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# NEWS RELEASE

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**Date** 17 June 2021
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## Potash outlook briefing

BHP will be hosting an investor and analyst briefing today on the supply and demand dynamics of potash.

A copy of the presentation is attached.

The presentation, speech and webcast will be available on BHP's website at:
https://www.bhp.com/media-and-insights/news-releases/2021/06/potash-briefing

Further information on BHP can be found at: **bhp.com**

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# Potash outlook and fundamentals 101


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**17 June 2021**

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# Potash: a future facing commodity with attractive long term fundamentals

# Potash fundamentals: key messages

**A future facing commodity with attractive long term fundamentals from multiple angles**

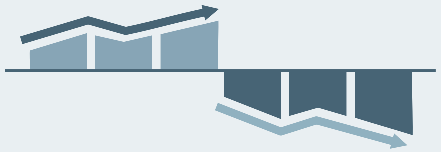
| | |
|---|---|
| **A Future Facing Commodity** | • Potash sits at the **intersection** of **global demographic, social and environmental megatrends**<br>• The **environmental footprint of potash** is **considerably more attractive** than other major chemical fertilisers<br>• Conventional mining with flotation is **more energy and water efficient** than other production routes |
| **Reliable base demand with attractive upside** | • Traditional demand drivers of **population** and **diet** are reliable and slow moving<br>• Attractive upside over basic drivers exists due to the **rising potash intensity-of-use** needed to support **higher yields** and offset **depleting soil fertility**<br>• **On top of the already compelling case,** decarbonisation could amplify demand upside[1] |
| **The industry's 4th wave is underway: demand to catch-up over the course of the 2020s** | • **Demand is catching up** to excess supply, and major **supply basins are mature**<br>• Price formation regime accordingly expected to transition from current SRMC to **durable inducement pricing,** with Canada well placed to meet market growth longer term at LRMC in the mid $300s<br>• Post the balance point, long-run geological and agronomic arguments skew probabilistic risks upwards (LRMC plus fly-up) rather than downwards (SRMC), in our view |

Note: Short Run Marginal Cost (SRMC); Long Run Marginal Cost (LRMC).
1. Based on BHP's 1.5°C Scenario. Refer to the BHP Climate Change Report 2020 for information about this scenario and its assumptions.

# Potash attractiveness parameters

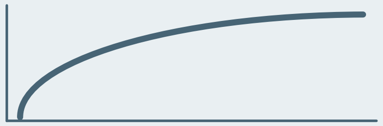
**Transitioning towards inducement pricing as consistent demand uplift absorbs today's excess supply**

## Favourable supply and demand gap



Inducement pricing expected to emerge and sustain once demand growth absorbs current supply excess

## Large market size



~70 Mt today, 89-97Mt in 2035[1]

## Differentiated demand drivers

Considerable differentiation from industrial metals over the course of the development process: no global demand peak in prospect

## Value creation and return potential

Capital intensity of new supply creates steep inducement curve

Operating margins superior in upstream segment

**Thrive in a Paris-aligned world**

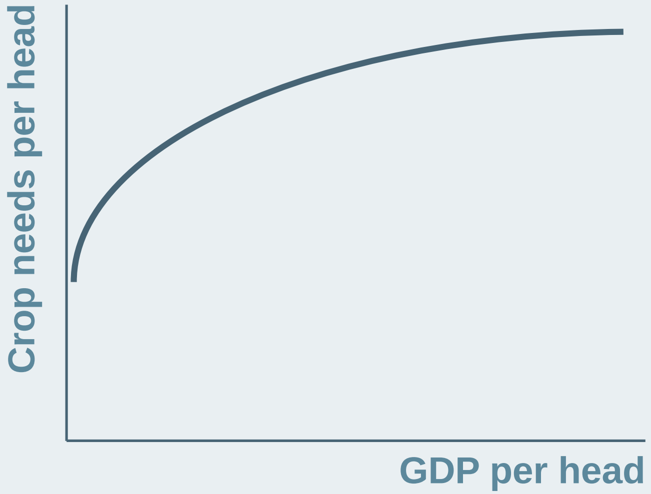
1. The rounded average of Argus, CRU and IHS is ~89 Mt. ~97 Mt is the level implied by Nutrien's 2020s range midpoint of 2.25% extrapolated to 2035.

# Downstream potash drivers highly differentiated

## Diversification in terms of demand drivers vs. our wider portfolio of steel making, non-ferrous and energy commodities

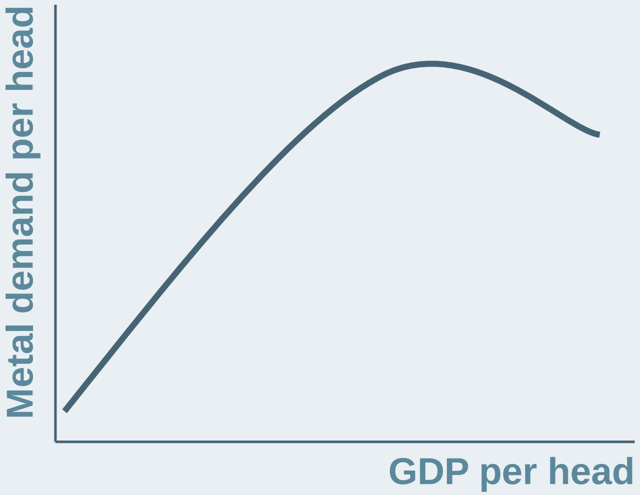
### Fertiliser value chain

- Population growth and dietary change
- Food, feed, fibre, fuel
- Low degree of recycling[1]
- Steady increase in intensity through the entire development journey, high income plateau



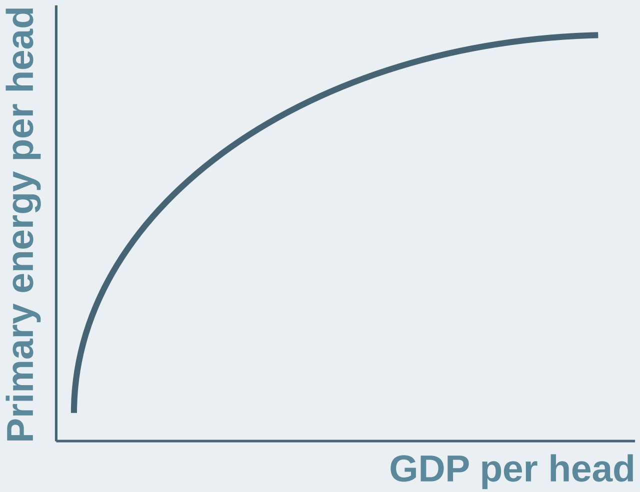

### Metals value chain

- Urbanisation and industrialisation
- Buildings, infrastructure, machinery, appliances
- High degree of recycling
- Swift increase in intensity on the way to middle income, where a distinct peak forms




