

# 2022 Global Aluminium Market Overview: An Environment of Unprecedented Change

5<sup>th</sup> Metallurgical Conference of Quebec  
Montreal, PQ

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3 November 2022



# Unprecedented events continue to create volatility and uncertainty



China's role in the aluminum community

- Primary production cap is maintained at 45 million tons...output now 40 million tons
- Rotation towards more usage of secondary aluminum is moving ahead rapidly
- China becomes the ultimate “broker” for the problem with Russian metal



Supply-Demand

- Demand destruction in China and Europe has eliminated risk of record 2022 deficit
- Record high energy prices in Europe and U.S. threaten survival of primary smelters
- Russia's role in the market fundamentally altered by Ukraine War and may never be the same



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Decarbonization and ESG

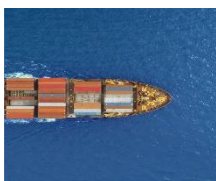
- Decarbonization embedded in finance, giving corporations incentives
- Heavy investment in recycling capacity in China, USA and Europe
- Low carbon or “green premiums” developing nicely in Europe, slower in US

LOWER CARBON FOOTPRINT



Supply Chain Dysfunction

- Global supply chains marginally , freight costs falling as recession risk rises
- On-shoring of demand in Europe and North America is accelerating > favors Canada
- Traceability is becoming a competitive advantage



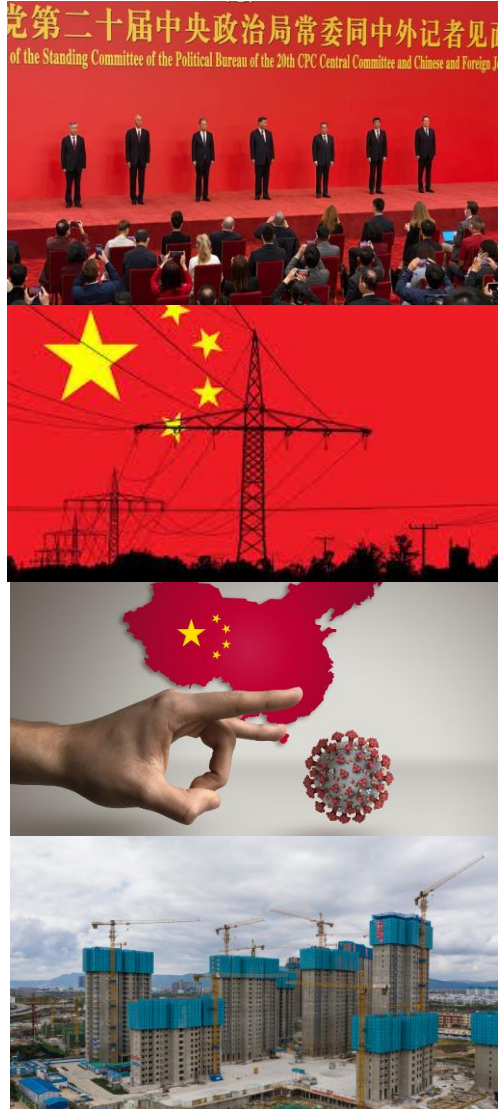
Trade Friction and Circumvention

- Shared values and trust are now being valued more highly than ever
- Russian weaponization of its energy exports having broad effect
- China semi-fabricated aluminum export rising > could be backchannel for Russian metal

# Agenda

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- Russia and China's evolving role in global aluminum trade
  - The crisis in U.S. and European primary production
  - Supply versus Demand
  - LME and Midwest pricing
  - Decarbonization: theory to execution
  - Responsible Production in the "ESG Era"
  - Summary

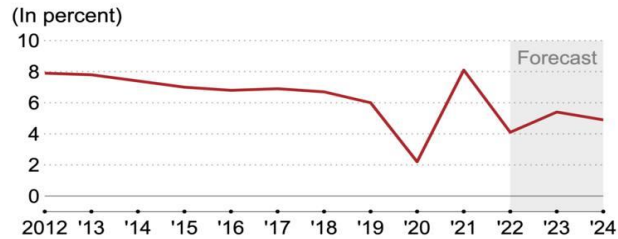
# China themes : Xi consolidates power, electricity short, covid, property weak



- 20<sup>th</sup> Congress of CPC put emphasis on Xi's consolidation of power base
- Politburo packed with loyalists, old school members retired or
- Chief goals are national security and community prosperity
- No relenting on zero covid tolerance even if domestic economy suffers
  
- Climate change brings drought and extremely hot temperatures to much of China
- Hydro-electric systems taxed and thwarting efforts to decarbonize aluminum in Southwest
- Exports of high carbon aluminum continue pattern of high carbon leakage to rest of World
- Massive amount of Chinese aluminum production making losses
  
- China's desire for total control of covid-19 has stifled its domestic economy
- Population restless under domestic travel constraints
- Consumer spending has suffered very badly and property markets weak
- Traditional fiscal stimulus may not be effective in absence of loosening covid policy
  
- Stalled development projects were 3.85% of total market in July 2022 = 231 million  $m^2$
- Bloomberg China Real Estate Developers Index on 10 year low
- Building & construction represents 30% of aluminum demand, 25 to 33% of GDP
- The subsidization of industry feeding exports remains a big threat

# China themes : GDP, Demographics, Balancing Act with Russia

## China's GDP growth



Source: China National Bureau of Statistics, Nikkei, Nikkei Quick News

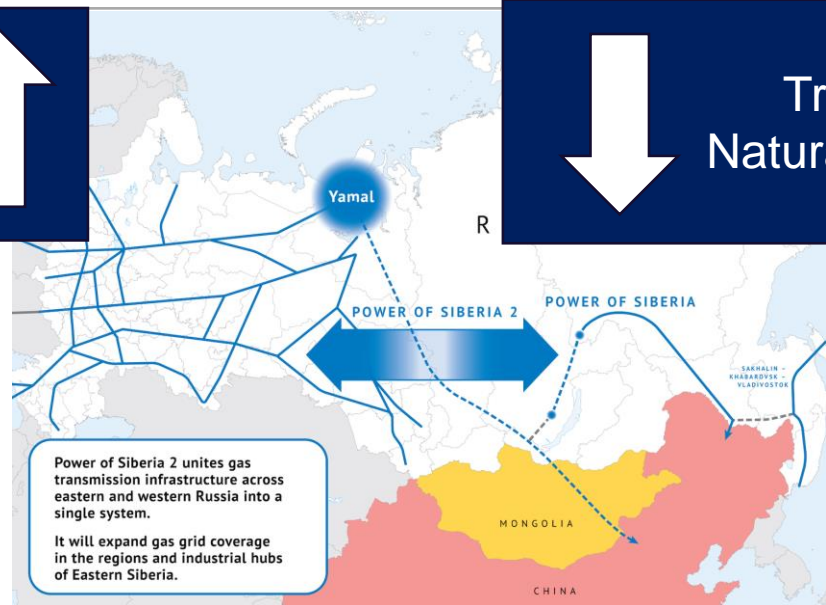


- National security and community prosperity is trumping sheer economic growth
  - Some extreme estimates place growth as low as 2.7% with IMF at 3.3%
  - Stunted domestic spending from weak auto, property and other consumer goods
  - Industrial subsidies face ever-increasing global scrutiny and countervailing action
- 
- China population aged 60 years or older = 264 million =18.7% of total population
  - Global average is 9.1%
  - Increasing social burden on economy to support this demographic profile
  - Low birth rate means work force not being replaced = long term rise in labor costs
  - China will drive automation and use of AI faster than the rest of World to compensate
- 
- Aside from political ideology, many reasons for close relations between China & Russia
  - Russia is rich in natural resources which China needs and can pay for
  - China decarbonization goals are accelerated by use of low carbon Russian aluminum
  - Risk to China of supporting an ostracized country, jeopardizing EU/USA trade

# China becomes the clearinghouse for Russian energy and aluminum



Trade Flow NORTH  
Alumina and Hard Currency



Trade Flow SOUTH  
Natural Gas and Aluminum

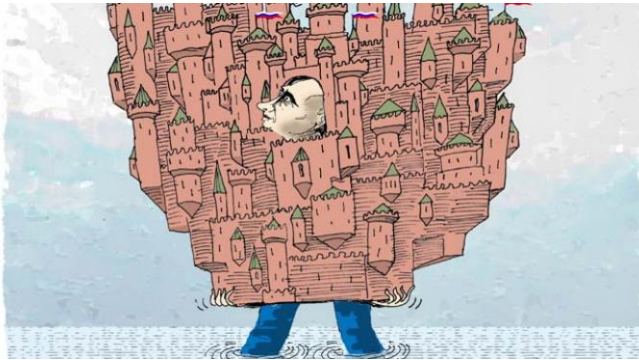


- China becomes supplier of alumina after:
  - Australian government ban on exports from Rusal-equity stake in Queensland Alumina
  - Loss of Ukrainian alumina asset due to War
  - Alcoa suspension of trade with Russia
- Alumina can be bartered in exchange for natural gas and aluminum going to China
- Russia increases its supply of natural gas:
  - Long-planned pipelines from Siberia into eastern China are being filled faster
  - Gas exports could be used as barter payment for alumina
- China imports low carbon aluminum to supplement domestic supply to de-carbonize its exports
- China's Strategic Reserve Bureau may use this as opportunity to replenish stockpile at very cheap prices

## Russia themes : New nationalism, isolation, lost of trust and markets



- Putin appears to have a vision of recreating the former Soviet Union
- Whipping up nationalist sentiment through alleged threats from West
- Annexation of Ukraine's eastern provinces is a carbon copy of Crimea action



- Economic sanctions having mixed impact on economy, aluminum demand down 22%
- Petrodollar earnings are \$20 billion month
- Central Bank's Nabiullina given credit for stabilizing ruble, star among central bankers



- Weaponization of energy exports has destroyed European trust in Russia
- Ukraine War, on heels of Crimean annexation begs question of "who's next ?"
- Russia's role as a leading exporter of low carbon aluminum is in disarray

# The ramifications of the Ukraine War on Russian aluminum



# GLENCORE



- Russia spent 30 years building its credibility as a reliable global exporter
  - Ukraine War has destroyed much of that reputation
  - Exports of 3.4 million tons with market shares in EU (40%), Asia (23%), N. America (7%)
  - Self-sanctioning by the private sector is rising
  - This is leading to substantial discounting in the market
- 
- Glencore in midst of 5-year, 1.5 mmt/yr. export deal signed in 2020, with option for 2025
  - Company has pledged to honor the deal through 2023
  - Performance under the contract may become problematic if banks won't finance
  - Additional risk arises if the London Metal Exchange (LME) elects to delist Russian metal
- 
- LME has registered most Russian smelters for delivery to the Exchange
  - This gives Russia a “market of last resort” if conventional physical markets dry up
  - LME delivery ensures Russia metal is fungible, allowing banks to finance
  - IF LME were to delist Russian metal, metal could begin to accumulate in Russia
  - Threat of Russian metal eventually flooding World ex China could destabilize market

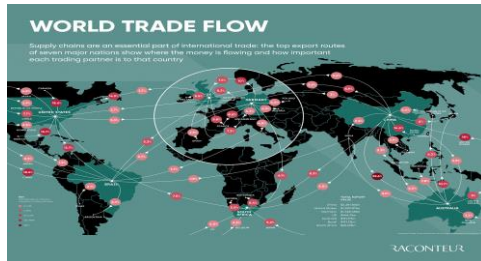


# Private sector is not waiting for government mandates to sanction Russia



## ESG standards are driving the decisions of individual corporations

- Existing 2022 contracts are being fully honored
- Companies are quietly replacing Russian supply with alternative suppliers for 2023
- When alternatives in place, companies are publicizing restrictions on Russian metal (Novelis)



## Russian metal continues to be produced AND exported, but with new trade flows

- Increased evidence of exports into **Turkey**, which is “trade bridge” to Europe
- **China** will be a natural “taker” of low carbon primary to meet its decarbonization targets for its exports + act as “bridging supply” as it approaches its 45-million-ton production cap
- Deliveries into **LME warehouses** in Malaysia and South Korea

**DISCOUNT PRICE**

## Developing new trade flows comes at a price to Russia

- If Russian metal is going to LME, it means they are not enjoying any regional premium benefit
- China will drive a hard bargain to take Russian metal for current consumption or replenish its State Reserves Bureau (SRB) stockpile



## Discounts being offered must be weighed against the risks

- Longshoremen may not handle cargoes at ports of entry (Norway)
- Teamsters (USA) and European Transport Workers (ETF) may refuse to haul Russian metal
- Banks may refuse to collateralize Russian inventory

