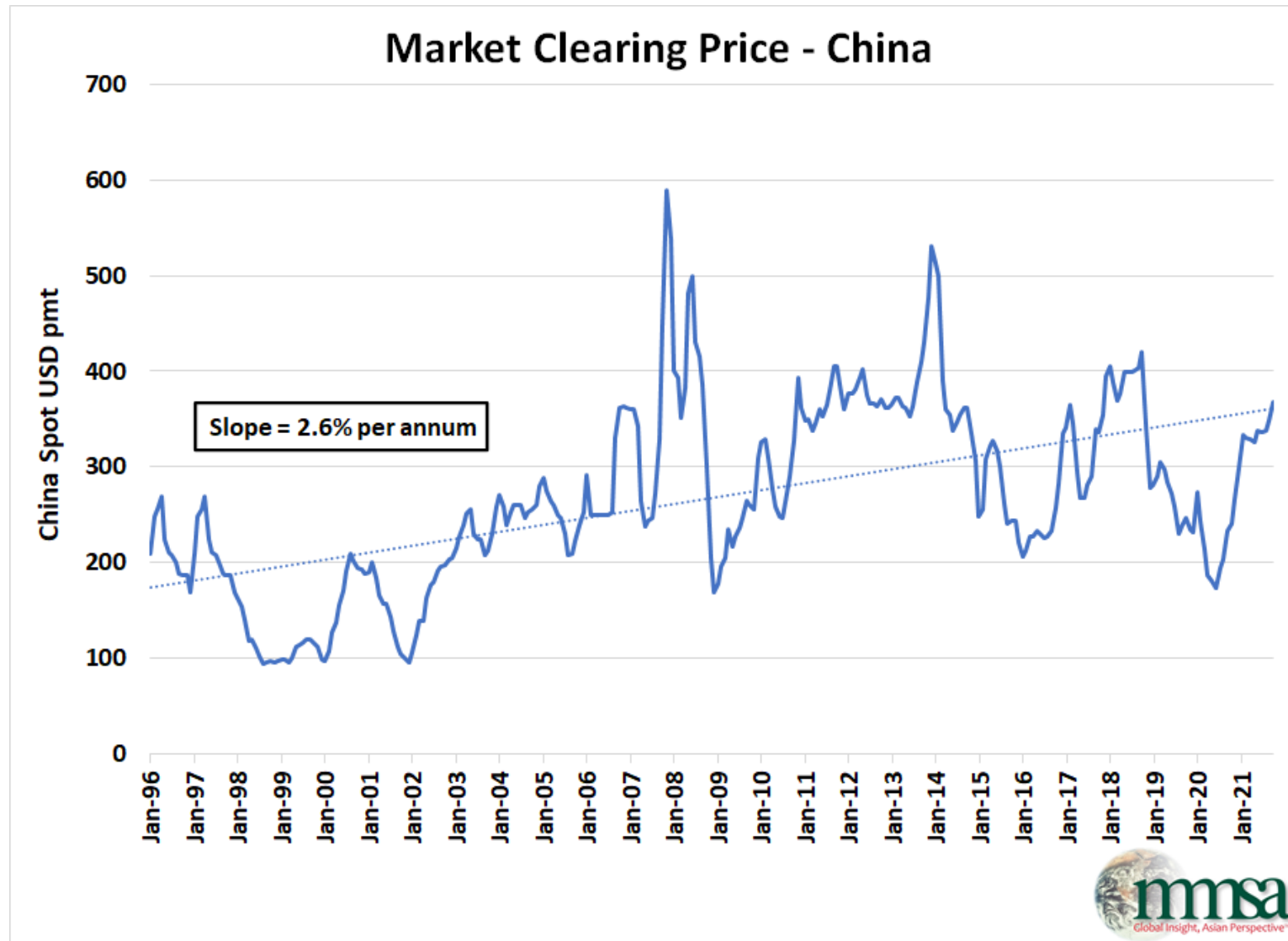


Supply Capacity for Methanol by Region  
2021E vs 2042E



- 60 million tonnes of new capacity needed by 2042 just to meet demand growth. This ignores replacement capacity.
- China needs methanol to grow its economy but priorities for natural gas and renewable energy lie elsewhere.
- The industry faces adding more than 40 million tonnes of new coal-based capacity or destroying demand.