### Energy value chain

- Motorisation, electrification, industrialisation
- Transport, power, heat, chemicals
- Low degree of recycling[2]
- Swift increase in intensity on the way to middle income, flatter beyond, high income plateau



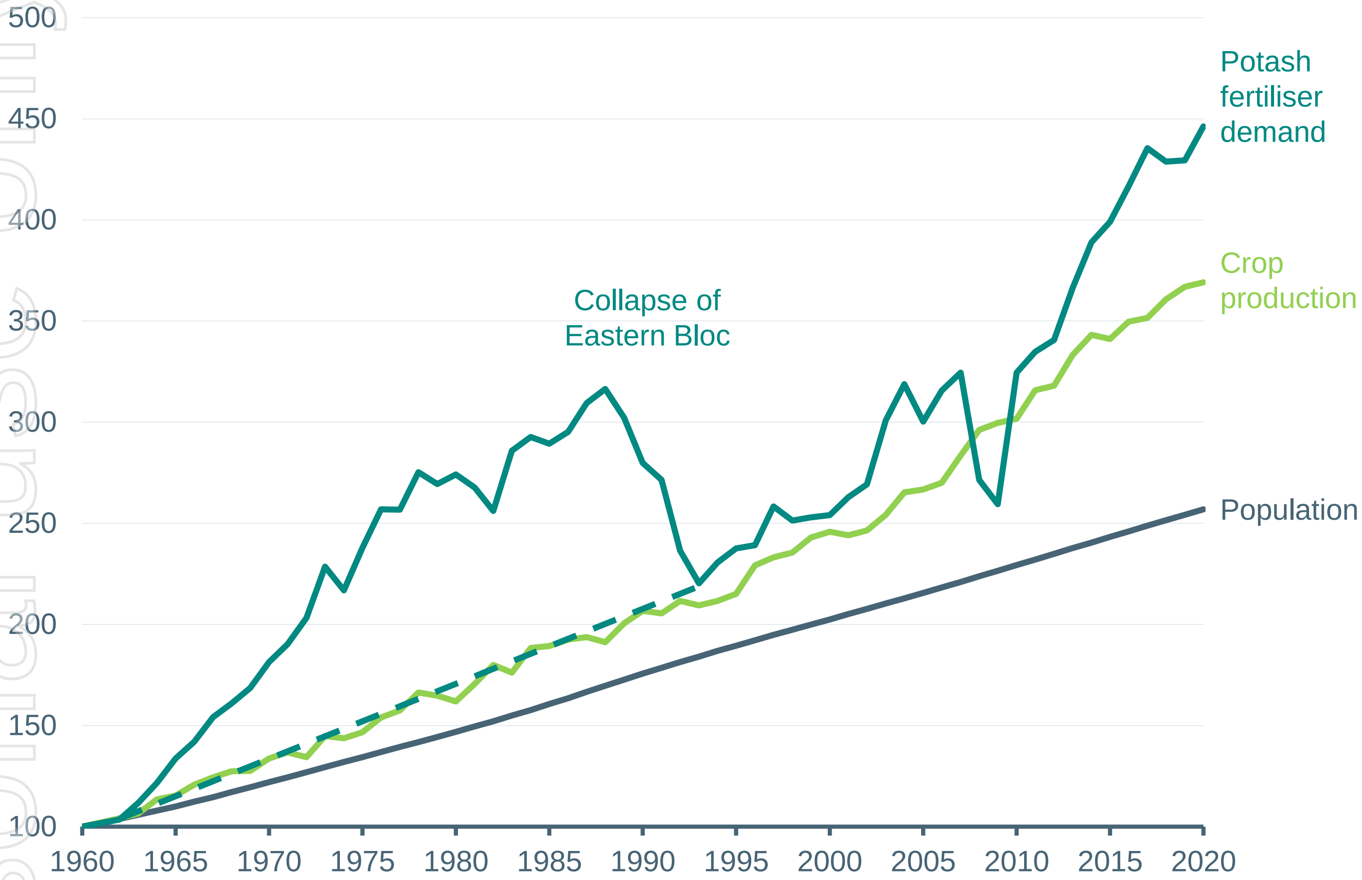

Traditional growth drivers | Major uses by society | Degree of Circularity | Relationship to living standards

Note: Illustrative only, reflecting stylised empirical path of major societies through time that have reached high income levels.
1. Recycling of nutrients via crop residue or manure occurs, but the food value chain is very inefficient and highly subject to waste.
2. Petroleum value chain specifically features plastics recycling, but this is a very small item in the entire value chain (a sub set of a sub set). Carbon capture use and storage (CCUS) expected to increasingly feature in industrial applications.

# Fundamental relationships are extremely reliable

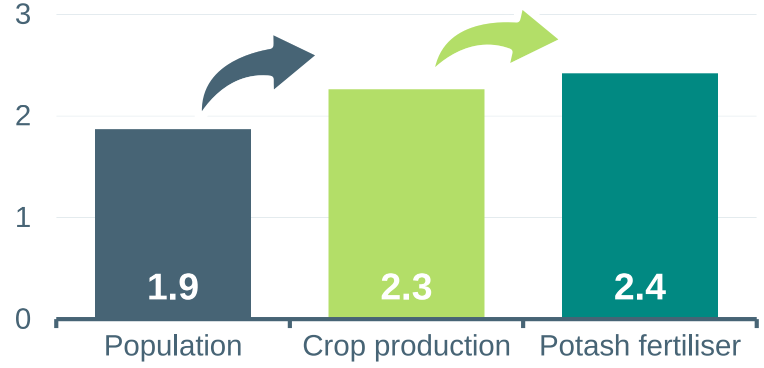
**Crop production growth has exceeded population growth in the long run: potash has in turn exceeded growth in crop production**

**Population up ~2.5 fold since 1960, crops ~3.5 fold, potash ~4.5 fold**
(Index, 1960 = 100)

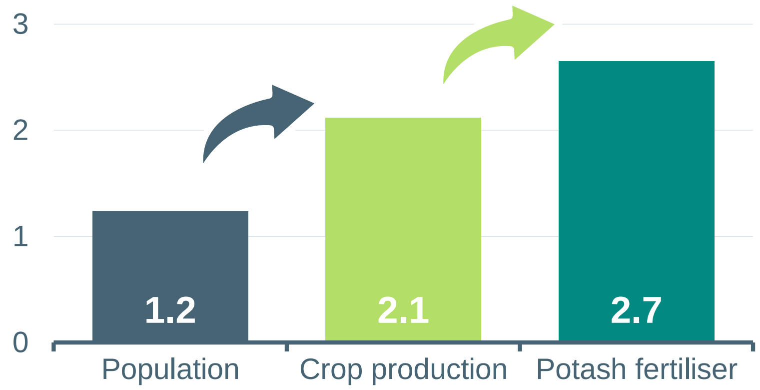



Data: UN World Population Prospects 2019; International Fertilizer Association; BHP analysis based on multiple sources.
Note that ‘potash fertiliser demand’ relates to estimated underlying consumption at the farm-level rather than to upstream MOP shipments.