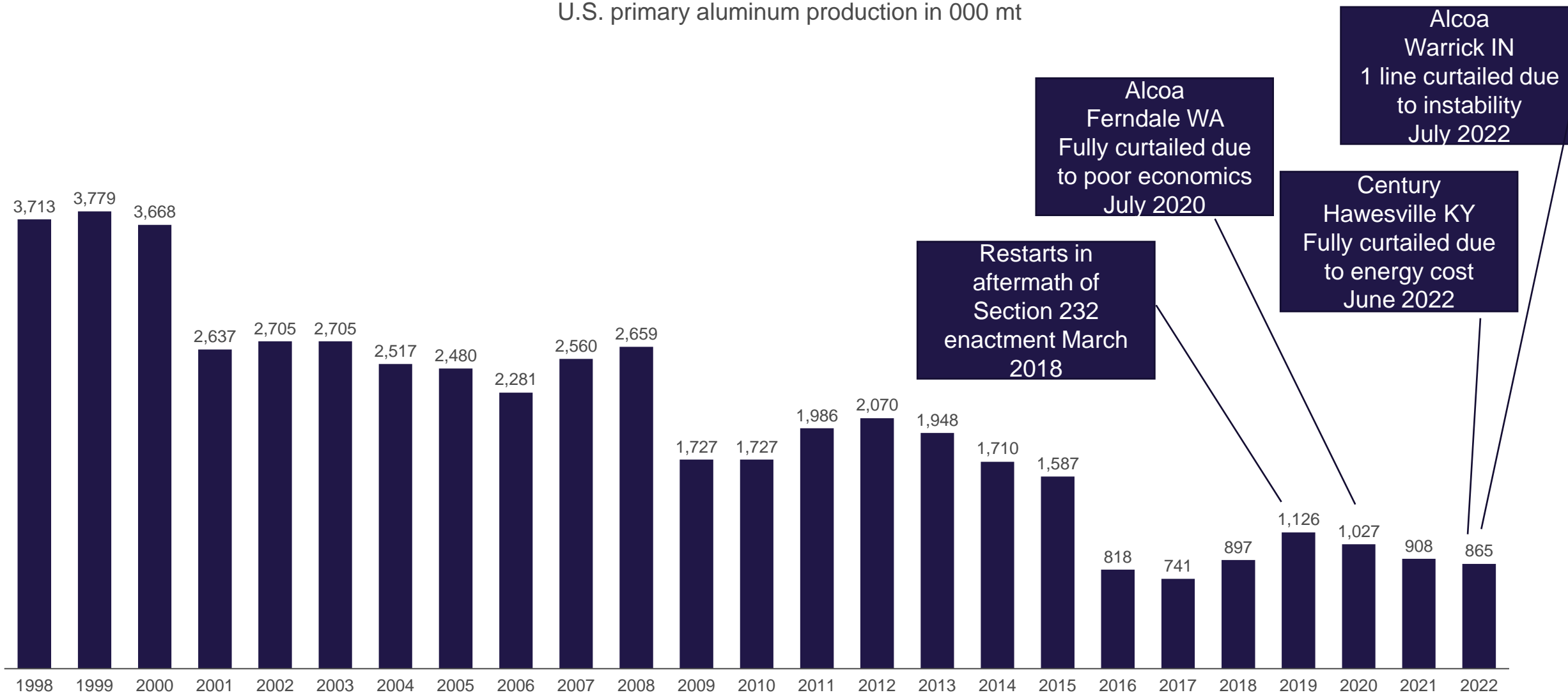
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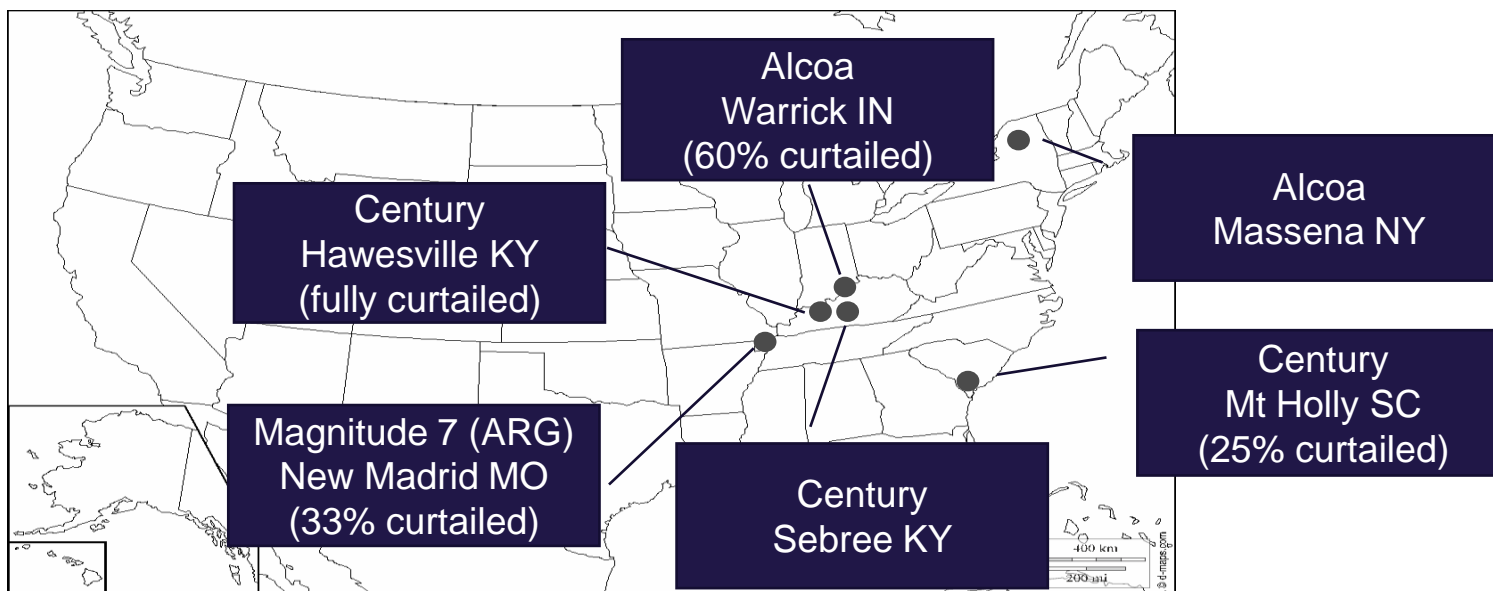
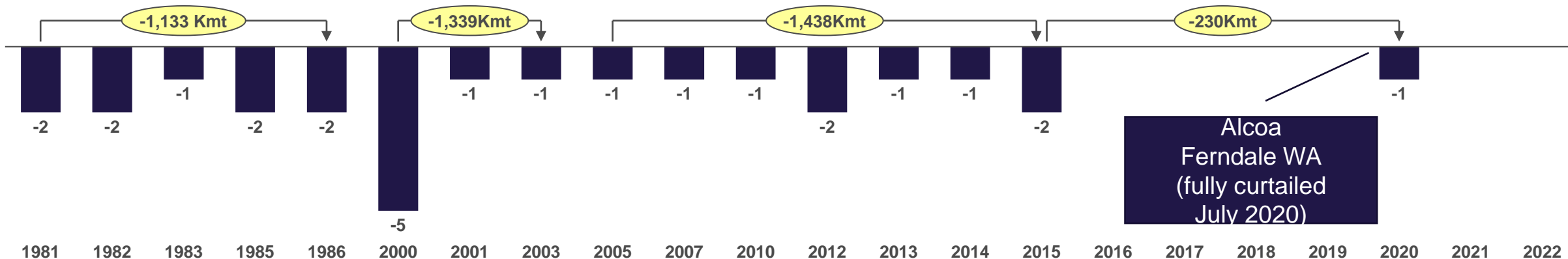
# Steady deterioration in U.S. primary production

U.S. primary aluminum production in 000 mt



# US primary profile in 2022: 6 smelters, 865 kmt production

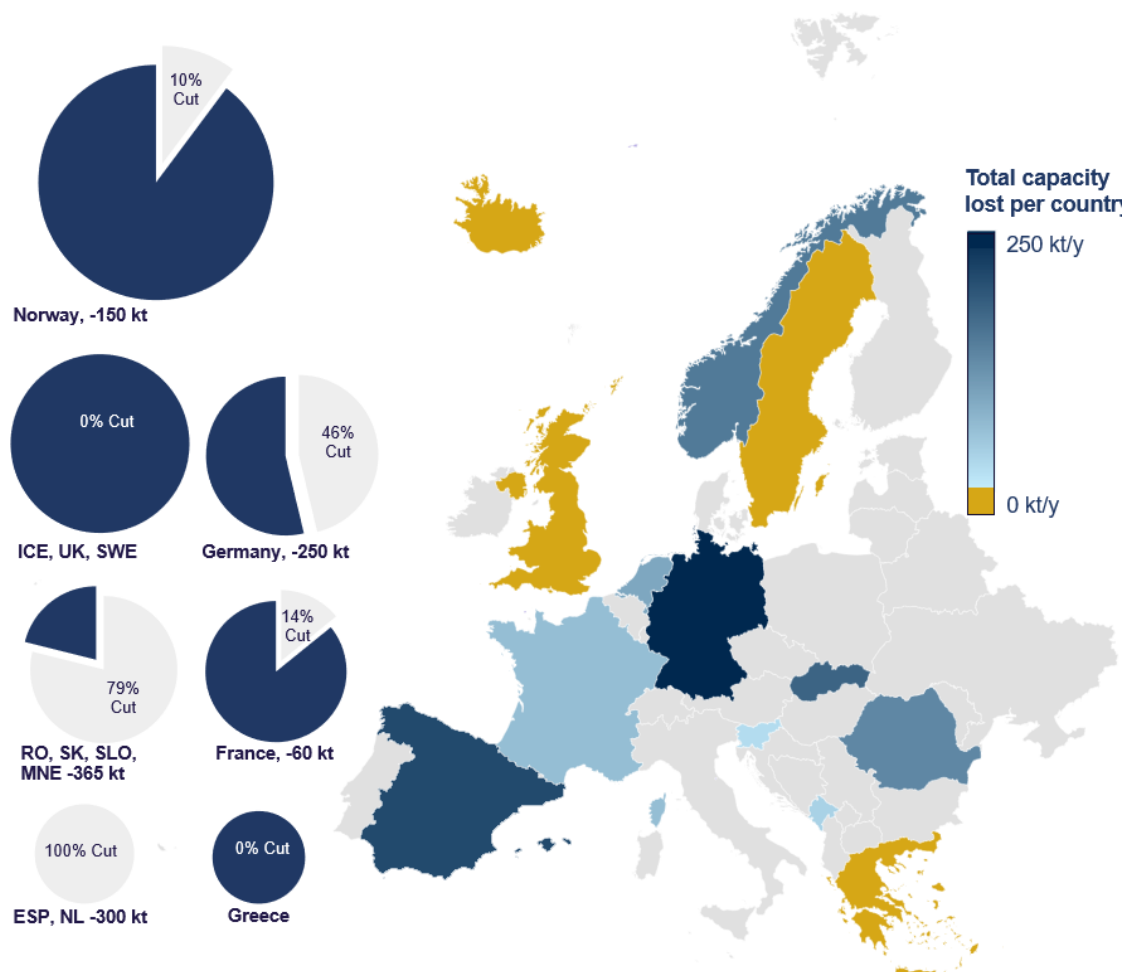
U.S. smelter closures 1980 to 2022



Source: CRU Analysis, U.S. Geological Survey, Bureau of Mines Annual Mineral Summary

# European disruption tracker

Europe lost 25% of its operating smelting capacity - the EU 46%.



Circle size corresponds to annual output in 2021. Absolute number corresponds to cuts in annualised capacity. Countries in grey did not produce any primary aluminium.

## Annualised production impact of European smelter closures

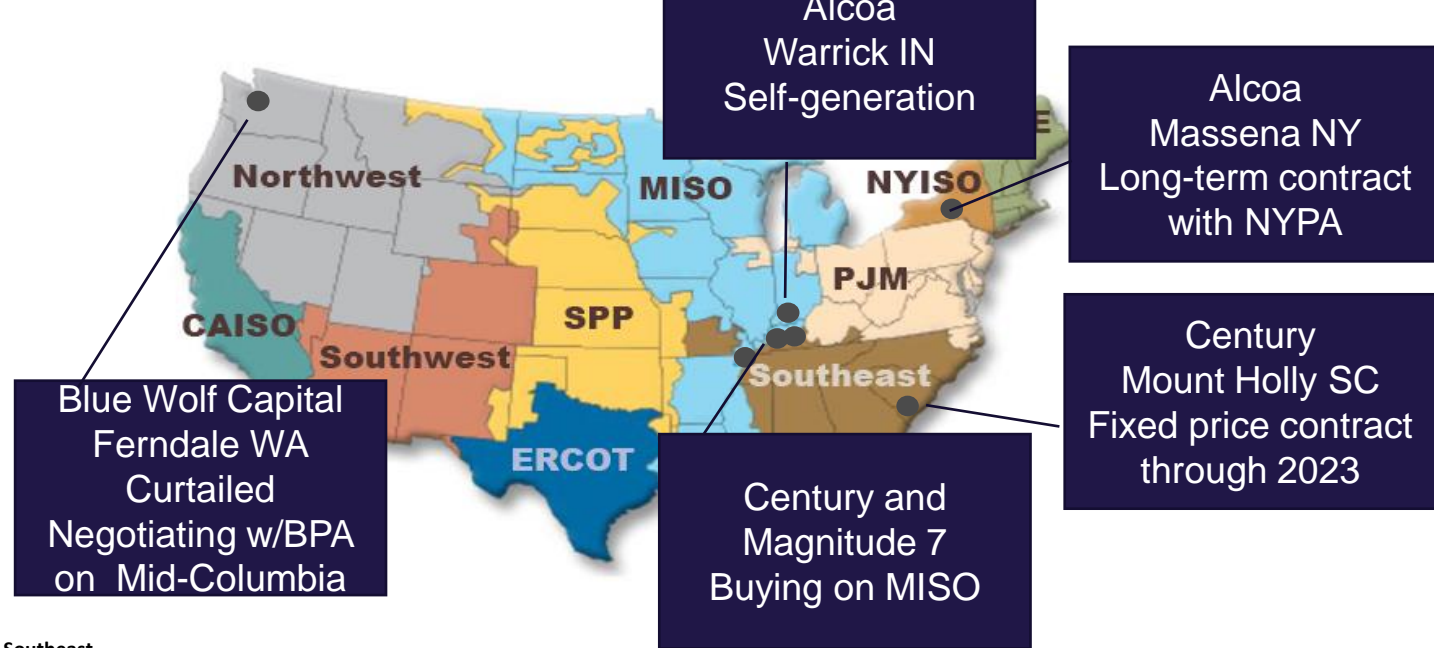
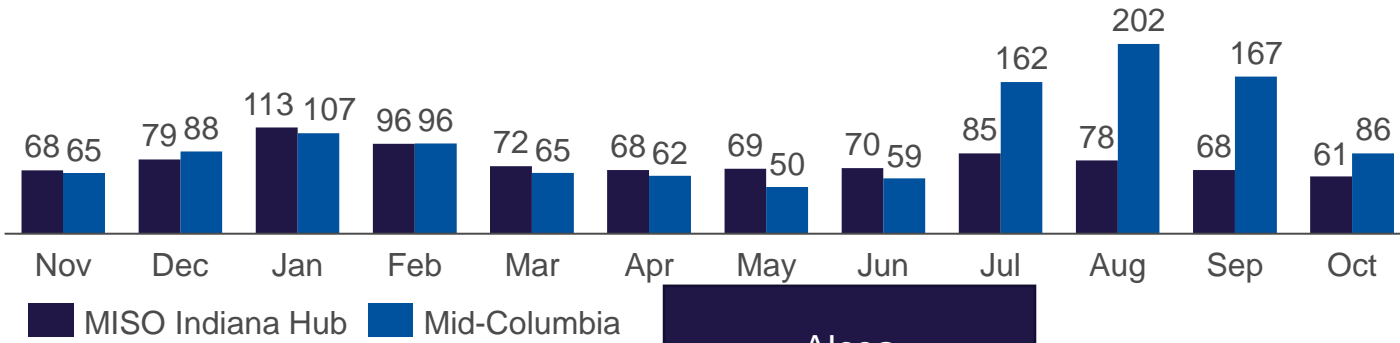
Smelter or Operator	Country	Type of closure	Ann. Output loss	Date	Restart
Talum	Slovenia	Partial	-12	Oct-21	
Delfzijl	Netherlands	Full	-90	Oct-21	
Ziar nad Hronom	Slovakia	Partial	-71	Oct-21	
Trimet Aluminium SE	Germany	Partial	-70	Oct-21	
Podgorica	Montenegro	Full	-38	Dec-21	
San Ciprian	Spain	Full	-207	Dec-21	2024
Slatina	Romania	Partial	-130	Dec-21	
Dunkirk	France	Partial	-46	Dec-21	May-22
Neuss	Germany	Partial	-20	Dec-21	
Trimet Aluminium SE	Germany	Partial	-70	Mar-22	
Talum	Slovenia	Partial	-11	Aug-22	
Lista	Norway	Partial	-31	Aug-22	
Ziar nad Hronom	Slovakia	Full	-104	Sep-22	
Husnes & Karmoy	Norway	Partial	-120	Sep-22	
Neuss	Germany	Partial	-70	Oct-22	
Dunkirk	France	Partial	-60	Oct-22	