# Methanol prices also inflate



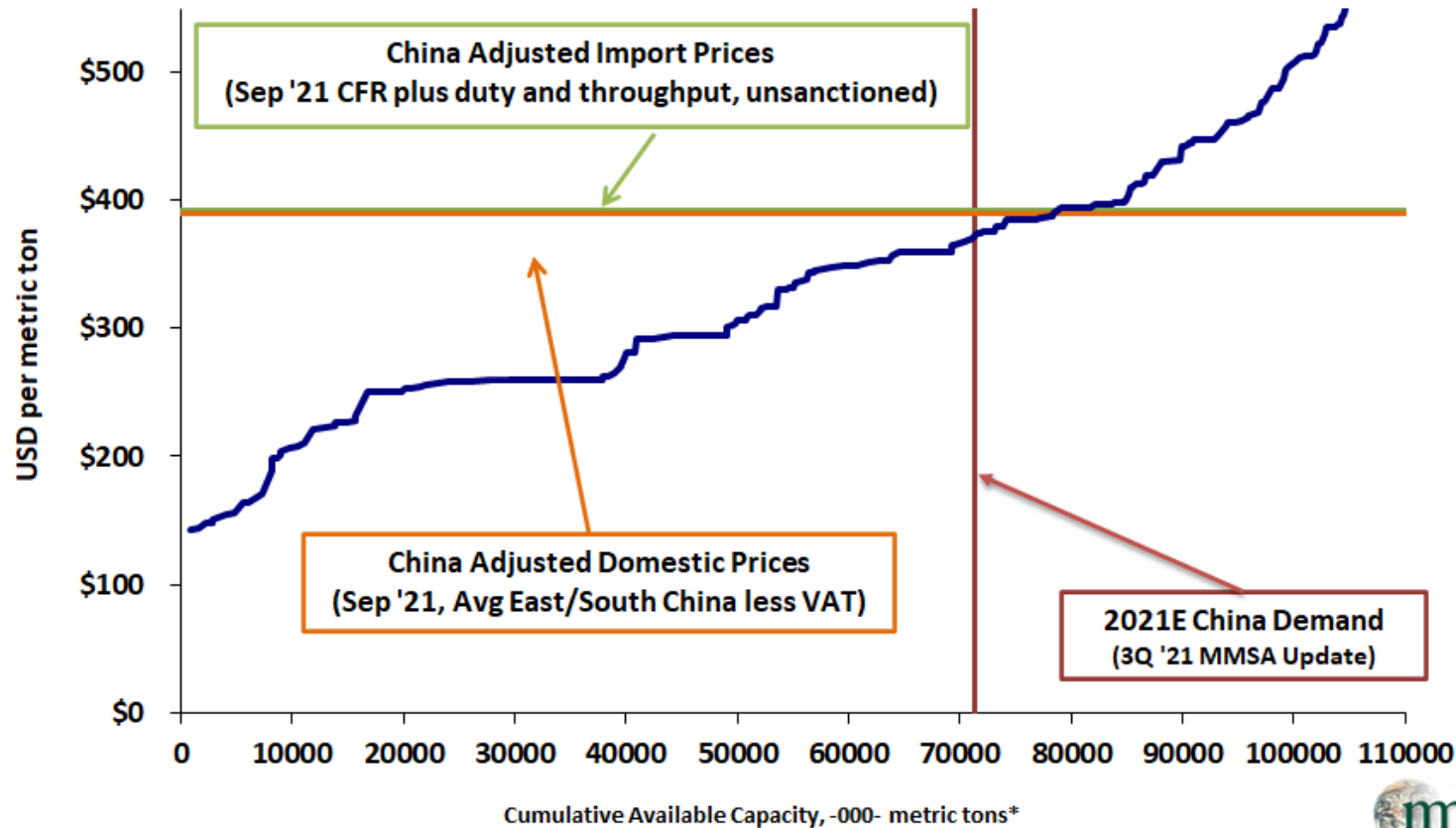
- Methanol prices must also inflate to incentivise reinvestment
- Prices never stay on the floor for long and never stay on peaks for long
- Methanol prices cycle but the underlying trend is always back to reinvestment pricing