**CAGR, 1960-1993**
(%)



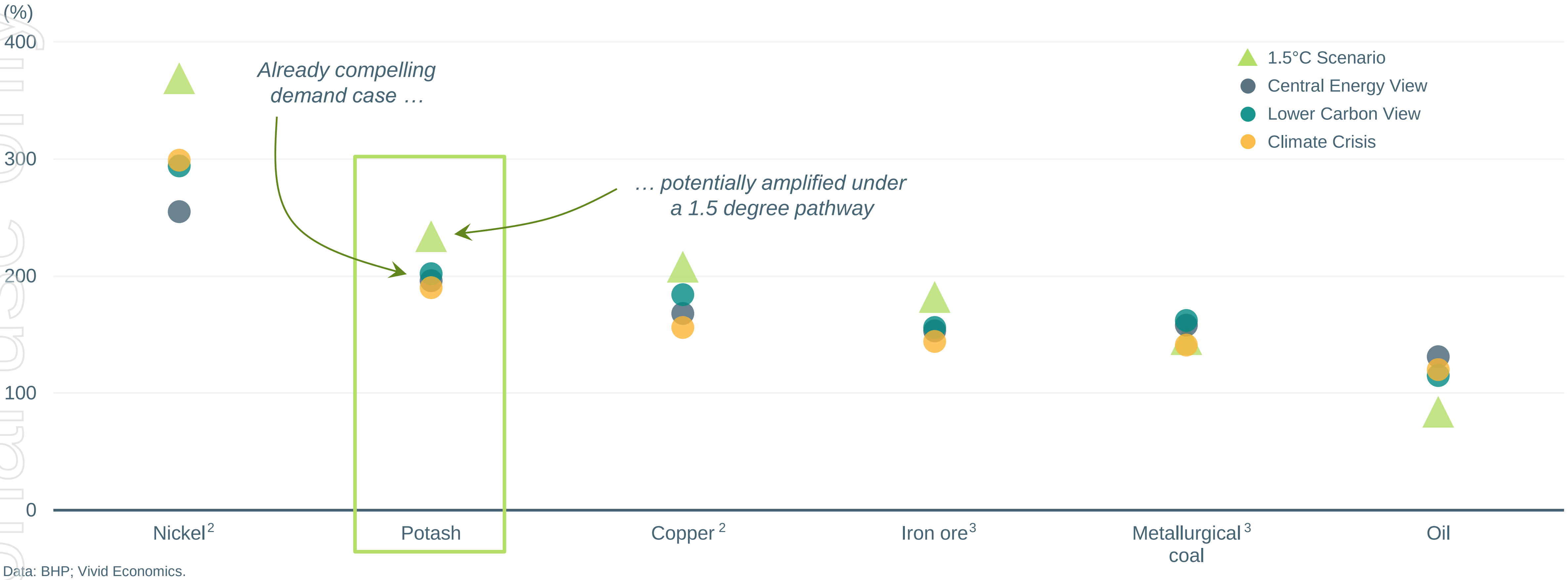

**CAGR, 1993-2020**
(%)



# Potash benefits in a decarbonising world

## Rising biofuels production and land use implications of afforestation burnish an already attractive potash demand profile

**Cumulative demand in the next 30 years compared to the last 30 years[1]**

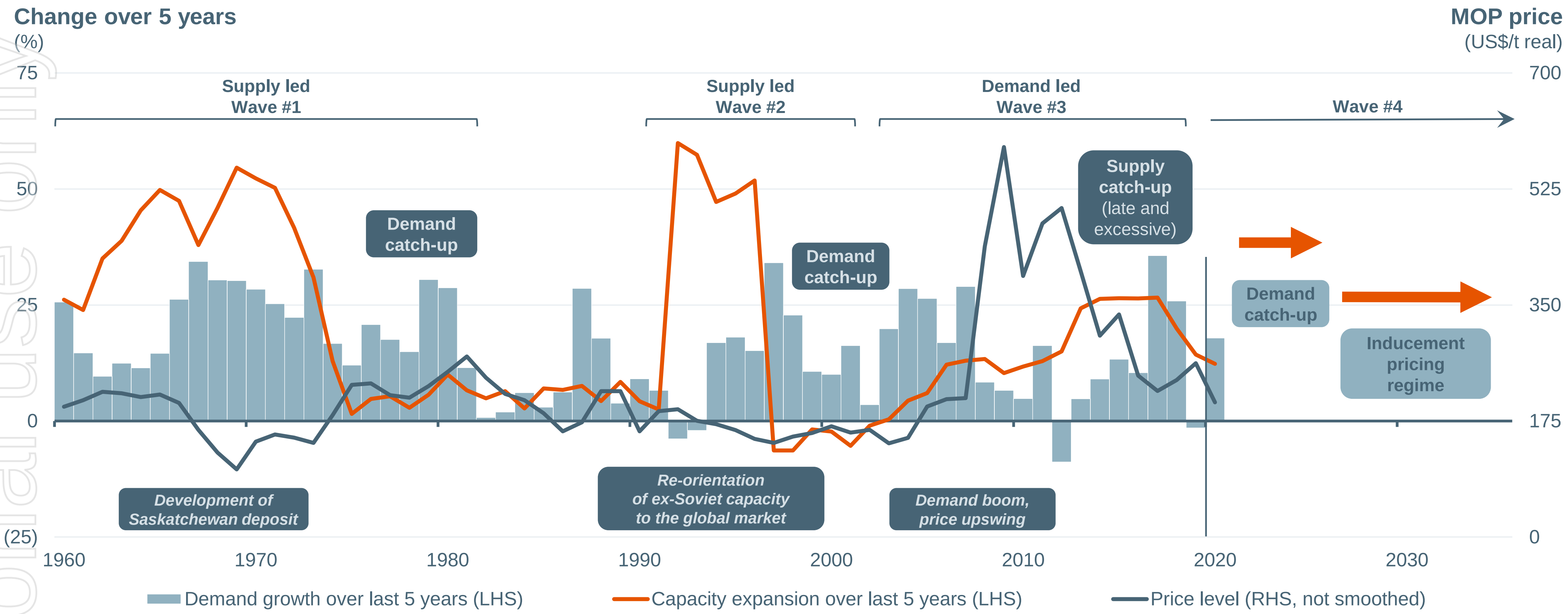



Data: BHP; Vivid Economics.

1. Our portfolio is tested across a range of futures. Refer to the BHP Climate Change Report 2020 for more information about these climate-related scenarios and their assumptions. Scenarios were developed prior to the impacts of the COVID-19 pandemic, and therefore any possible effects of the pandemic were not considered in the modelling.
2. Nickel and copper demand references primary metal.
3. Iron ore and metallurgical coal demand based on Contestable Market (Global seaborne market plus Chinese domestic demand).