**Total idled capacity by the end of 2022 -1104**

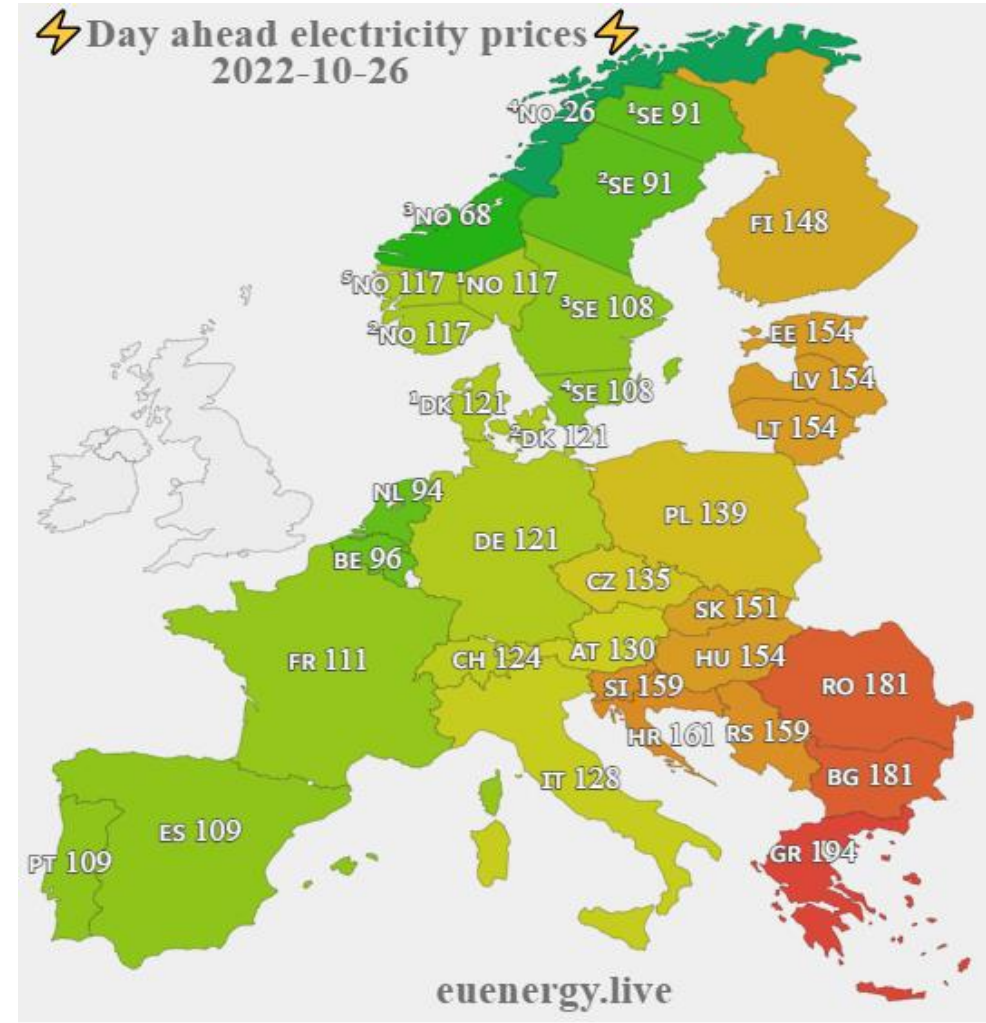
DATA: CRU. Note: Restart refers to the period when idled capacity has been announced to restart.

# US and EU electricity prices remain high: smelters have high exposure

CME Forward Electricity Prices in USD per MWh as of October 26, 2022



**Southeast**  
 The Southeast electricity market is a bilateral market that includes all or parts of Florida, Georgia, Alabama, Mississippi, North Carolina, South Carolina, Missouri and Tennessee. It encompasses all or part of two NERC regions: the Florida Reliability Coordinating Council (FRCC) and the Southeastern Electric Reliability Council (SERC). Utilities in the Southeast are vertically integrated and virtually all the physical sales in the Southeast are done bilaterally.



# Section 232 remains a stopgap measure versus strategic metals policy



Providing for operational surety of U.S. primary smelting

- U.S. production is falling with Century Hawesville fully curtailed due to high power price
- Alcoa shut 1 line at Army Warrick due to operational instability
- Magnitude 7 indicates no desire to invest capital to restart idled 33% capacity



Providing for financial surety of U.S. primary smelting

- Collapse of LME and Midwest premiums has hurt revenue stream
- Blue Wolf Capital continues to be frustrated in efforts to buy and operate Ferndale smelter
- Inflation Reaction Act “may” provide green credits to Blue Wolf, but enough to offset power?

Critical Minerals	
1%	Aluminum
1%	Iron
1%	Copper
1%	Nickel
1%	Zinc
1%	Lead
1%	Fluorine
1%	Chromium
1%	Vanadium
1%	Antimony
1%	Cerium
1%	Diagnosium
1%	Erbium
1%	Europium
1%	Fluorapatite
1%	Gadolinium
1%	Gallium
1%	Graphite
1%	Hafnium
1%	Indium
1%	Lanthanum
1%	Lithium
1%	Manganese
1%	Neodymium

Reduce dependency on imported strategic metals

- U.S. deficit in primary metal is rising again
- Large increase in Russian P1020 recently, stable non-Russian origins
- U.S. has not devised a comprehensive strategic metals policy that integrates Canada



Surety of cost for end use buyers remains function of LME price

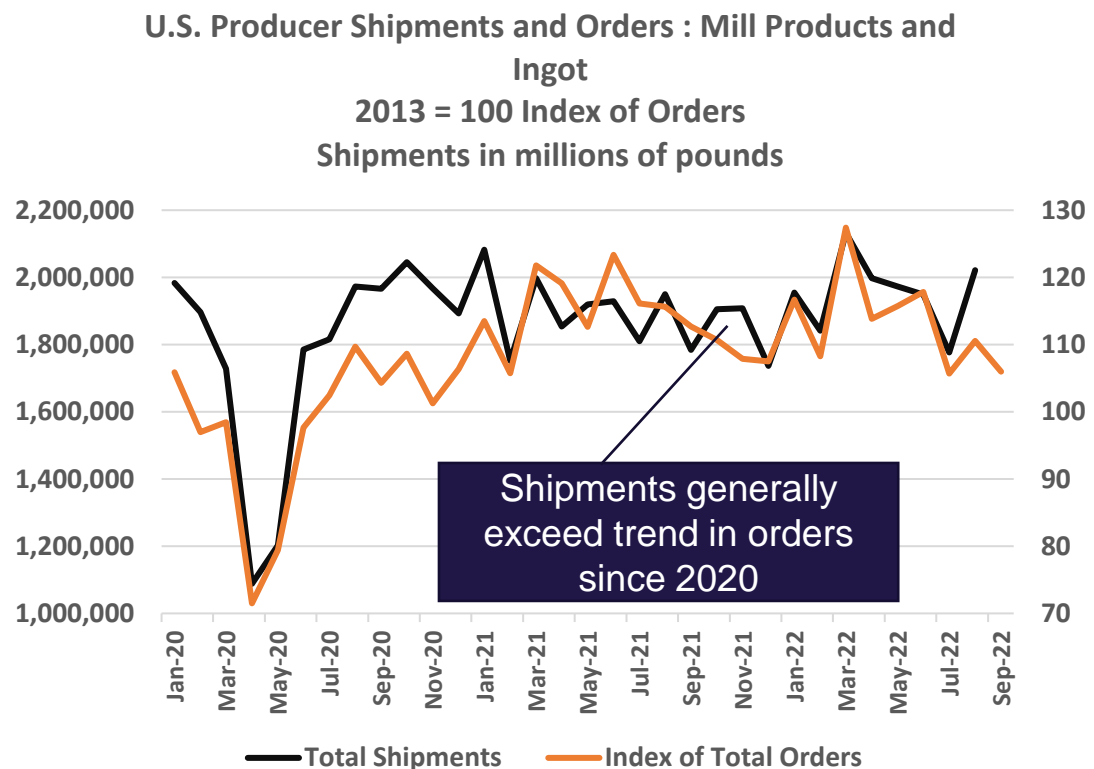
- Fabricators index selling prices to Midwest and push all price risk to end users
- Final OEM are absorbing the effect of the duty embedded into their Midwest price
- Collapse of LME prices during 2022 has weakened end user argument about cost

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# The difference between demand & consumption: destocking is happening



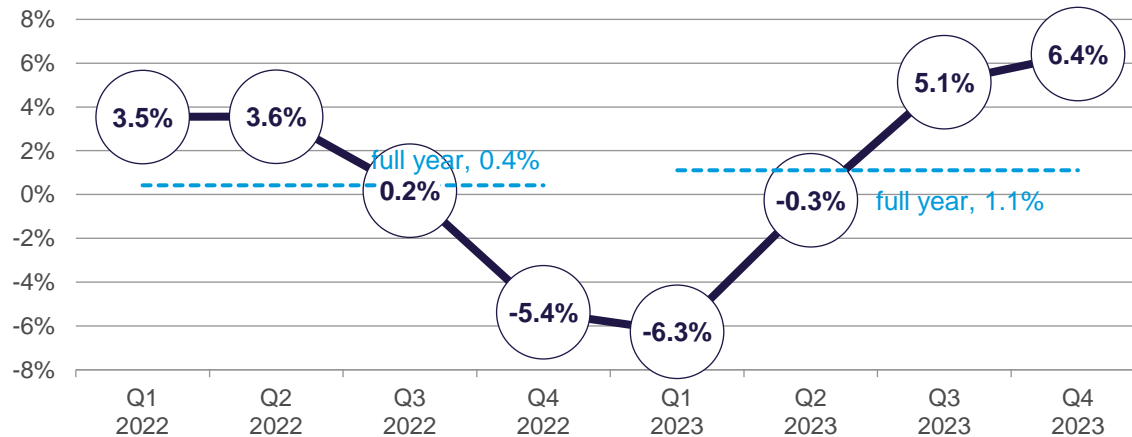
When prices drop as they have in 2022, a major de-stocking cycle occurs bringing a decline in orders below shipments

When shipments begin to decline faster than the decline in orders....real consumption is under threat

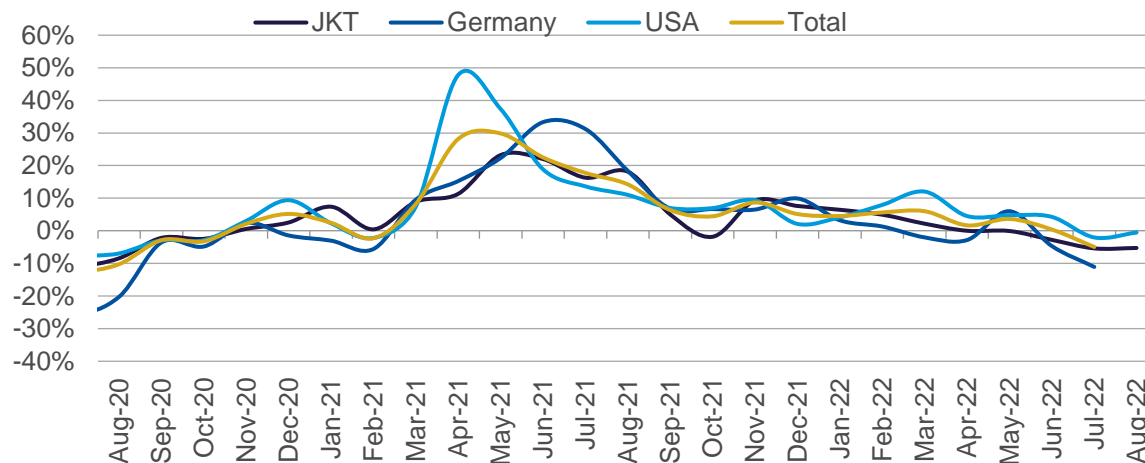
- Demand is sum of consumption for use + **inventory replenishment**
- Consumption is the metal need to sustain current production
- Over the past 35 years notable examples where changes in inventory fooled the market :
  - **1987-1988: Black Monday** stock market fell 22% on October 19, 1987; the metals market convinced itself the world was coming to an end and sold everything  
Reality was consumption remained solid, but people destocked...in June 1988 > LME record high of \$4200/ton
  - **2008-2009 :the Global Financial Crisis** . Companies dumped inventory and went to cash  
When people realized consumption was good ,we saw Midwest premiums rise > record high then in the \$.20's
  - **2020: the Covid Pandemic Lockdowns.** Panty hoarding stripped stores of everything > classic inventory build
  - **2022: Ukraine War –Energy Crisis;** July \$1.38 versus \$1.95 in January ; buyers dump higher priced inventory before replacement cost catches up to them in market