# Industry cost-curve methodology well proven



## MeOH Delivered Cash Cost - September 2021E EXW China Main Port, Current Net Available Capacity\*

\* Net Available Capacity is based upon historical trends in supply from the locations selected and will vary depending upon market conditions.

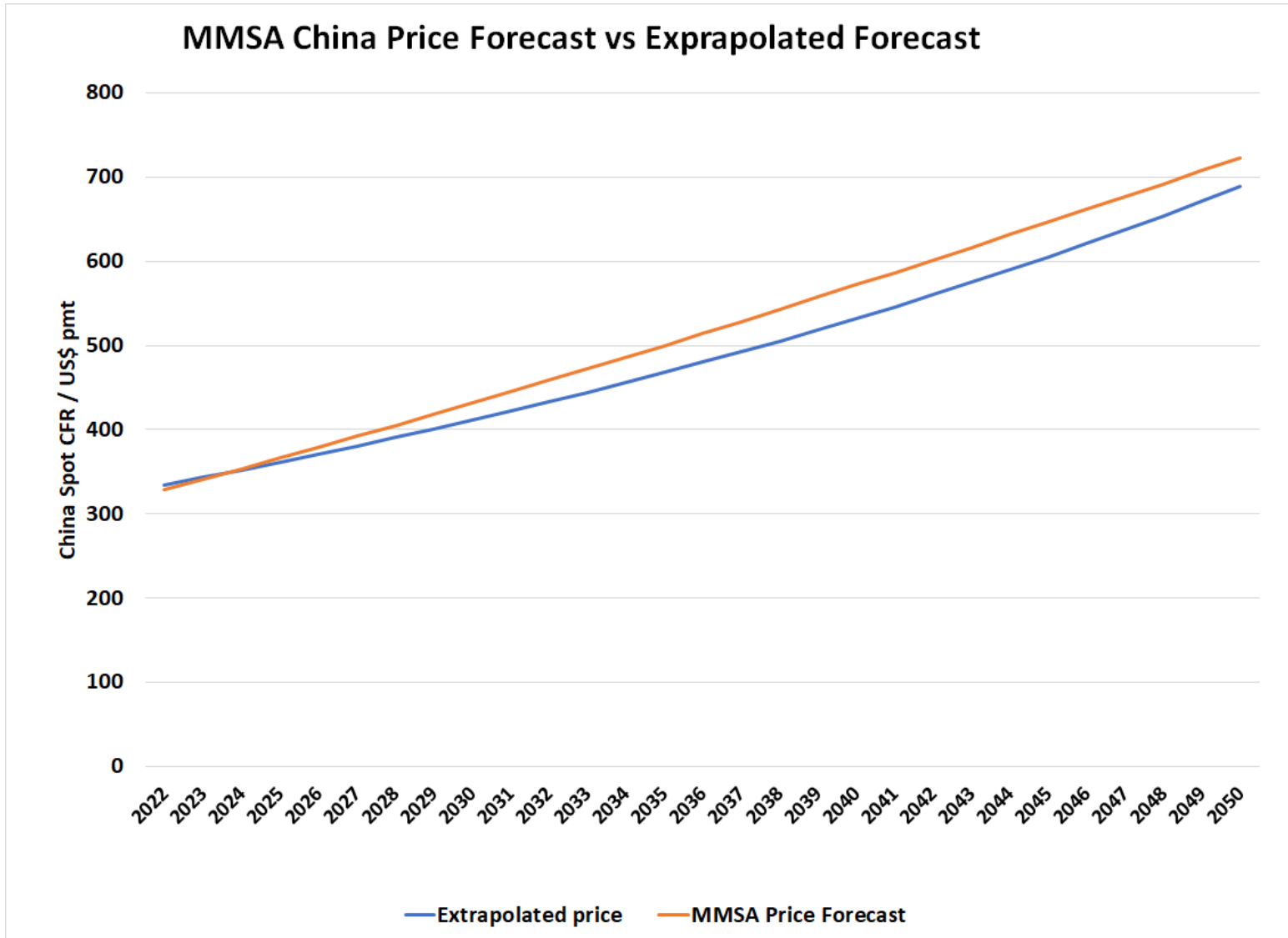


- MMSA forecasts using established, industry-wide commodity price forecasting methodology.
- Based upon forecast energy prices, costs to produce and ship to market.
- Current methanol prices are above marginal production costs due to global supply shortages.
- This is likely to lead to a demand correction unless supply recovers quickly.