# The waves that have defined the potash industry

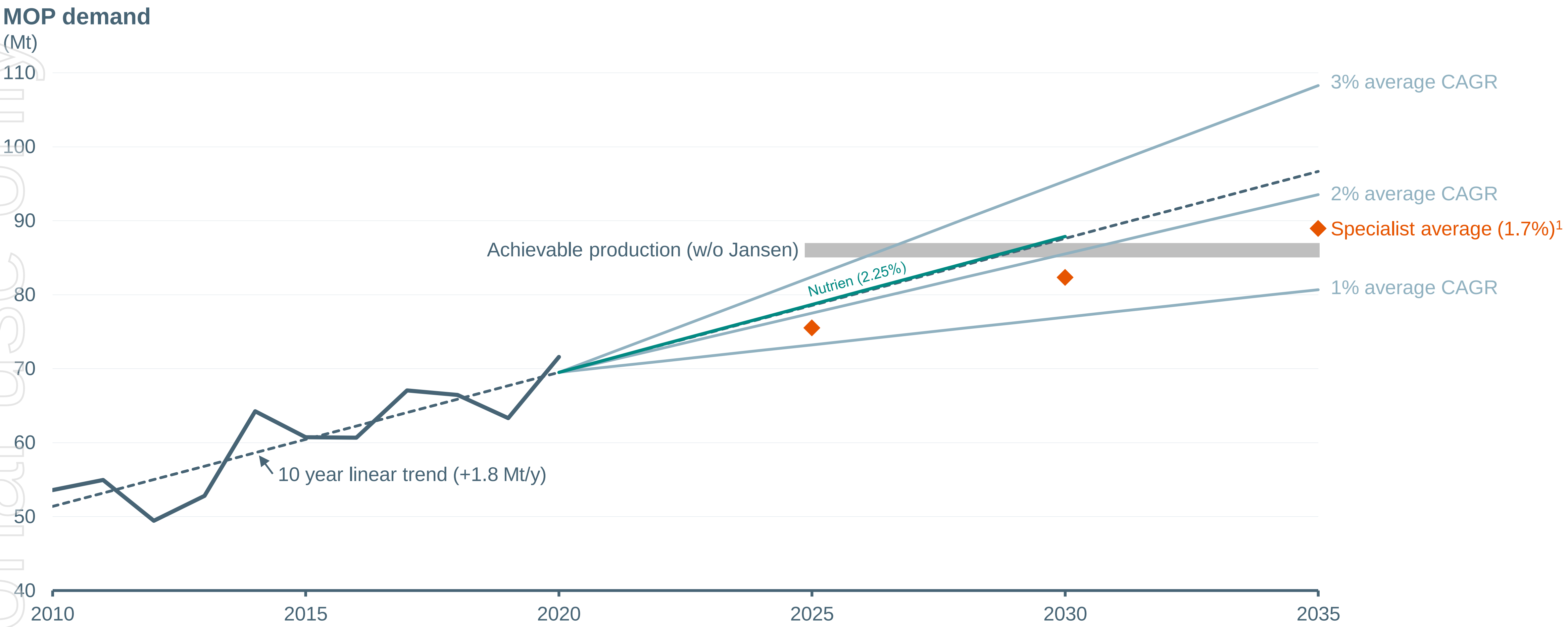
**A 4th wave is underway, with demand in catch-up mode. Once it does, an inducement pricing regime is the most likely outcome**




Data: BHP analysis based on multiple sources
Note: New supply from FSU is shown in 1990s when existing supply was re-directed from domestic and Eastern Bloc markets after local demand collapsed. Eastern Bloc demand excluded until 1992. 2009 demand excluded.

# How soon will demand catch-up in Wave #4?

## Consensus view is that demand will catch-up in the late 2020s/early 2030s

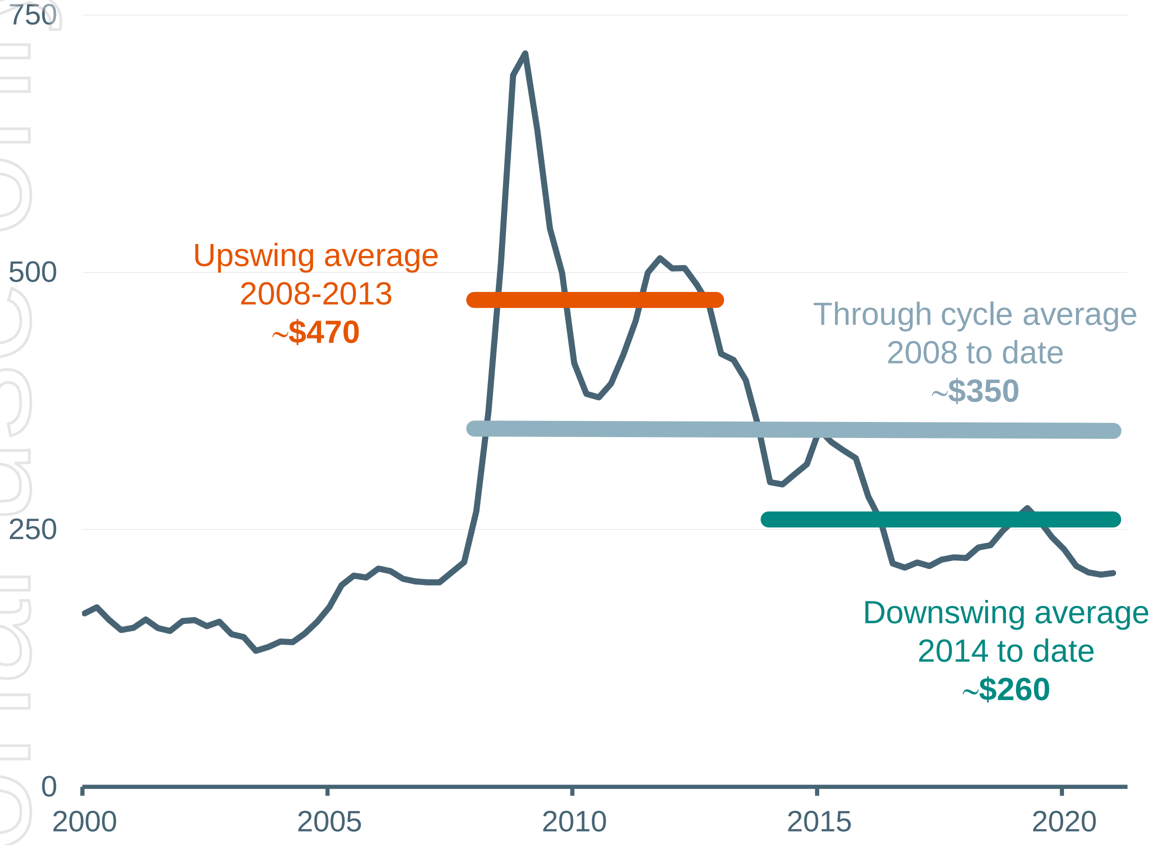



Historical data: CRU. Nutrien range of 2.0% to 2.5% in the 2020s as disclosed in 2021 Q1 earnings call. Achievable production is BHP analysis based on multiple sources.
Note that the chart shows linear interpolations that result in the same 2020-2035 aggregate tonnage increment as the stated CAGRs.
1. Specialist average based on CRU, Argus, Fertecon (IHS Markit). 2020-2035 CAGR calculated relative to trend level in 2020 (69.5 Mt) not to actual level estimated by CRU (71.6 Mt).