# World ex. China consumption: demand growth continues to decline

World ex. China aluminium consumption, y/y % change



Aluminium rolled products and extrusions reported production, y/y change



## Outlook

- Consumption to grow by 0.4% y/y in 2022
- 2023 modest rebound to 1.1% growth

## Key developments

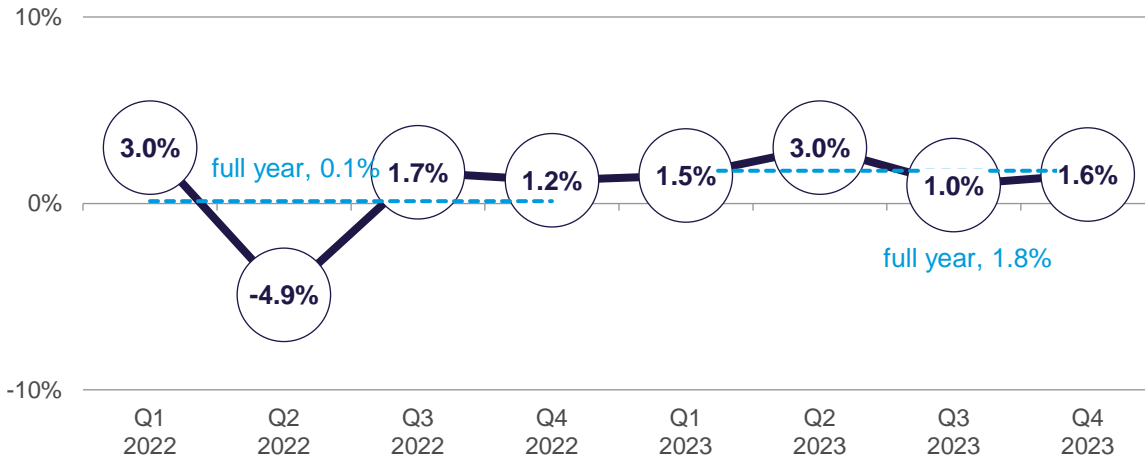
- According to the Eurostat, annual inflation was 9.1% in August, up from 8.9% in July. Driven by energy as result of Nord Stream suspension of delivery
- Demand for aluminium in Europe remains weak, as building and construction, transport and consumer durable end use sectors suffer from inflation.
- In the US, inflationary pressures are mounting, leading to a decline in discretionary consumer spending on discretionary durable goods

## Risks

- Inability of European governments to mitigate energy shortages, leading to more price inflation

# China consumption: construction demand is very weak

China aluminium consumption, y/y % change



Chinese exports of unwrought aluminium and products, '000 t



## Outlook

- Consumption to grow by 0.1 % y/y in 2022
- Rebound in 2023 to 1.5-1.8%

## Key developments

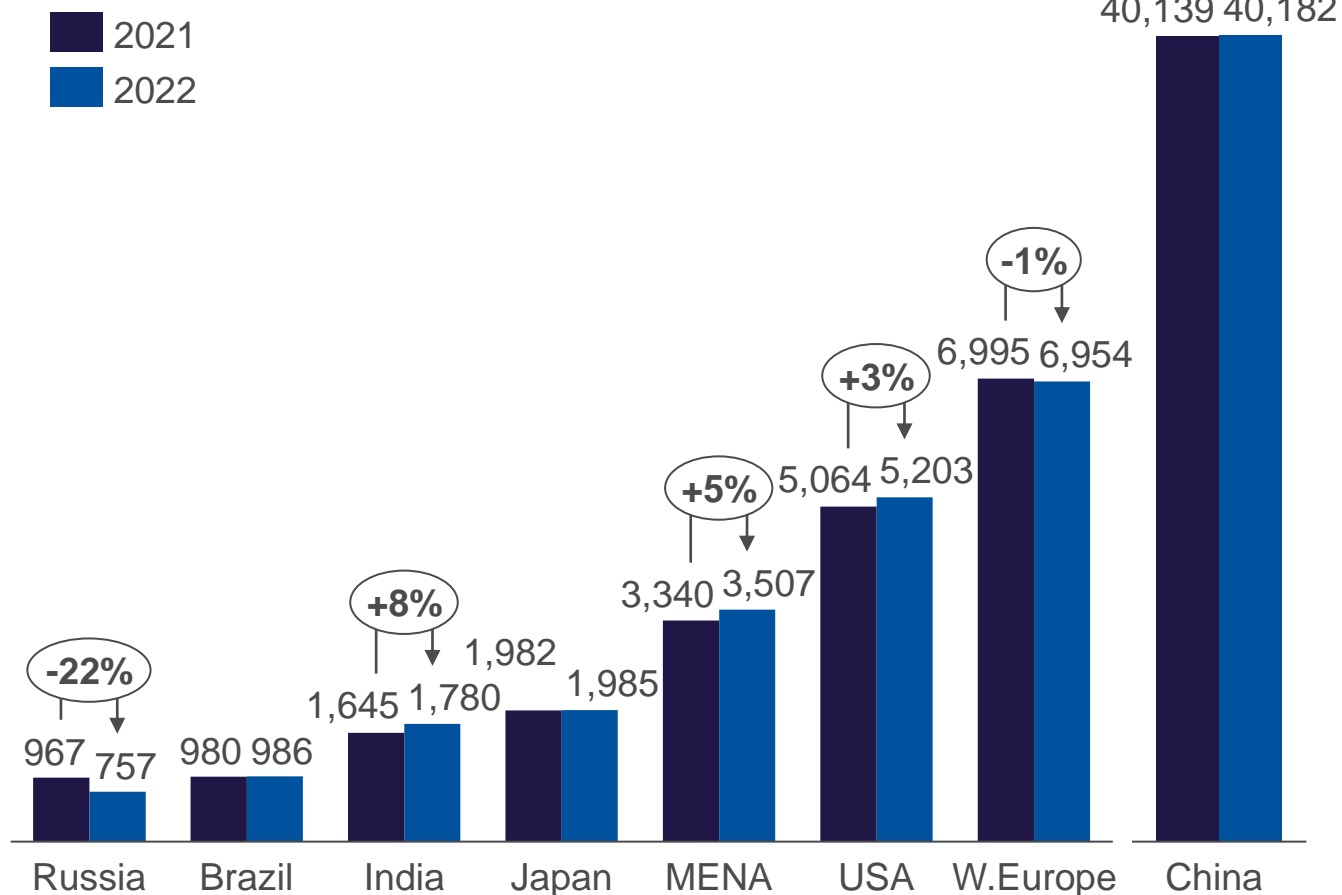
- China Association of Automobile Manufacturers (CAAM) reported August auto output of 2.395 M for with sales of 2.383 M, an increase of 38.3% y/y in output and 32.1% y/y in sales thanks to intensive stimulus policies
- Chinese exports of unwrought aluminium have recorded their 2<sup>nd</sup> consecutive month on month decline, down 8.2% but YTD still 27.8% ahead of 2021

## Risks

- China's demand recovery in real estate sector may take longer than expected
- Xi's hard-line approach on covid may mean chronic underperformance in domestic economy

# Consumption comparisons: USA and emerging markets still performing

In 000 metric tons  
(charts not to scale)



## The Good

- Strong growth in India with emerging middle class
- MENA benefiting from the flow of petrodollars
- USA continues to enjoy solid growth despite an auto industry still chip-constrained



## The Bad

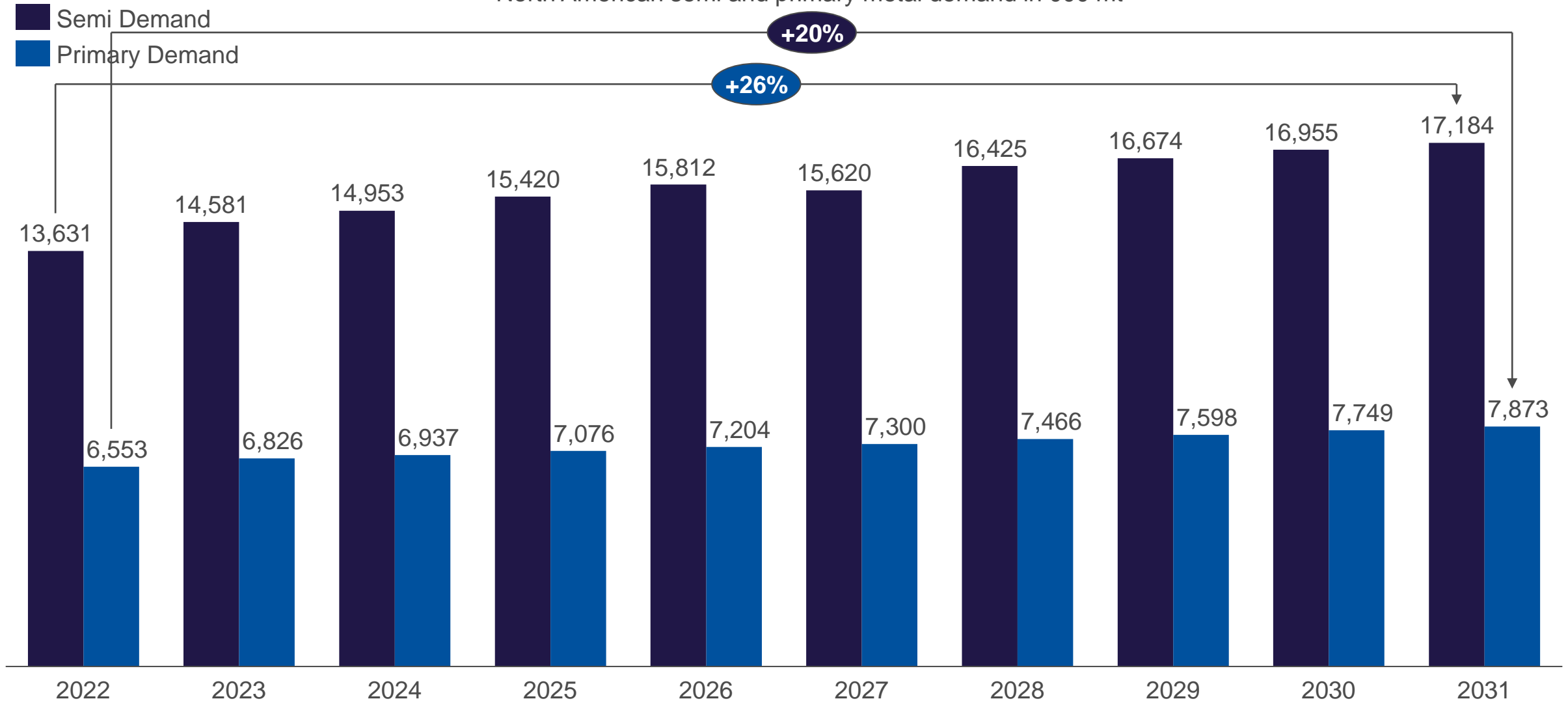
- China suffering the effects of its zero-tolerance policy on covid and property/auto markets
- Europe sinking under effects of high natural gas price and constrained supply

## And The Ugly

- Russian economy crushed by Western sanctions

# North America long-term demand prospects remain very healthy

North American semi and primary metal demand in 000 mt



# Aluminum growth: Inflation Reduction Act (IRA) helps Canada fabricators

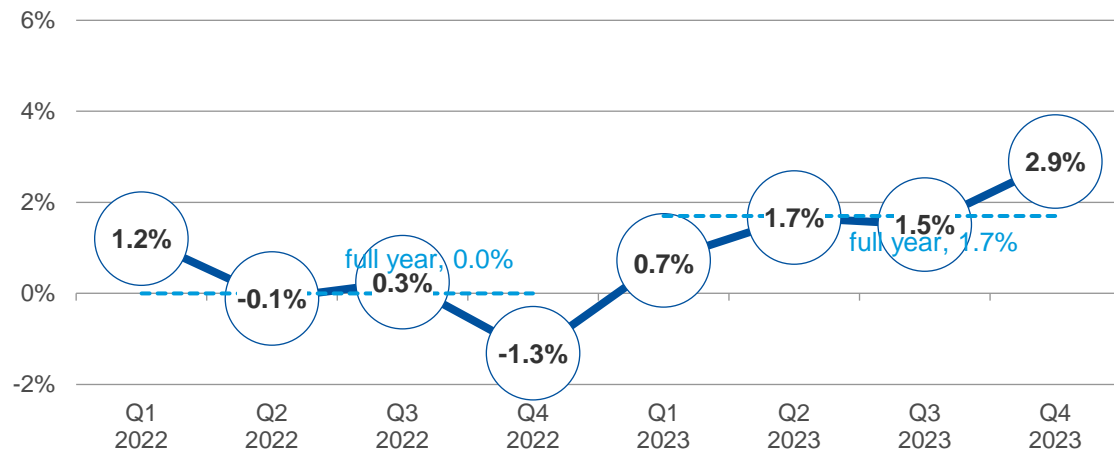
Key provisions of the law signed August 16<sup>th</sup>, 2022:

- Make it in America- incentives for American made equipment for clean energy production: *More on-shoring of demand within USMCA*
- **\$391 billion on energy and climate change initiatives:**
  - **\$128 billion for renewable energy and grid energy storage**
    - ✓ Investment tax credit for solar extended 10 years: *Solar panel frames (extrusion), grounding cables (wire/cable)*
    - ✓ \$30 billion for nuclear power : *Storage containers for waste, cooling systems (extrusion, rolled products )*
- \$37 billion for advanced manufacturing: *Computer numerical control (CNC) machines and robotics (extrusion, rolled products, die-castings)*
- \$27 billion grant and loan program from green decarbonization bank : *Accelerates adoption of standards across residential, institutional and commercial construction*
- \$22 billion for home energy supply improvement: *Reconductoring of medium voltage grid + new connection for renewables (wire/cable)*
- \$14 billion for homes energy efficiency upgrades
  - ✓ 30% tax credit for home upgrades : *Retrofitting of windows and doors (extrusion, rolled products)*
- \$13 billion for EV incentives
  - ✓ \$7500 tax credit extended : *Migration to EV which contain higher amounts of aluminum than Internal Combustion Engine vehicles (extrusion, rolled products, die-casting, wire/cable)*



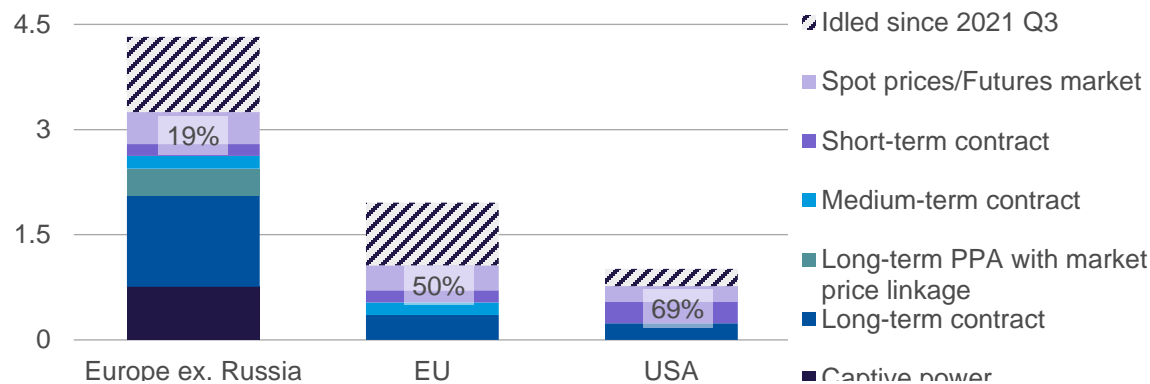
# World ex. China production: The scene is set for further production cuts