# The past is a good guide to the future

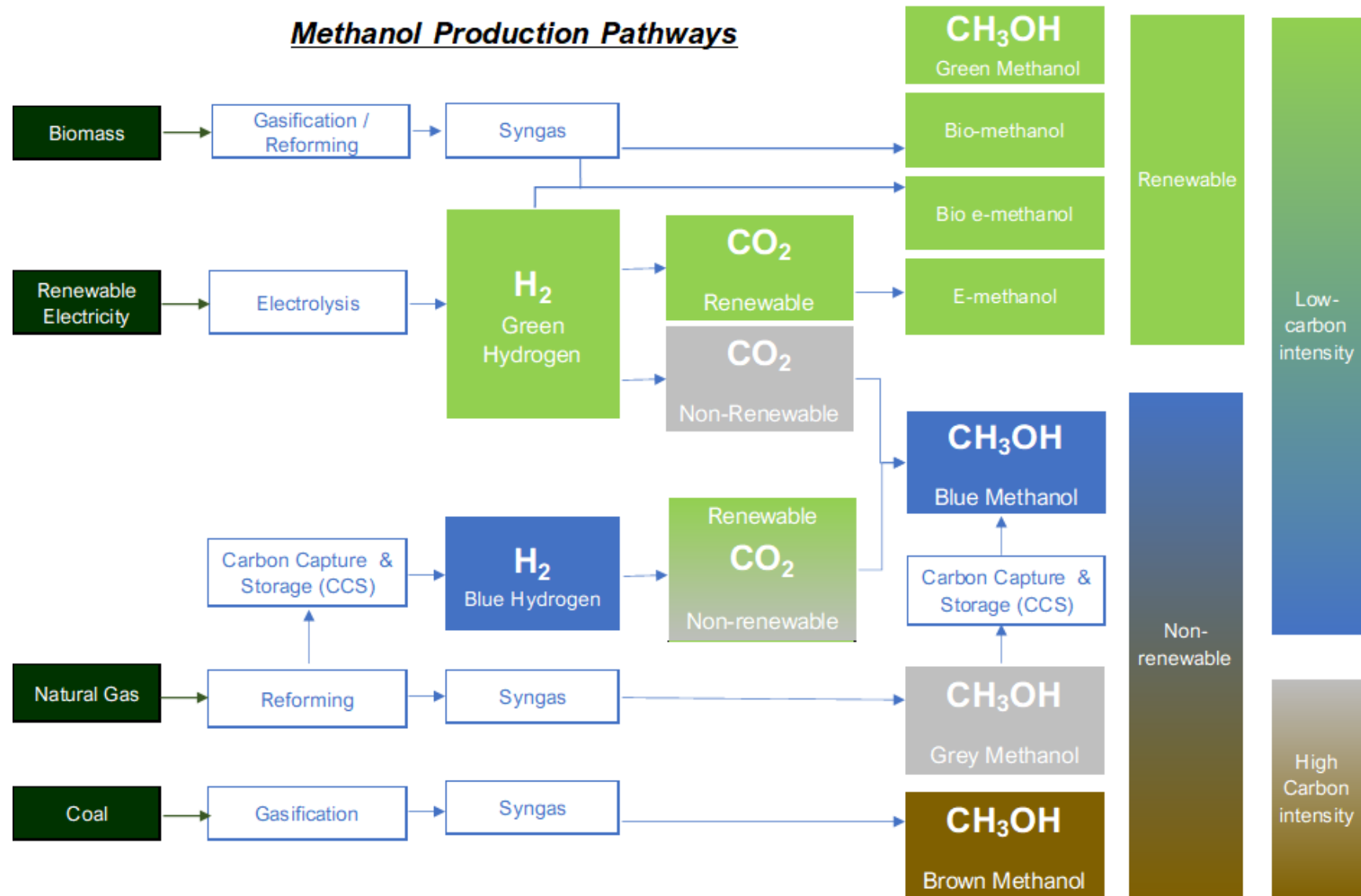


- Top-down vs bottom up
- MMSA forecasts using established, industry-wide commodity price forecasting methodology.
- Based upon forecast energy prices, costs to produce and ship to market.
- Extrapolated forecast shown here based upon price inflation from 1996-2021