# What can be expected under inducement & fly-up pricing?

**Forward looking LRMC is broadly in line with through-cycle averages, considerably above SRMC experience of the last few years**

**MOP price**
(US$/t real)




Indicative of multi-year "fly-up" pricing should a strong demand-led cycle emerge with a delayed supply response from ageing basins

Long-run marginal cost (LRMC)
*at mid case macro assumptions[1]*

Short-run marginal cost (SRMC)
*across a range of macro assumptions[1]*

Data: IHS Markit. Average trade value of Canadian MOP exports.
1. Macro assumptions include items such as FX rates, energy costs, carbon and labour. Shaded boxes are the approximate price range associated with the operating conditions described therein.

# Inducing solution mining will provide tilt to the cost curve

**SRMC significantly higher than conventional flotation, forward looking LRMC for Canadian solution mining is mid-$300/t**

## Operating cost curve
### SRMC conditions

Solution mines use significantly **more energy** and **more water** than conventional mines. Sustaining capex is also higher

This comes at a material **operational cost disadvantage** that is expected to amplify under rising carbon pricing

- The lowest cost mines[1] (~US$100/t FOB), and the vast majority of mines in Q1 of the operating- cost curve, are large scale conventional operations
- Operating solution mines in Canada[1] are currently in the range of US$180-$210/t (FOB)

## Inducement cost curve
### LRMC conditions

The **inducement curve is steep** due to the underlying capital intensity of projects

Solution mining in Canada is expected to **set the industry LRMC**

- Other candidates are too small, or disparate, to serve as an effective “bench” to anchor long run trend pricing
- This solution mining bench is still “available” because conventional opportunities, with their favourable operating costs, have been rightly prioritised for development
- In bulk mining, **you do not save the best for last**
- We estimate a trend price in the mid-US$300/t region will be required to induce a material portion of this Canadian bench into production

1. Source: CRU.

Note: Long Run Marginal Cost (LRMC); Short Run Marginal Cost (SRMC).

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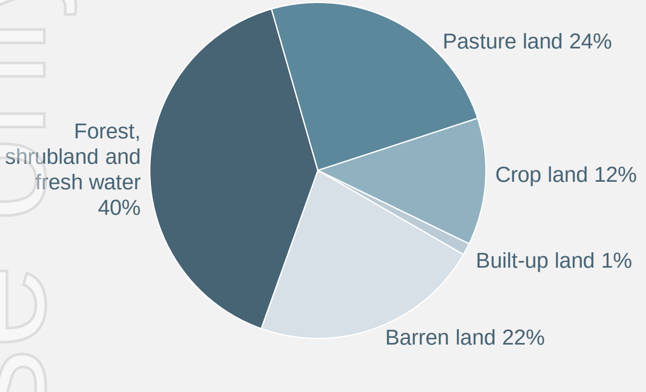
# Fertiliser and the global food supply chain

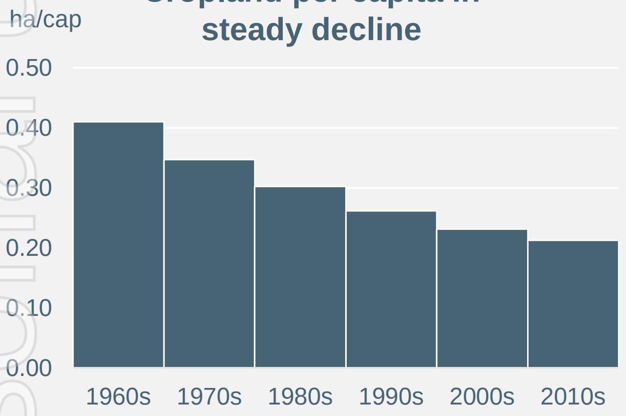
# Crop yields hold the key to future food security

**Impressive gains in yields have offset declining cropland per head since the 1960s, but there remain major yield gaps between regions that could narrow with better farm practice, including scientific fertiliser application**