World ex. China aluminium production, y/y % change



Annual production in December 2022 divided by type of power contract

in Mt, % highlights operating capacity dependent on short-term contracts and spot pricing



Note: EU capacity included in Europe ex. Russia

## Outlook

**Production outside China is expected to remain flat in 2022 on a y/y basis**

Growth is expected to bounce back to 1.7% in 2023

## Key developments

Over 1Mt in Europe and the US could be exposed to spot power prices by the end of 2023

Power prices has fallen in the last month : in Europe, <200€/MWh, and the US, <\$100/MWh

European prices still too high for profitable smelting but lower US power prices into 2023 is encouraging

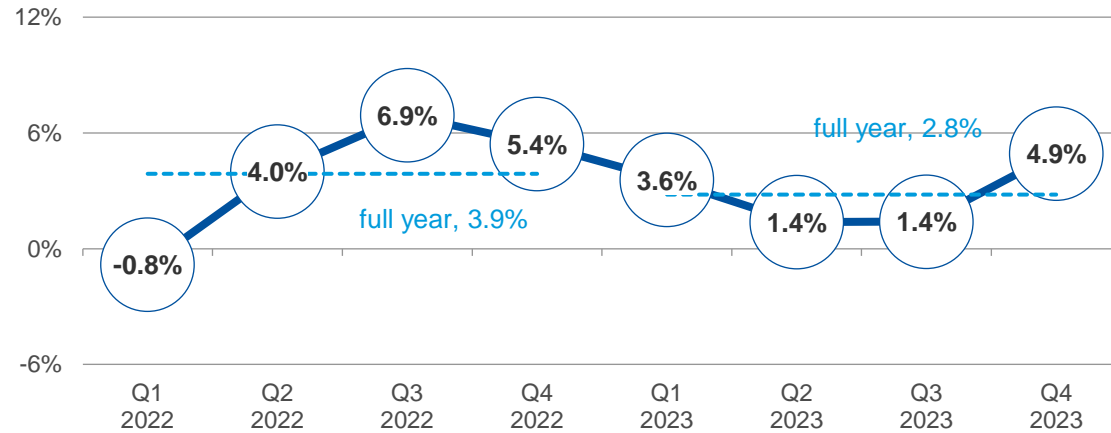
Weakened LME and premiums, together with high carbon products prices provide additional pressure on smelters.

## Risks

Further power price or cost related production cuts in Europe, the US & India provide downside risk

# China production: Weather extremes hamper output growth

China aluminium production, y/y % change



## Outlook

**Chinese production will increase by 3.9% in 2022, Growth in 2023 is forecasted at 2.8%.**

## Key developments

Smelters in Yunnan have production by 20% in September as the Province is hit by low hydro-reservoir levels. Restarts are forecasted for 2023 Q2, near the end of the dry season once hydro-reservoirs levels have been replenished.

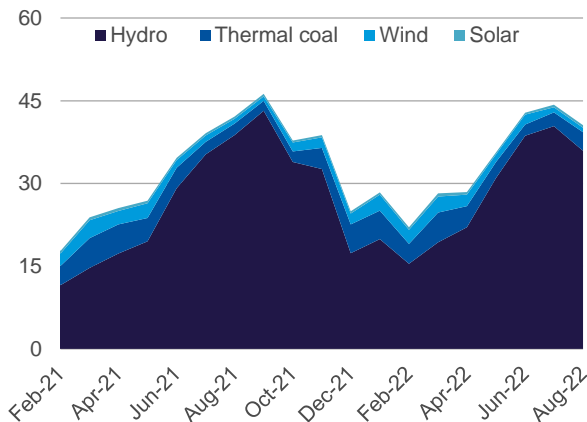
This is the second significant production cut in the region in the last two years.

## Risks

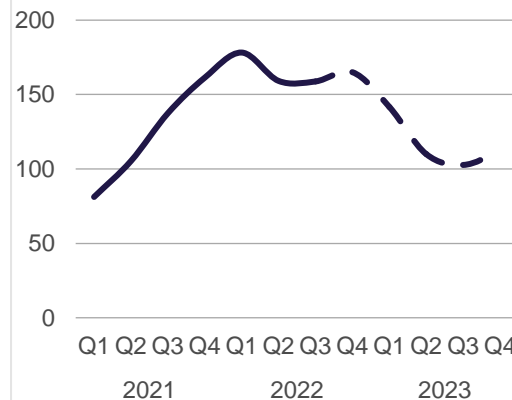
The largest upside and downside risks are provided by an improvement or worsening of the power situation in Yunnan.

Lots of capacity underwater and at risk of closure

Power generation in Yunnan province fluctuates over the seasons, TWh



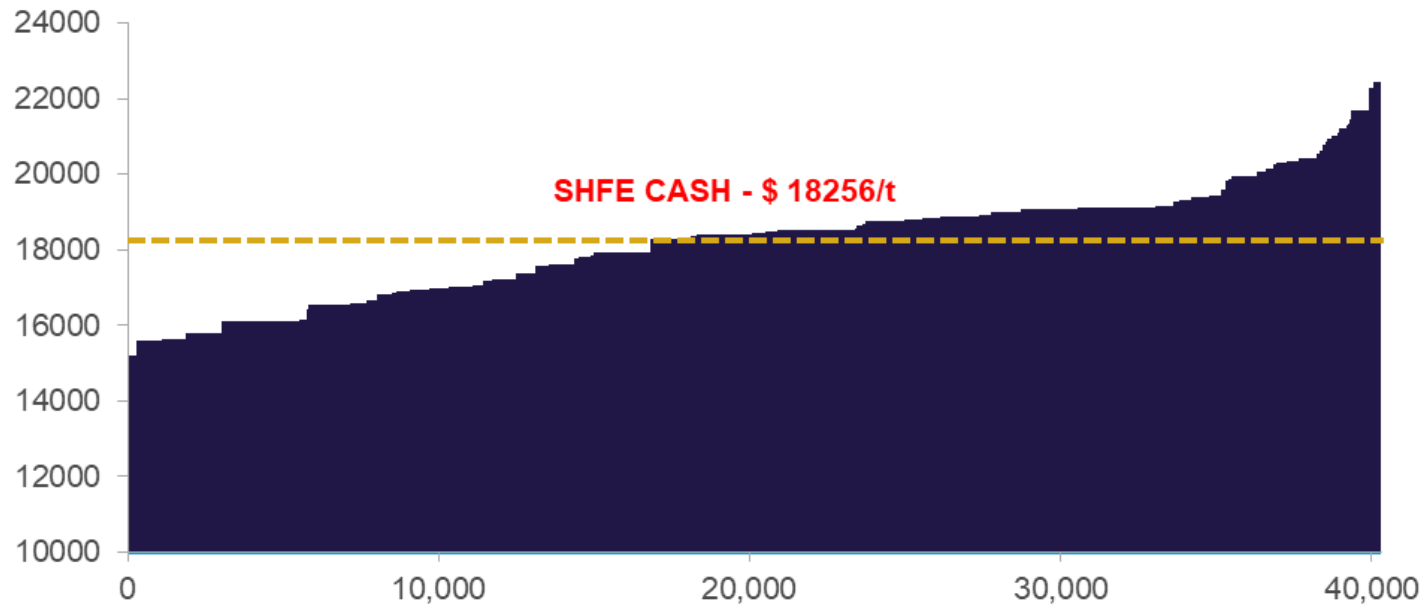
CFR South China thermal coal prices remain elevated, in \$/t



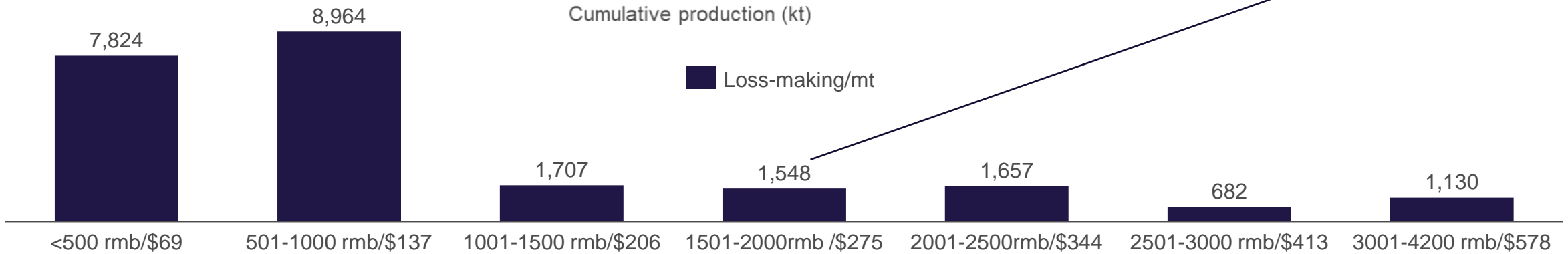


# China profitability basis 18,526 renminbi /ton = \$ 2,548 : 58% underwater

China aluminium Business costs, RMB/t, spot cost curve, end of September 2022

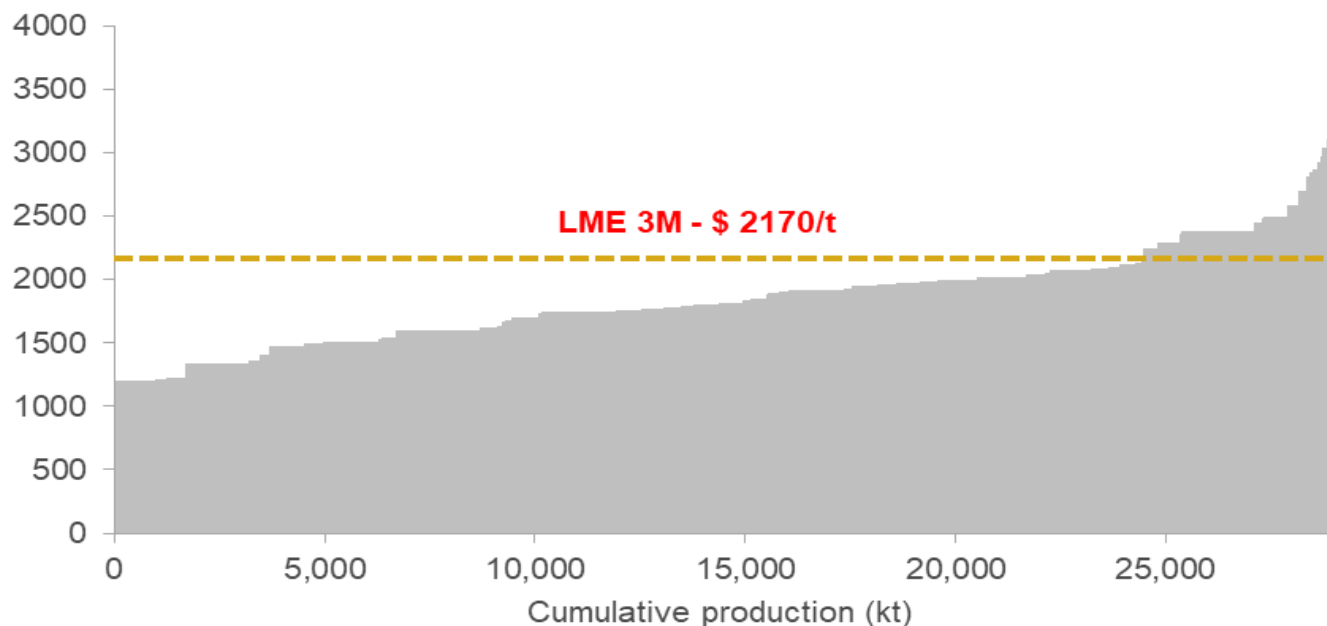


~40,336 kmt run rate  
 23,500 kmt of Chinese operating capacity are generating losses  
 Failure to curtail speaks to the "stickiness" of Chinese capacity in an environment of direct and indirect industrial subsidization