# We can't predict the unpredictable, but climate change policies are sure to have an impact



# Low Carbon Methanol, deciphering the labels



# Excellent solutions being developed to help the transport sector solve its carbon intensity problem

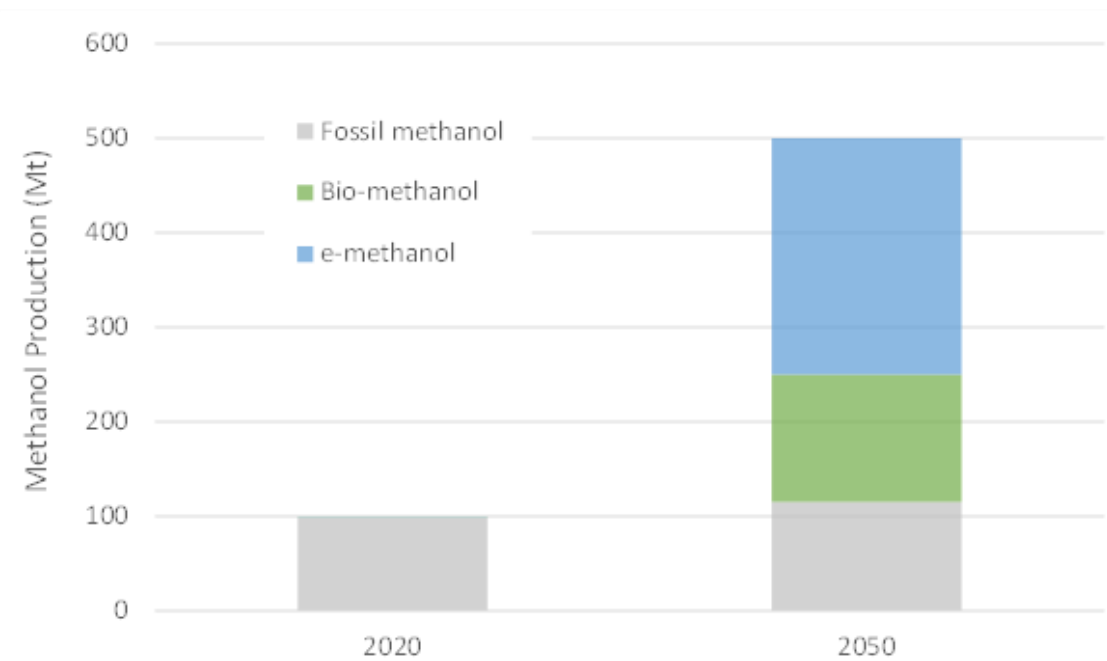
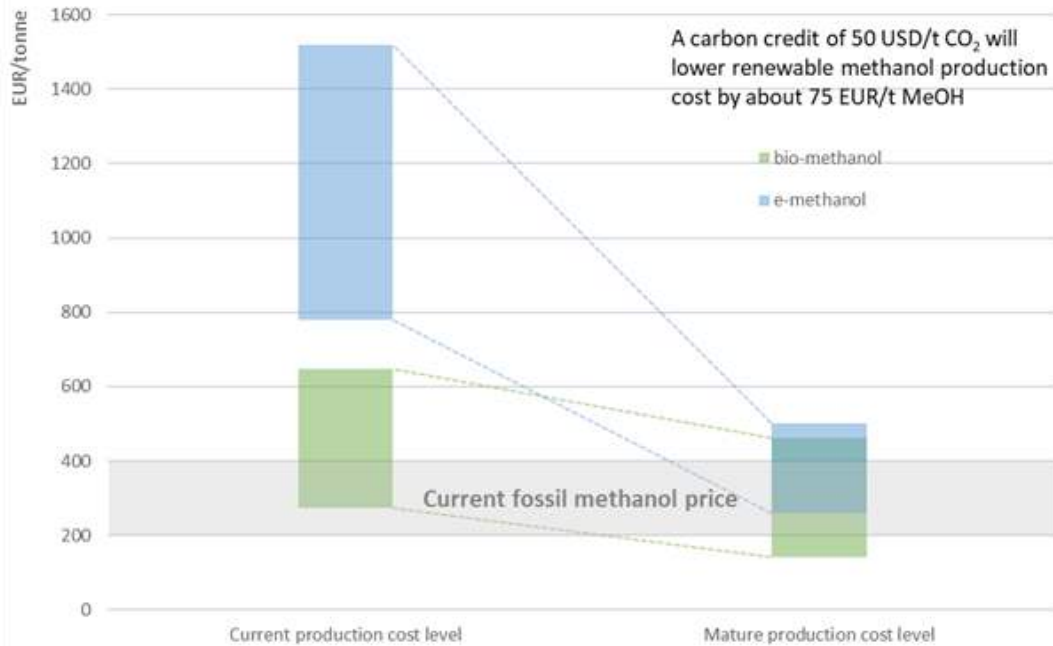