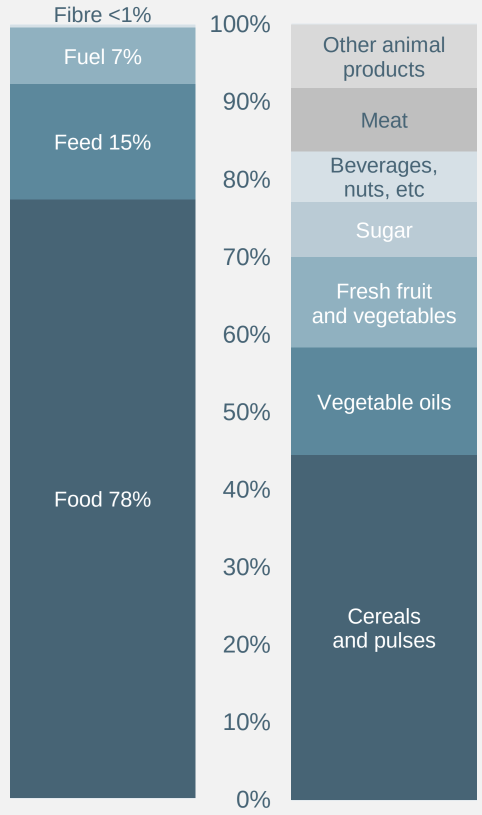
### Competition for global land use



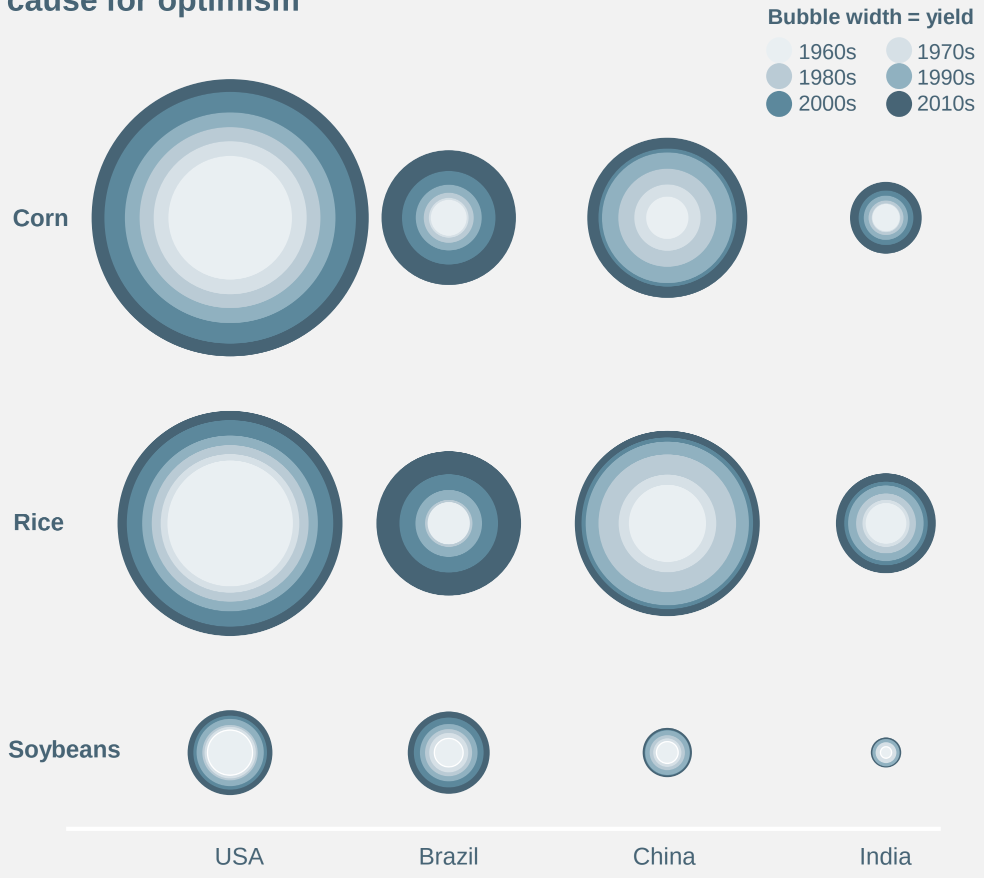

### Cropland per capita in steady decline




### Global crop use[3] / Global dietary profile[1]




### Crop yields: large gaps between the frontier and the rest is cause for optimism




Data: UN FAO, IHS Markit; BHP analysis based on multiple sources.

# What governs crop yields?

**Potassium availability is just one of a complex web of interacting factors that impact crop yield**

## Potential yield

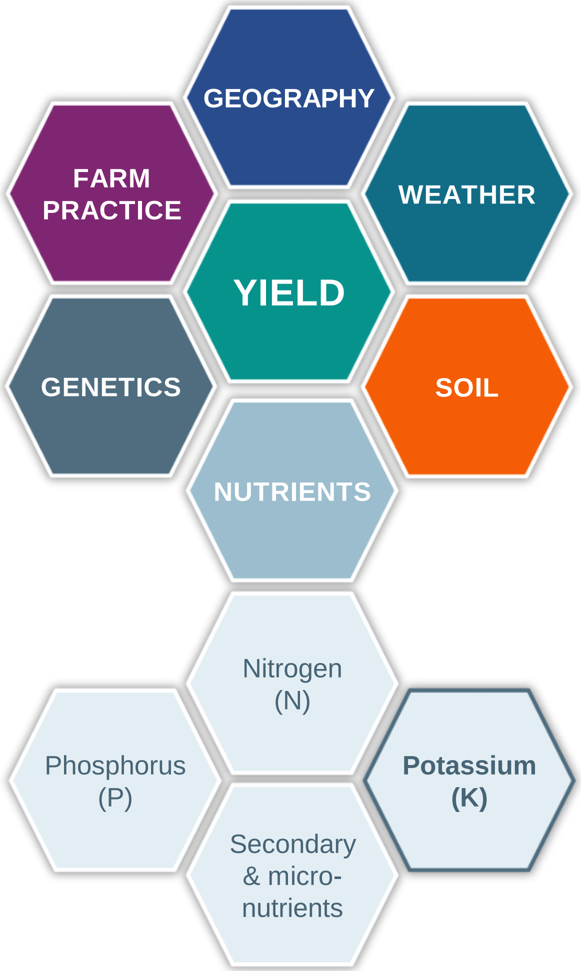
Determined by genetics

## Attainable yield

Limited by external factors – aspects of climate, soil type and geography

## Achieved yield

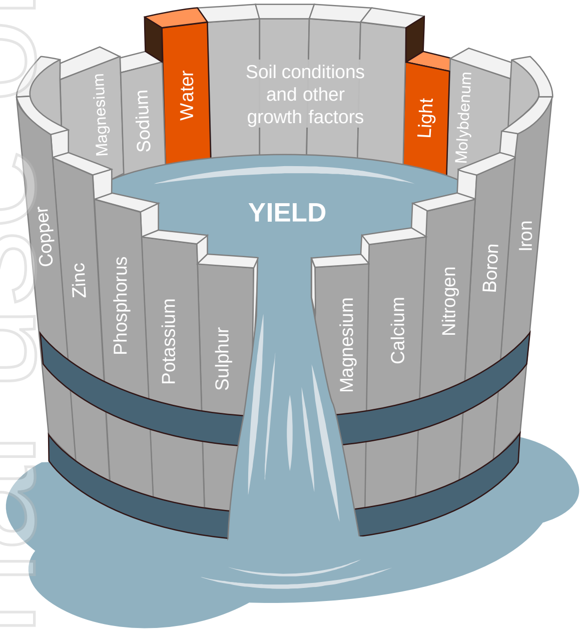
Dependent on farm practice to optimise availability of water and nutrients, to minimise the impact of pests, disease and bad weather, and to condition the soil



# Why do plants need potassium?

**Potassium works as a chemical regulator – adequate potassium is needed for healthy growth**

## Liebig's Law of the Minimum




Potassium availability is one of dozens of factors that influence crop yields

Any one of these factors may be yield-limiting

If potassium availability isn't yield-limiting then applying more won't have any effect on yield

Identifying existing or approaching yield limitations, including potassium, is critical in closing the gap to Attainable Yield


**Building block**
Potassium is found in cells throughout a plant; It regulates critical processes including photosynthesis, enzyme activation and temperature control