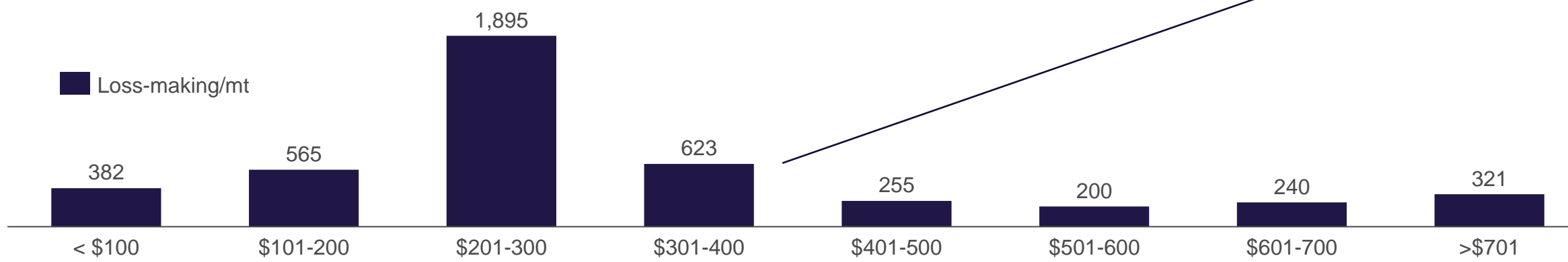


# World ex China profitability basis \$2,170 LME : 15% underwater

Ex China aluminium Business costs, \$/t, spot cost curve, end of September 2022

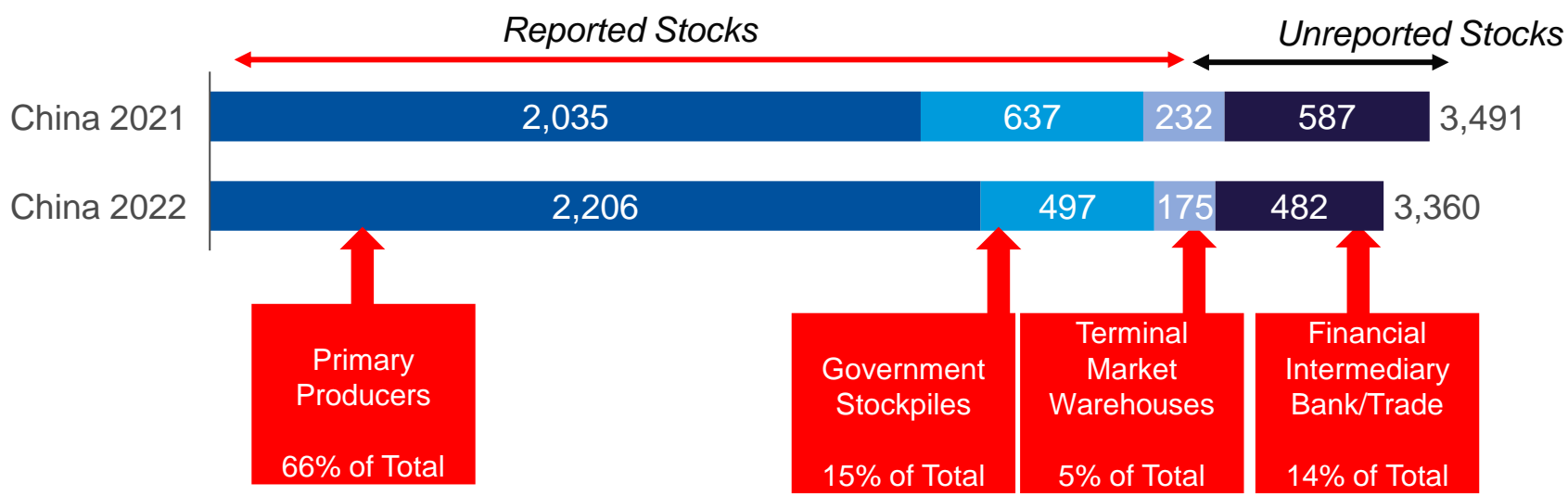
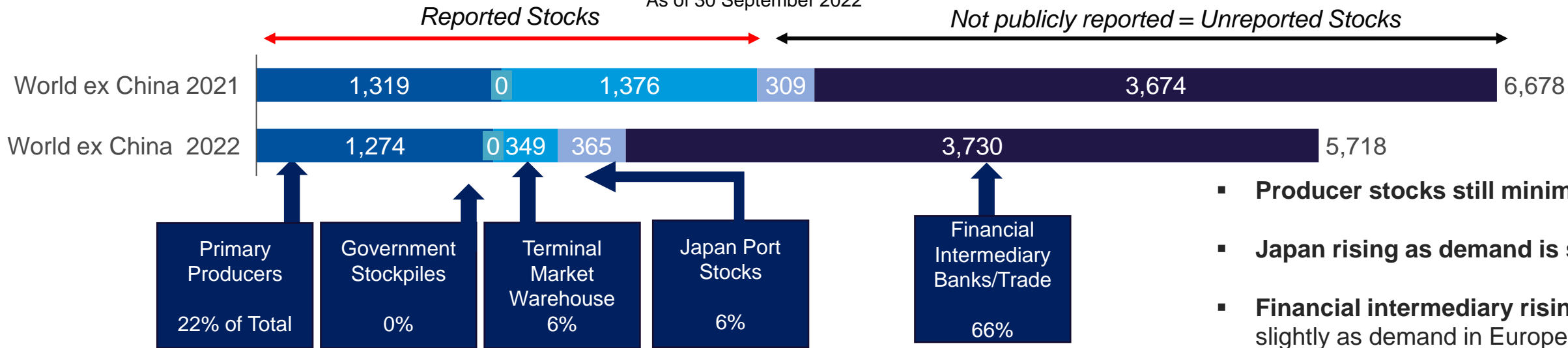


~ 28,921 kmt run rate  
 ~4,480 kmt of operating capacity generating losses  
 Responsiveness to market incentives has been swift, with massive curtailment in Western Europe



# World ex China stock-14.3% Y/Y-China -3.8%: LME fills with Russian metal

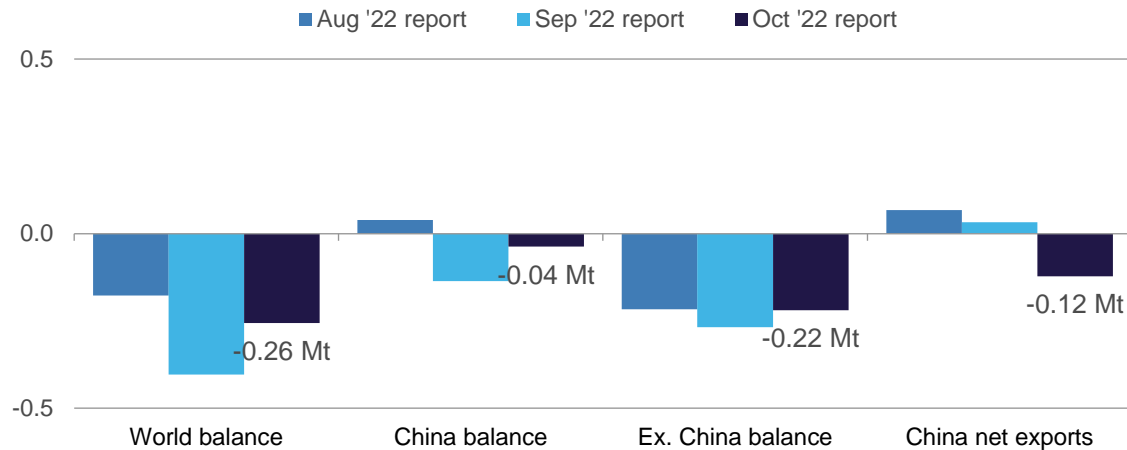
As of 30 September 2022



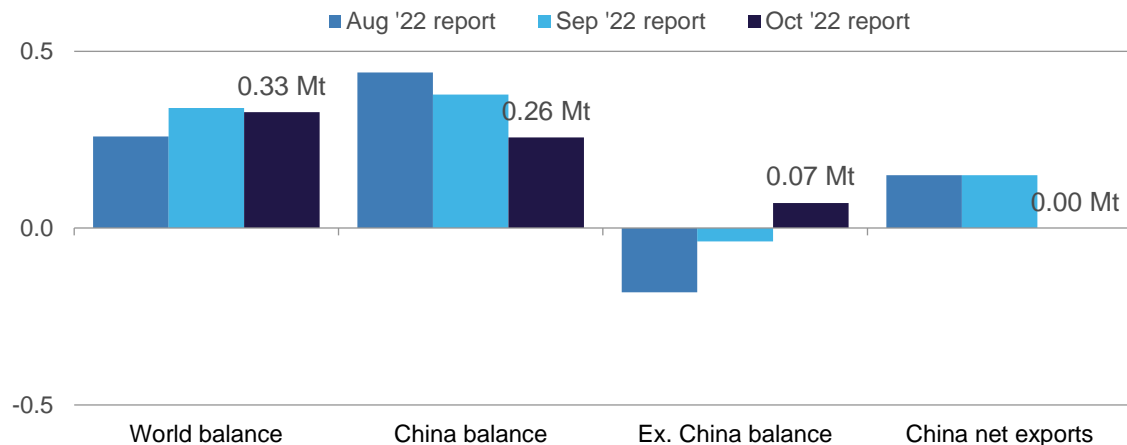
- **Producer stocks still minimal**
- **Japan rising as demand is soft**
- **Financial intermediary rising** slightly as demand in Europe softens and selling of Russian inventories becoming more problematic
- **LME stocks in South Korea, Malaysia and Singapore are rising** with consensus that this is Russian metal being delivered by Glencore
  - **Rising concern over heavy Russian deliveries** if they exhaust conventional physical markets due to self-sanctioning or government bans or punitive duties

# Balance: Deficits become less severe as demand weakens

2022 aluminium market balance, million tonnes



2023 aluminium market balance, million tonnes



## Outlook

- We forecast a 2022 world deficit of 0.26 Mt
- This is due to a weak demand outlook in 2022. By 2023, we expect a surplus of 0.33 Mt

## China

- We also expect a smaller deficit in 2022 of 0.04 Mt
- This results from declining demand in major provinces

## World ex. China

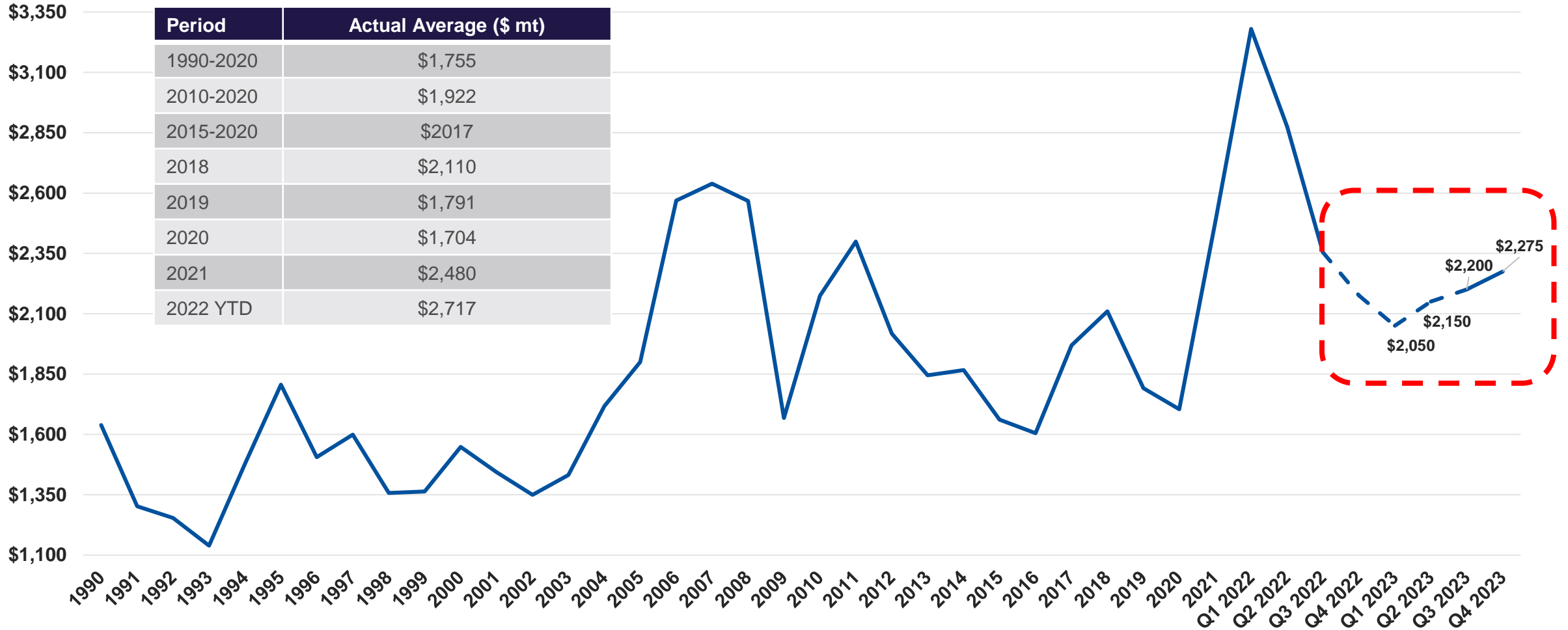
- In the World ex. China, we expect a deficit of 0.22 Mt in 2022
- Demand has slowed given high inflation, and recession in Europe

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# LME nominal price touches 1988 levels, major plunge ever since

LME Price (Nominal) versus 2023 Quarterly Forecasts



# LME 7 Signals: fears of demand destruction skew market to bear trend

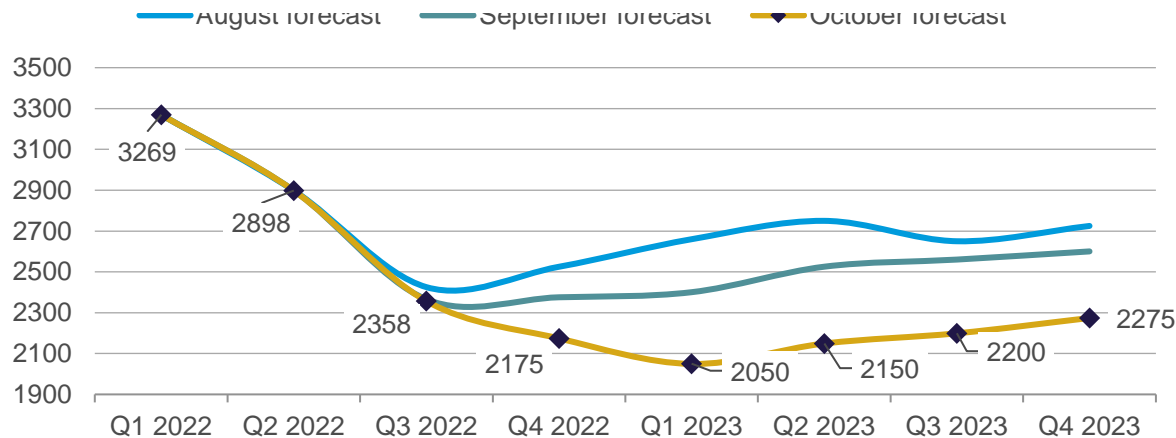
CRU's Seven Price Signals (forecast)	Bull/Bear/Neutral	Next month	Next 6 months
<b>US dollar:</b> Continued tightening by the Federal Reserve will push the USD higher and hurt USD-denominated commodities	<b>Bearish</b>		
<b>Energy prices:</b> European gas prices have eased as efforts to build storage have worked and LNG is arriving ; EU considering price cap as a surge breaker measure of last resort	<b>Neutral to Bearish</b>		
<b>Chinese economy:</b> Delays in release of key economic data is raising concern about how bad the numbers might be; the tone coming out of the 20th Congress of CPC did not deliver the stimulus signal some had hoped for	<b>Neutral</b>		
<b>Chinese arbitrage:</b> Exports fell for 2nd consecutive month indicating weaker trading conditions, but also lessens the pressure from Chinese supply	<b>Neutral</b>		
<b>Investors:</b> Commitment of Traders Reports shows funds have moved to being net short for the first time since July 2020	<b>Bearish</b>		
<b>Operating costs:</b> Smelters remain in jeopardy, now joined by concerns in the downstream sector raising fears of more demand destruction	<b>Bearish</b>		
<b>Aluminium market:</b> The preoccupation with falling demand in Europe and a sluggish Chinese economy are still preventing the market from pricing in potential supply-side shocks	<b>Bearish</b>		