# Novel technology, Green methanol projects are our future

Renewable and Biomethanol Projects 2021



# Most novel technology is uncompetitive without price support or tariffs, but we know demand is growing



# ETS programs are being implemented globally

- Price of carbon offsets increasing and recently hit peak of EUR 62 / MT



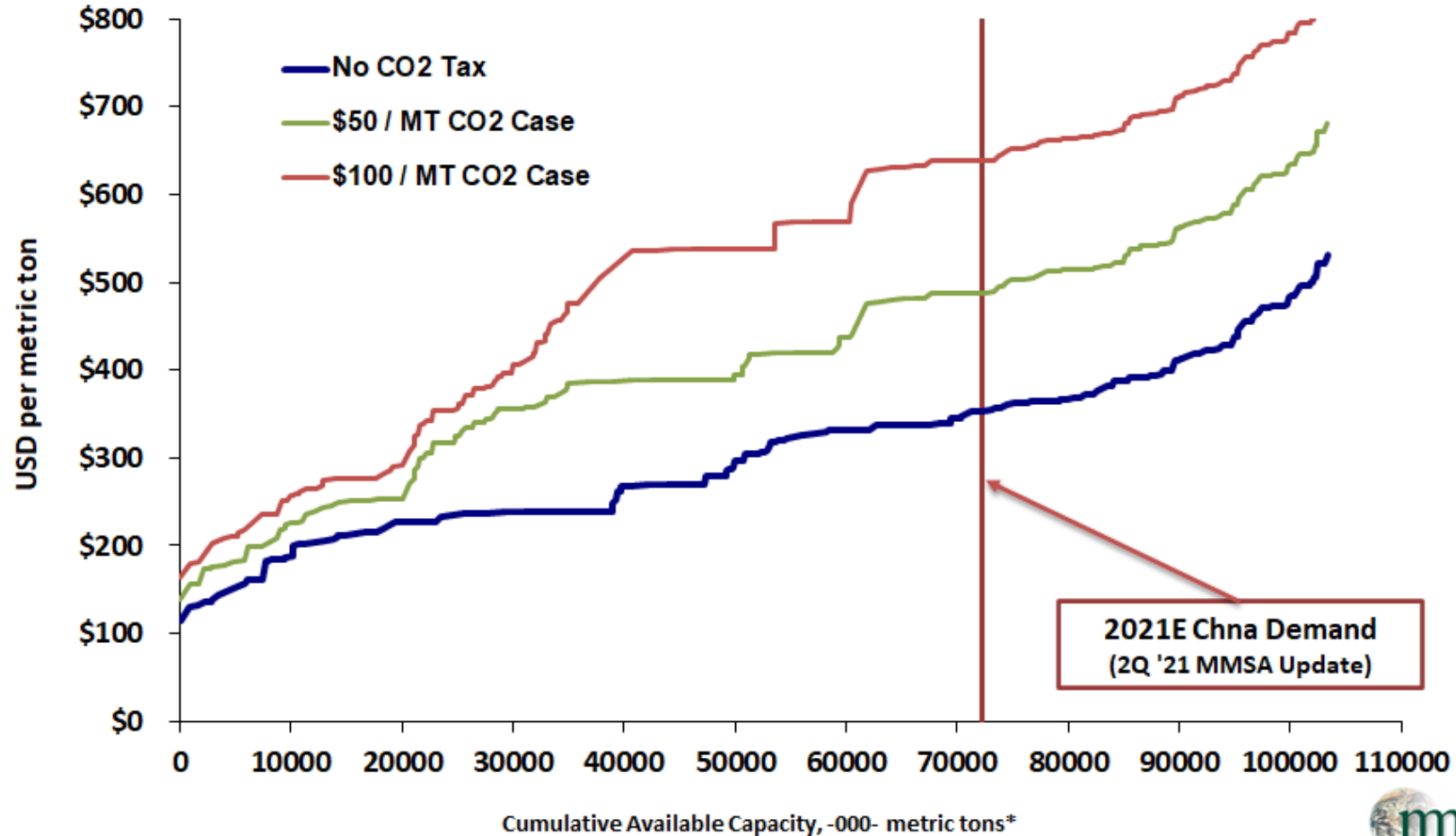
- Price of carbon will be a function of how well each region or country is progressing against decarbonisation goals and availability of renewable energy