**Drought tolerance**
Potassium plays a major role in the transport of water, and in the uptake of other nutrients

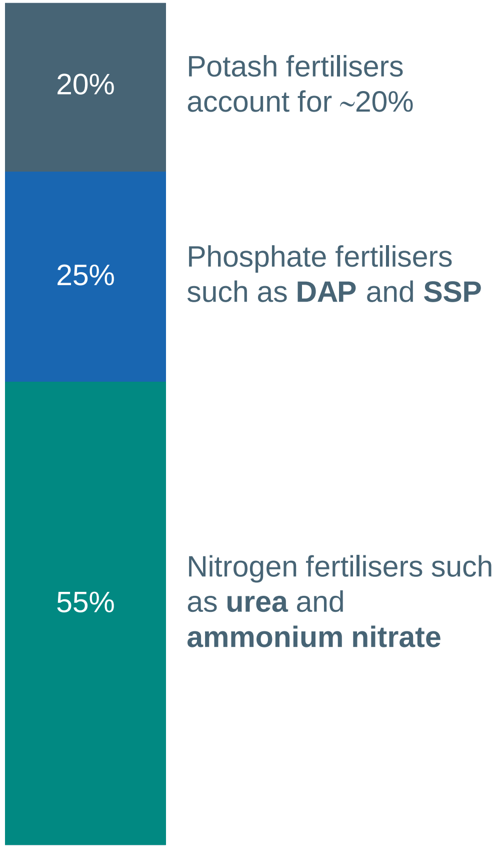
**The 'quality nutrient'**
Potassium can improve appearance, taste, shelf life and nutritive value

# What is fertiliser?

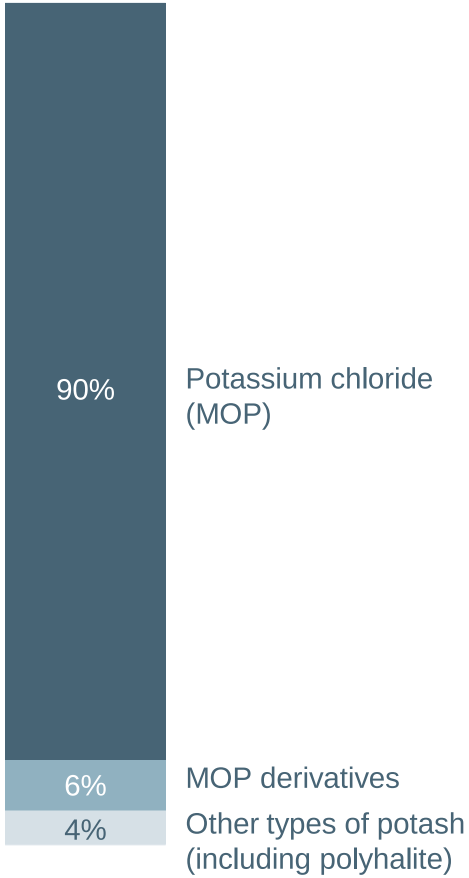
**Fertilisers are materials that contain essential nutrients that are the "building blocks" of plants**

- The primary nutrients are nitrogen (N), phosphorus (P) and potassium (K) but many other nutrients are also needed
- Different nutrients perform different functions in plants and are not substitutable
- Plants can draw on native potassium in the soil, but farmers commonly provide additional nutrients by spreading potash fertiliser and/or organic material like animal manure

**Consumption of primary nutrients via inorganic fertilisers**




**Consumption of potash fertiliser in different forms**




**Potassium chloride (MOP) is the most common type of potash fertiliser**

### Purity ($KCl$ / $K_2O$)

| | |
|---|---|
| Agricultural: | min 95% KCl (60% $K_2O$) |
| Technical: | min 98% KCl |
| Pharmaceutical: | 99.9% KCl |

### Particle size

| | |
|---|---|
| Fine: | ~ 0.2 - 0.5mm |
| Standard: | ~ 0.5 - 1mm |
| Coarse: | ~ 2 - 3mm |
| Granular: | ~ 3 - 4mm |

### Colour

Red
White

Data: BHP; IFA.



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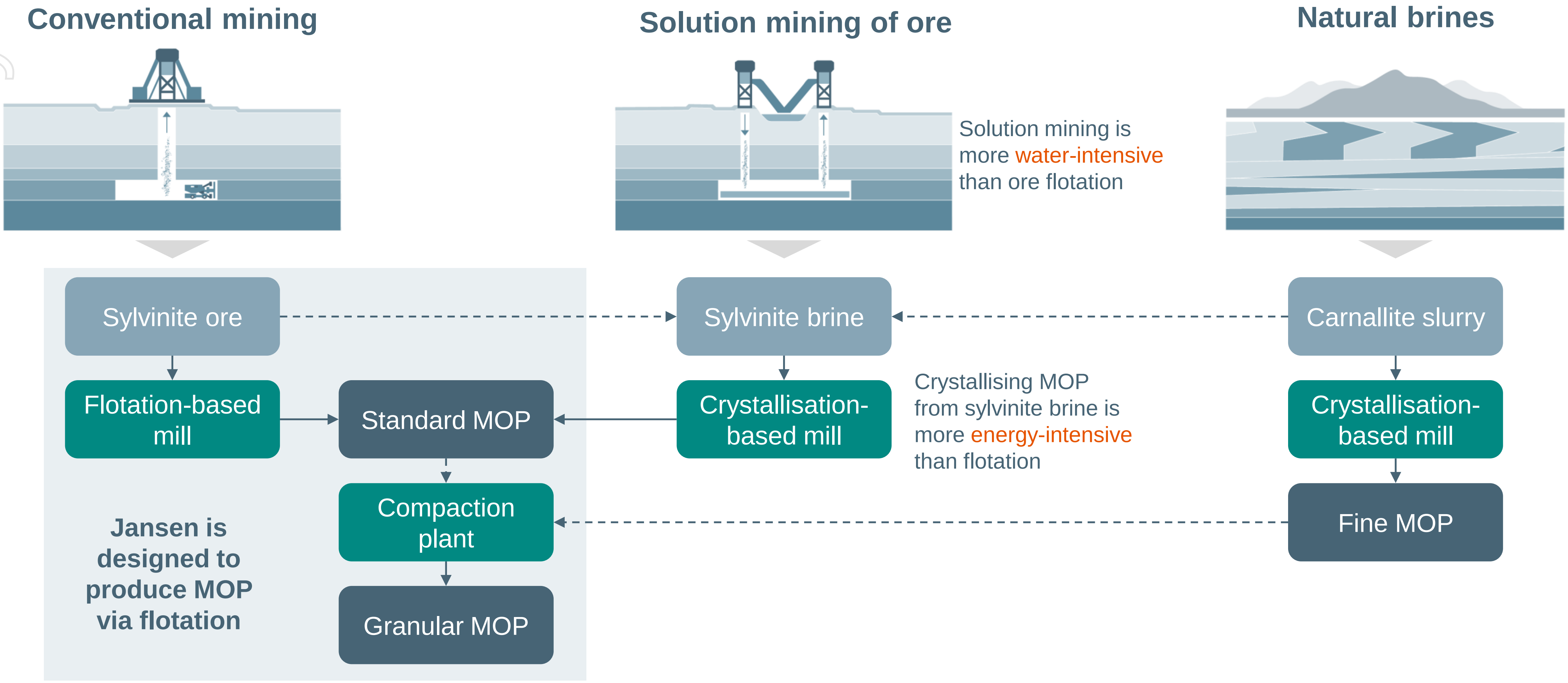
# Most potash operations fall into three basic types