# LME price forecast: LME rebound not expected before 2023 Q2

LME aluminium 3-month price, \$/t



CRU LME 3-month price forecast, \$/t



## Next month

- Some upside potential for the price in the short-term depending on LME decision to delist or restrict Russian metal
- US ban or punitive duty on Russia still in play
- Gains could be short-lived as the market gets increasingly worried about demand going into Q1 2023

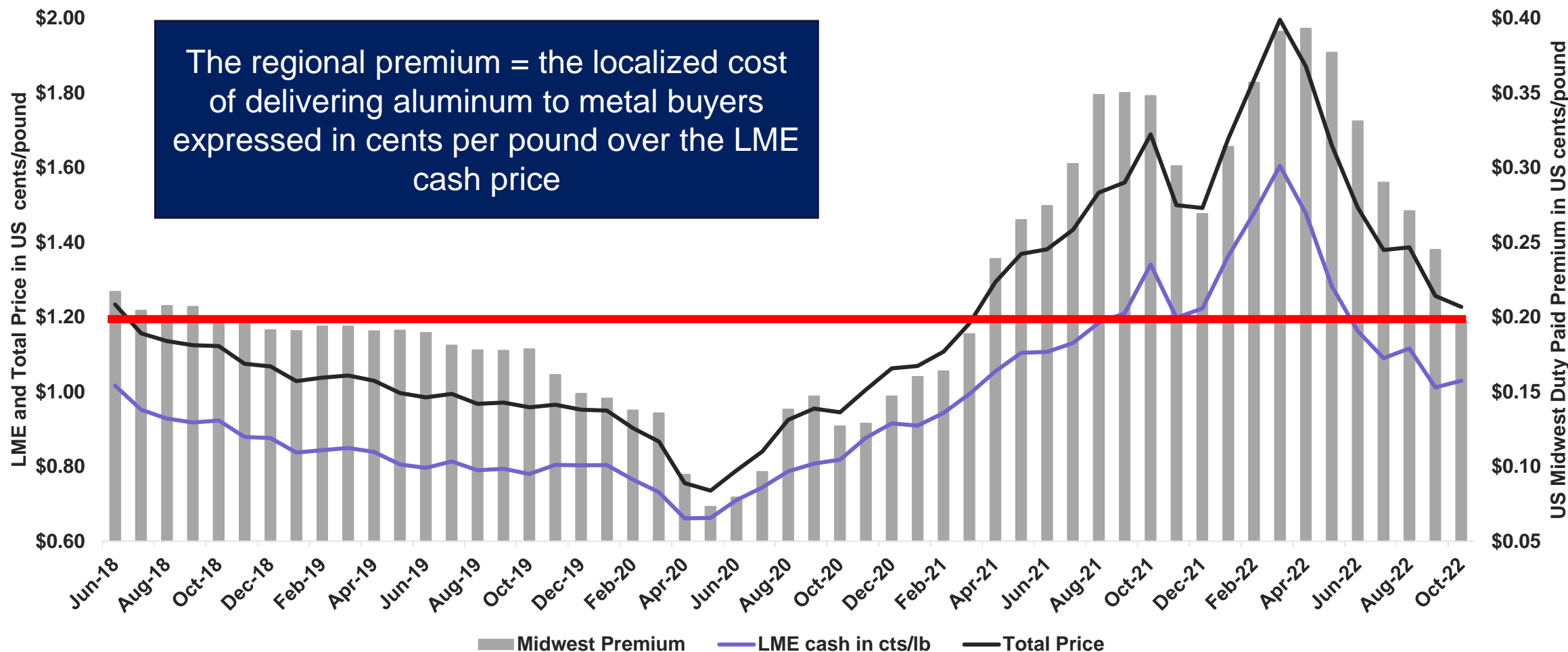
## Next 3 to 6 months

- We now expect LME to fall further in Q4 2022 and Q1 2023 with a recovery only in Q2 2023
- World ex-China demand outlook is expected to remain under pressure due to higher energy prices and the impact of overall inflation on business activity and retail consumption
- Despite European curtailments, the outlook is for surpluses to re-emerge



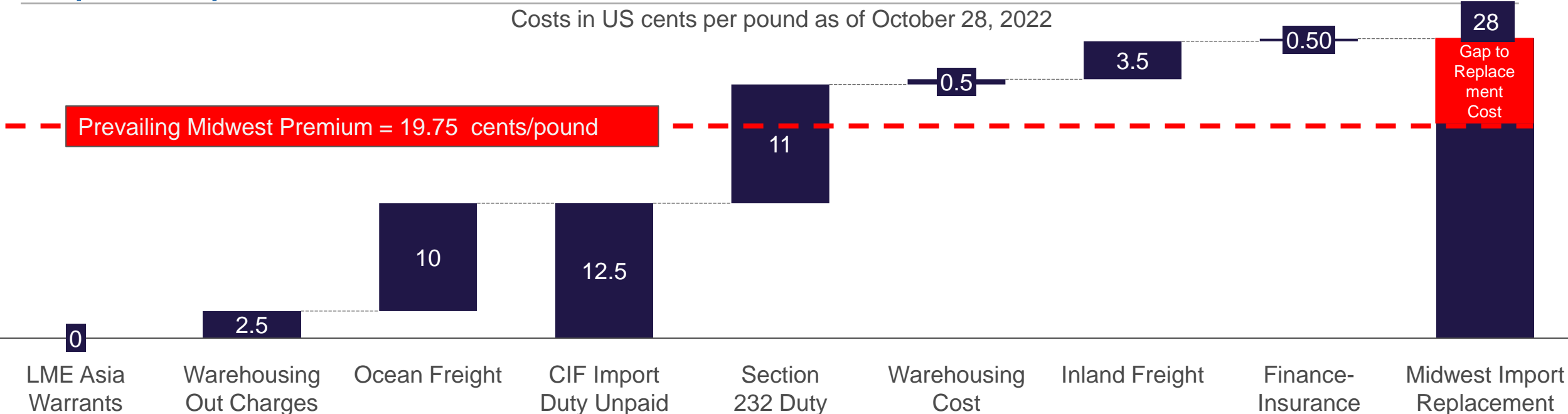
# Midwest premiums : retracing to levels at the beginning of of Section 232

LME cash - Midwest - Total P1020 Price



# Import replacement cost is 8 + cents above market: not sustainable

Costs in US cents per pound as of October 28, 2022



Cost Component	Description
LME Asia Warrants	Cost to purchase warehouse receipts in Malaysia or Singapore over LME
LME Out Charges	LME prescribed load out fees paid to LME registered warehouses
Ocean Freight	Current container freight costs from Asia to US West Coast or US Gulf
CIF Import Duty Unpaid	Cost, Insurance and Freight to declare value for duty calculation
Section 232 Duty	10% Ad Valorem basis declared value in US dollars per pound
Warehousing Cost	Discharge cost from vessel and loading to rail or truck
Inland Freight	Freight from Port of Entry to consumer works in Midwest
Finance-Insurance	Direct cost for period of transit and cargo insurance

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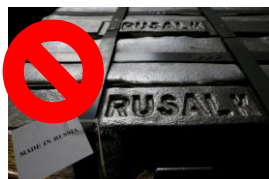
## Central themes on decarbonization and directional trend



- **US/EU Global Arrangement on Sustainable Steel and Aluminum** (October 31, 2021) sets new goals
- Negotiate a global arrangement on **carbon intensity** and **global overcapacity**
- **Discourage trade in high-carbon intensity**
- Developing an EU/US database to track embedded emissions



- **Price discovery on low carbon or green metal is moving forward**
- **Strong push in the EU and in the auto and packaging segment**
- OEM requirements are pushing this down through the supply chain
- **Building and construction , wire/cable remain laggards** and need government support to accelerate progress



- **Loss of Russian metal could boost low carbon premium pricing as they were a big share of supply**
- More and more primary metals are rolling out low carbon product lines to capitalize on growing demand
- **OEM are now demanding recycled content** and seeking more transparency in carbon accounting



- **Surge in capital investment for scrap recycling in North America, China, India and Europe**
- More primary producers are integrating scrap into their casting operations to lower carbon intensity
- OEM are now demanding recycled content and seeking more transparency in carbon accounting



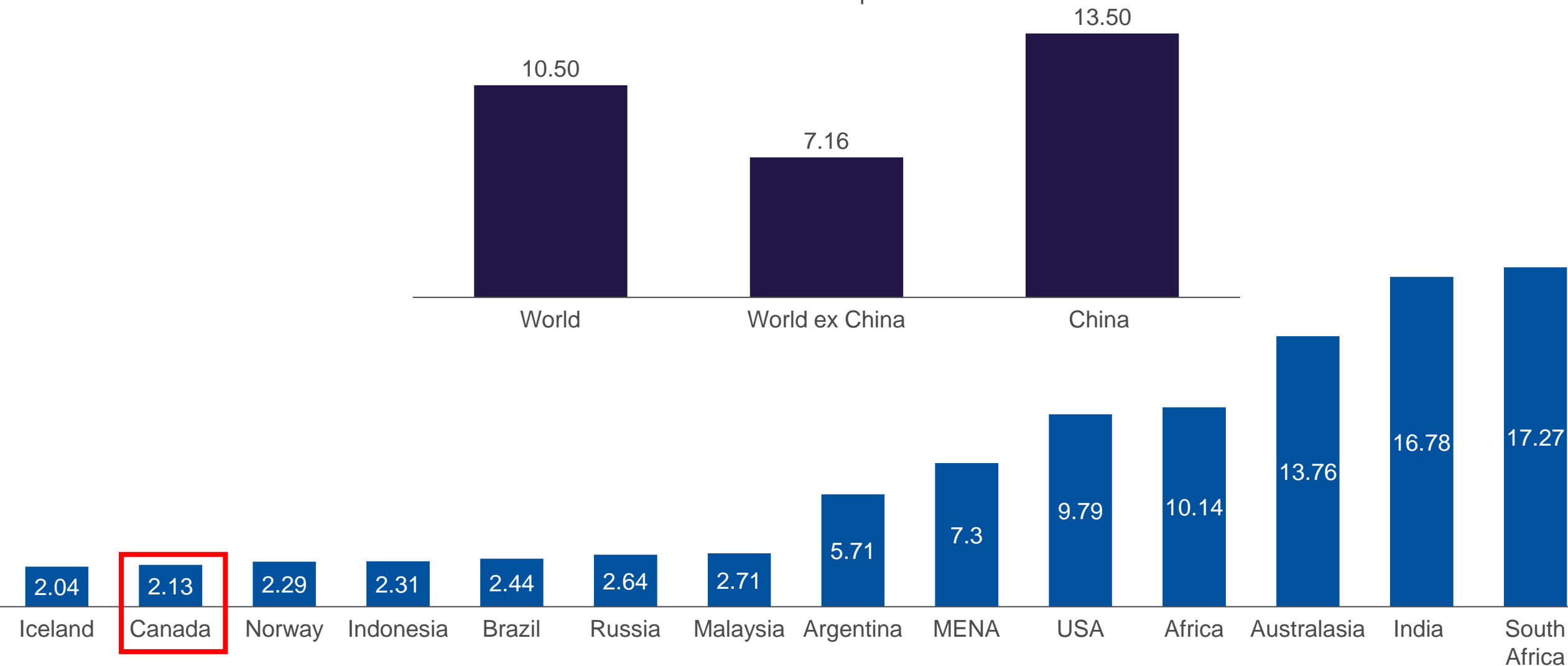
- **EU has pushed out carbon border adjustment mechanism (CBAM) full implementation until 2025**
- 2023 will see some gradual introduction of some standards for carbon treatment
- Carbon tax is dead in the USA, especially if Republican seize control of Congress in mid-term elections
- **Canada must guard against putting its aluminum sector at a competitive disadvantage to competitors in US/EU**



- **Low carbon metal driven by hydro is the natural means to achieve economic multiplier effect for Quebec versus “one and done” approach of exporting power to US or other provinces**

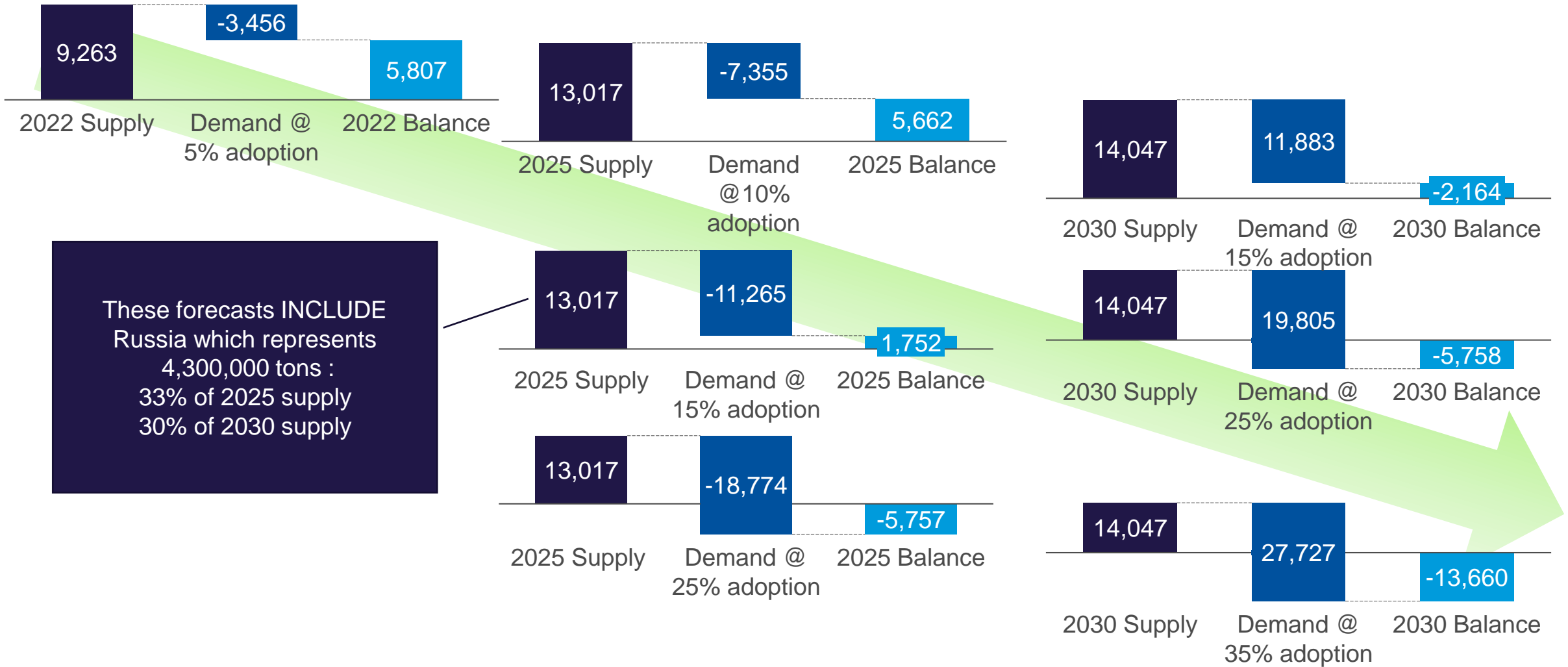
# Direct & indirect emissions by region/country: Canada best in class