# Methanol industry cost curve with uniform CO<sub>2</sub> tariffs



## MeOH Delivered Cash Cost - June 2021E EXW China Main Port, Current Net Available Capacity\*

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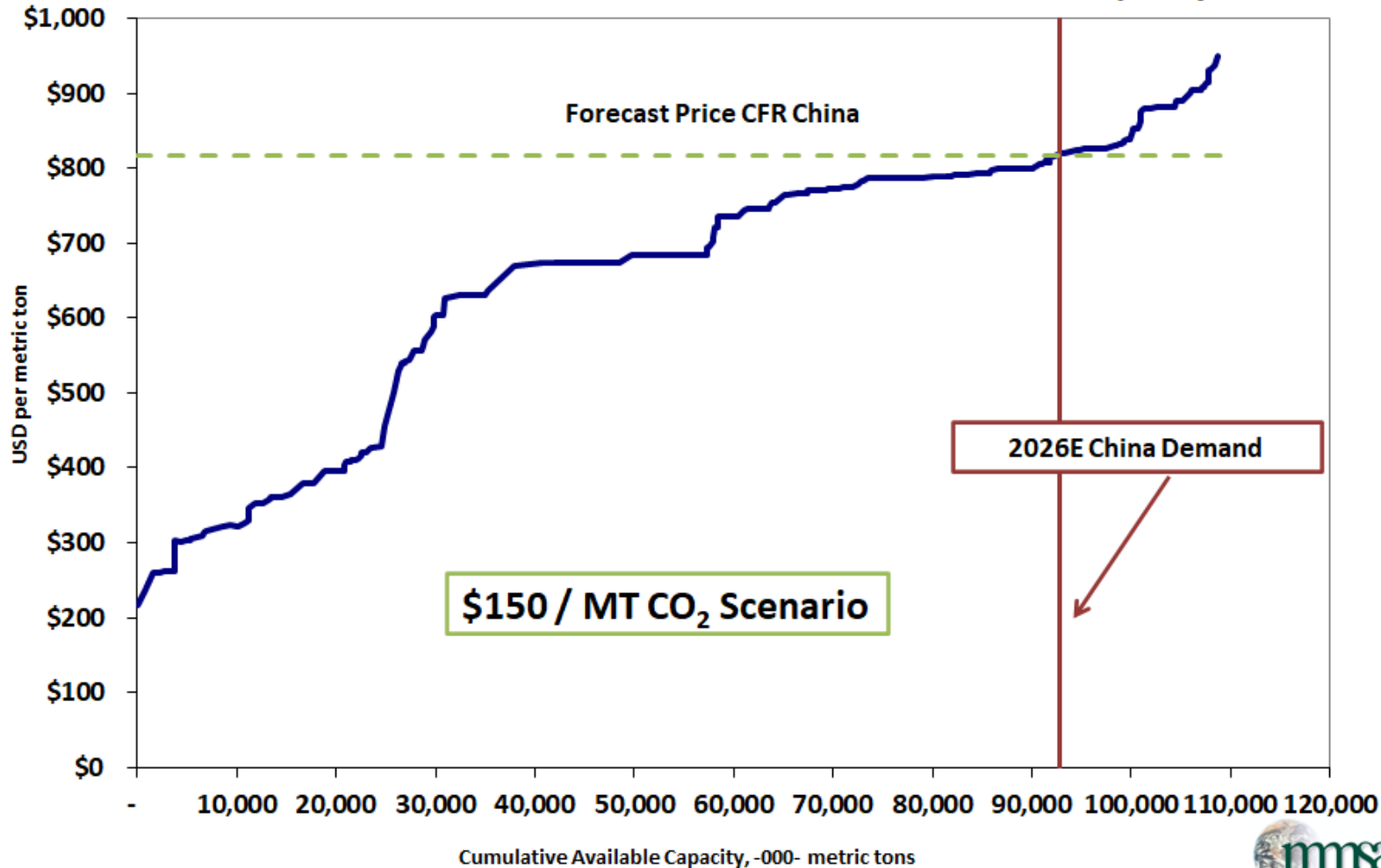




# Five years forward; Costs plausibly rise given CO<sub>2</sub> = USD 150 pmt



## MeOH Delivered Cash Cost, DDP - 2026E Coastal China Main Ports, 2026 Net Available Capacity



- A simple model applying USD 150 pmt on CO<sub>2</sub> emissions from all methanol producers based on typical process yields; estimate versus survey
- Marginal production costs reach USD 800 pmt, creating room for some green methanol projects to compete.



# Methanol supply growth will come from blue technology initially while enhancements to green technology are made



- Blue technology is the quick win for the industry to decarbonise while still expanding supply.
- Competition for renewable sources of feedstock and energy from other industries will be intense and moderate new green methanol additions.
- Green methanol will be more competitive as tariffs increase and technology improves.

# Commercial pathway to Low-Carbon Methanol

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- Methanol prices will and must rise to incentivise investment in large-scale, low-carbon methanol technology.
  - \$100 / MT for CO<sub>2</sub> would be enough for some projects, but it must be applied to everyone.
- China is the largest and marginal supplier of methanol and emits 75% of the methanol industry's CO<sub>2</sub>. Its CO<sub>2</sub> abatement policies will determine the industry's transition low carbon and pace of demand growth.
- New methanol projects will be mostly blue in the near term, targeting established methanol derivatives.
- Green methanol projects will initially support transport applications, such as marine and road, before supplying the mainstream industry.
- Methanol prices will continue to be a function of marginal feedstock and production costs.

- The first 100 years of commercial methanol production are almost complete
  - The industry is in good shape highly investable
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