2022 Tons CO2e /Ton Aluminum Scope 1-2-3 Emissions



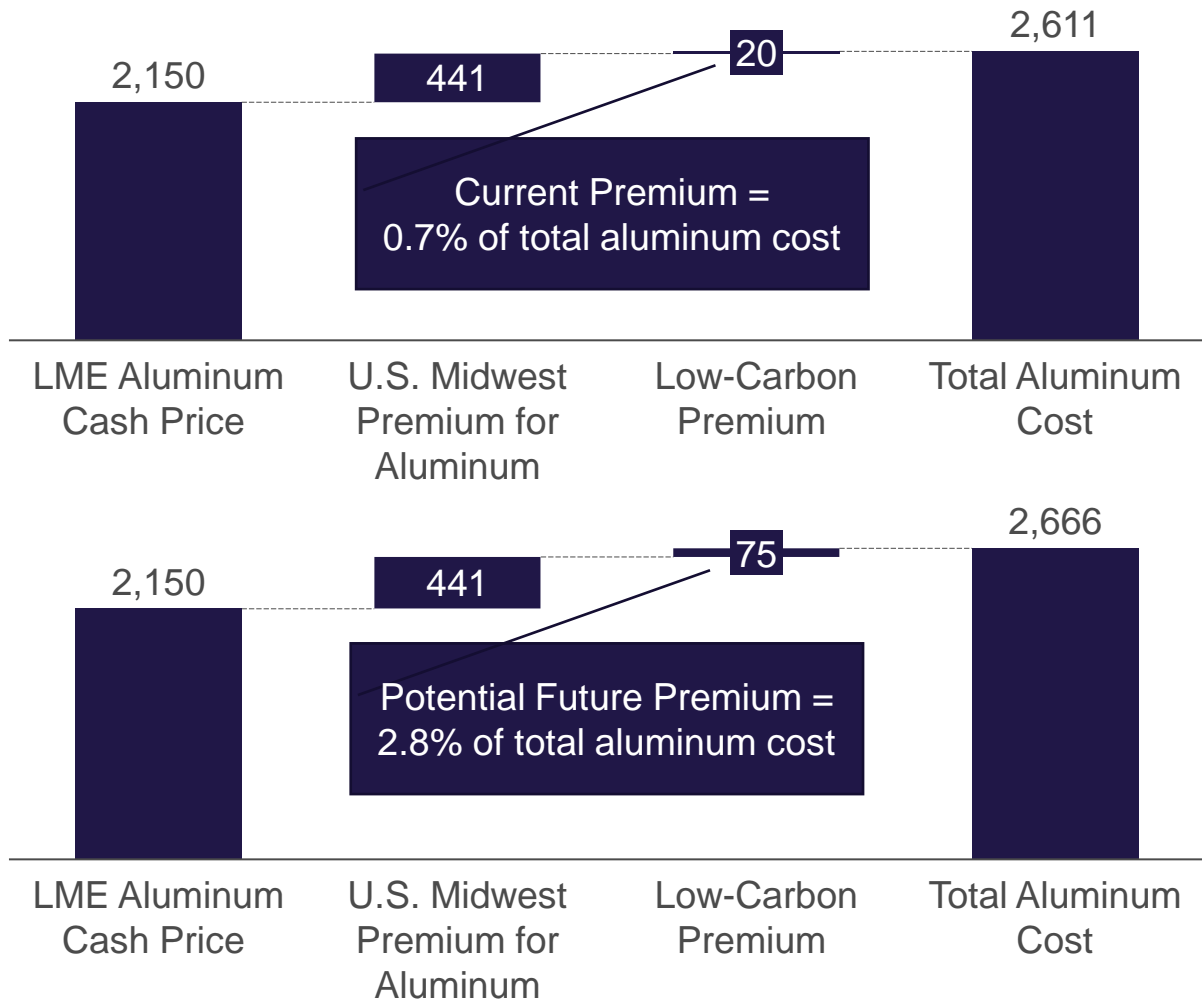
# Low carbon growth invites Canadian expansion *with or without* Russia

Global Primary Low Carbon (<4.00 CO<sub>2</sub>) Balance at Modeled Rate of Adoption  
In 000 mt



# Low-carbon premium is a small price to help offset climate change

Prices as of October 25, 2022, in USD per mt



Rogers Place Edmonton AB  
 (Built 2016 , CA\$ 480m LEED Silver Certified)  
 City of Edmonton Applied **9.5% Ticket Surcharge**  
 Covering CA\$125m Share of Costs



Is Connor McDavid worth more than the Earth ?



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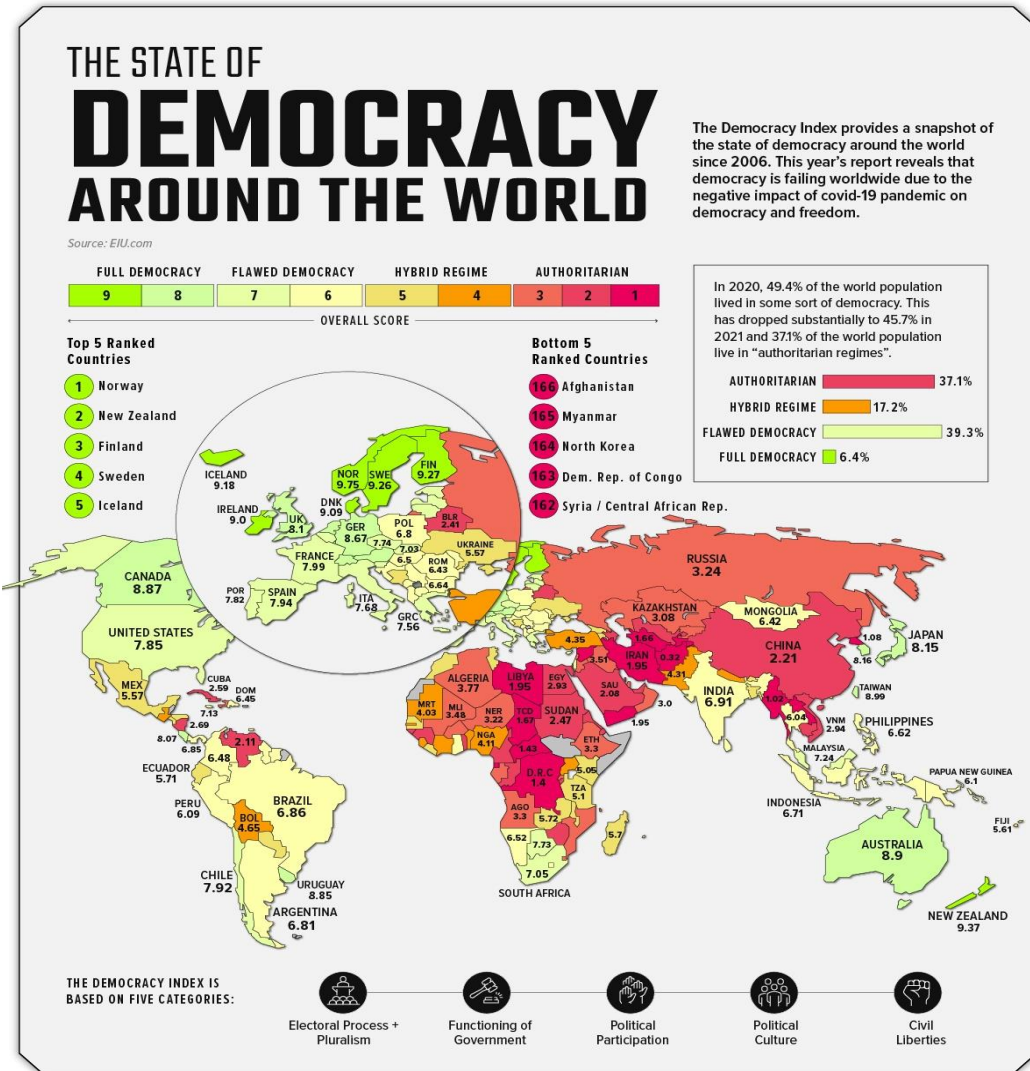


# Canada as “the responsible producer of choice as part of “friend-shoring”



- Russian situation underscores importance of democratic principles properly weighted in a decision-making process of responsibly sourced aluminum
- Companies are self sanctioning Russia metal becomes they DO value the total package that aligns with their ESG values
- Canada has few peers into this regard
- Supply chain problems persist, on-shoring is growing and puts more value on proximity of Canada to US , Mexico and EU27 markets
- EU energy crisis won't be solved for long time, Canadian metal must bridge gaps in compromised EU production , shrinking US footprint and reduced Russian role

# Production size & low carbon: not enough to be a “responsible producer”

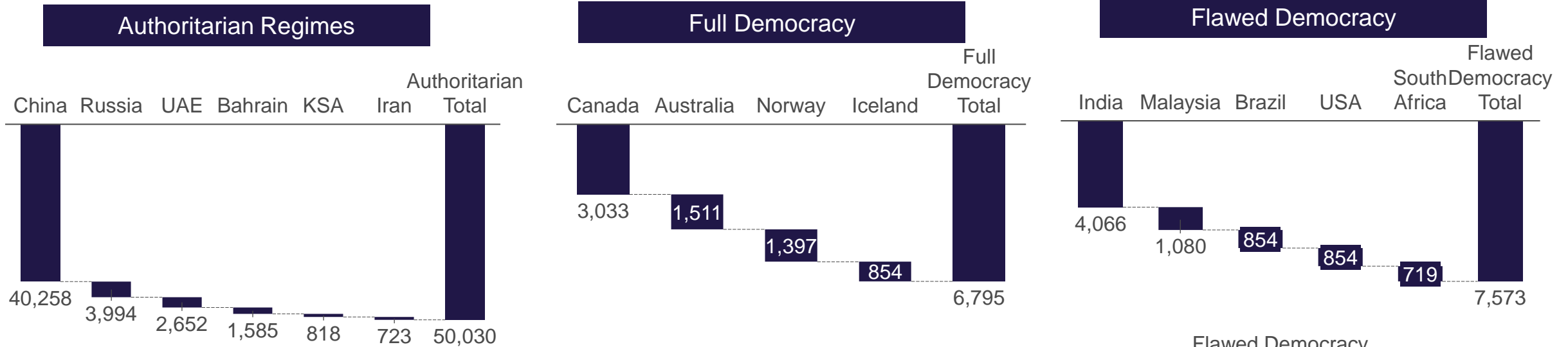


Category (Democracy Score)	Countries	Share of Countries	Share of World Population
Full Democracy (8-9)	21	12.6%	6.4%
Flawed Democracy (6-7)	53	31.7%	39.3%
Hybrid Regimes (4-5)	34	20.4%	17.2%
Authoritarian Regime (3>)	59	35.3%	37.1%

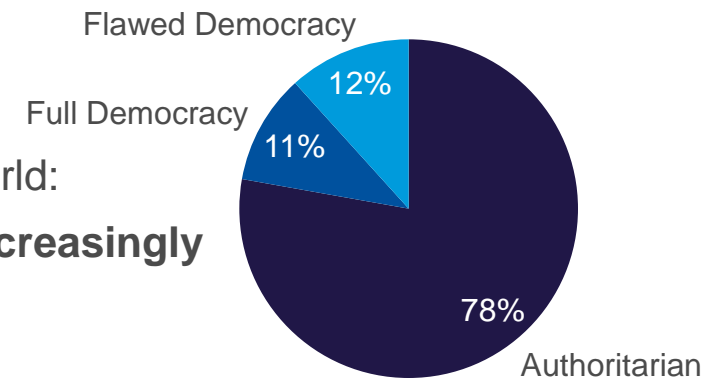
Country	Aluminum Production	Carbon Intensity	Supply Chain Surety	Democracy Score
China	40258	13.5	1	2.21
India	4066	16.78	3	6.91
Russia	3994	2.64	1	3.24
Canada	3033	2.13	5	8.87
UAE	2652	7.06	5	2.9
Bahrain	1585	7.5	5	2.52
Australia	1511	13.76	3	8.9
Norway	1397	2.29	5	9.75
Malaysia	1080	2.71	1	7.24
USA	854	9.79	5	7.85
Brazil	854	2.44	3	6.86
Iceland	854	2.04	5	9.18
Saudi Arabia	818	7.3	1	2.08
Iran	723	9.57	1	1.95
South Africa	719	17.27	3	7.05

# Governance amongst leading aluminum producers is disconcerting!

- The choice of responsible suppliers *by responsible buyers* will look much different if buyers weigh governance amongst the top 15 producers of primary aluminum in the World :



- Authoritarian regimes 78% of the total production amongst the top 15 producers in the World:
- Coupled with carbon considerations, it makes the addressable supply for buyers increasingly limited , while highlighting Canada’s unique combination of qualities**



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- **China aims to cap its primary production and rotate toward secondary metal**
- **Russia has lost massive credibility** in market and self-sanctioning will continue to gather momentum
- Without energy policy, the **U.S. primary sector struggles to survive**
- **Europeans crushed by Russian weaponization of gas** and face energy problems throughout 2023
- **China has a massive amount of capacity losing money** and will need to have to deal with this by Q1 2023
- **European demand is very weak, China is stunted** due to zero covid and the US may surprise to upside
- **Market is balanced, but supply-side risks remain as high if not higher than risks to demand**
- **LME is obsessed with demand destruction** and ignoring further risks to supply and Russian sanctions
- **Midwest is trading 8 cents/lb. below import replacement** and that is unsustainable
- **Decarbonization via scrap usage is booming** and obsolete scrap may become a premium item
- **Responsible production more than low cost , low carbon intensity....governance matters> Canada wins**



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