**MOP is extracted from underground ore deposits or recovered from natural brines**



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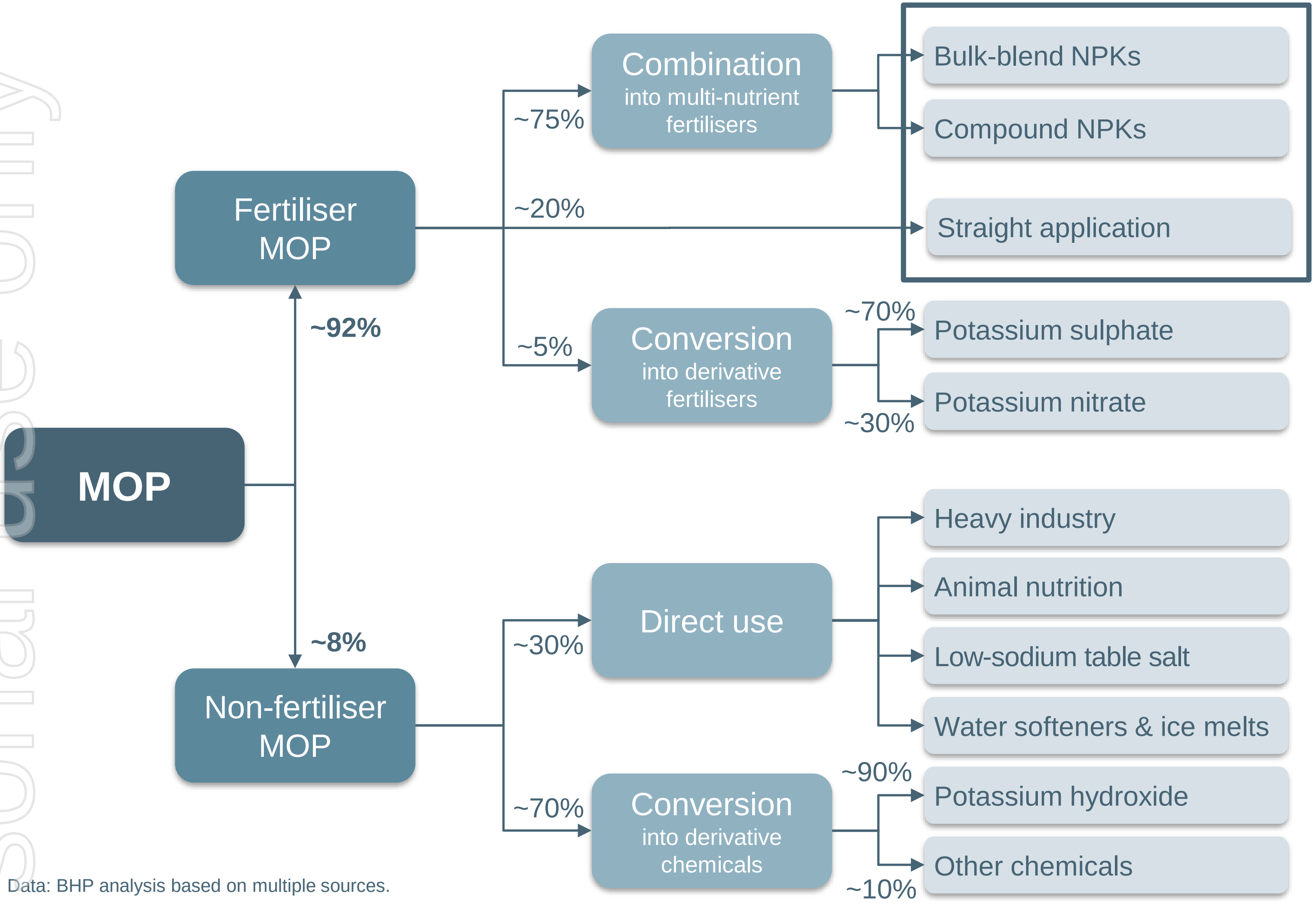
# How is MOP used?

## Most MOP is used as fertiliser, often in combination with other nutrients

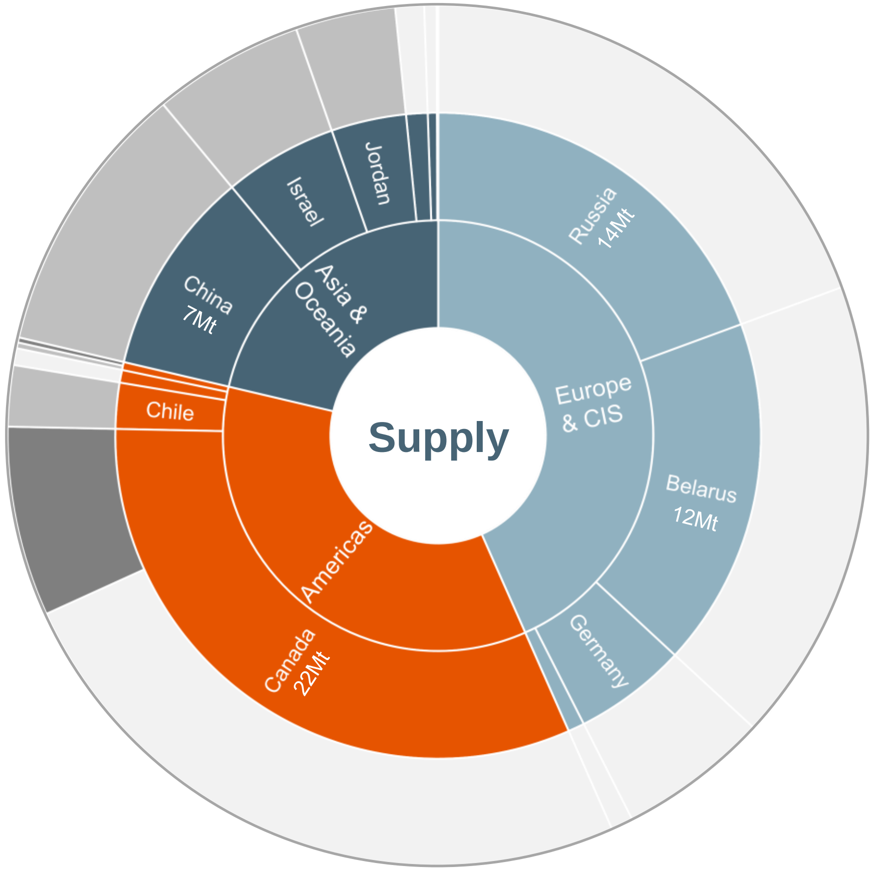


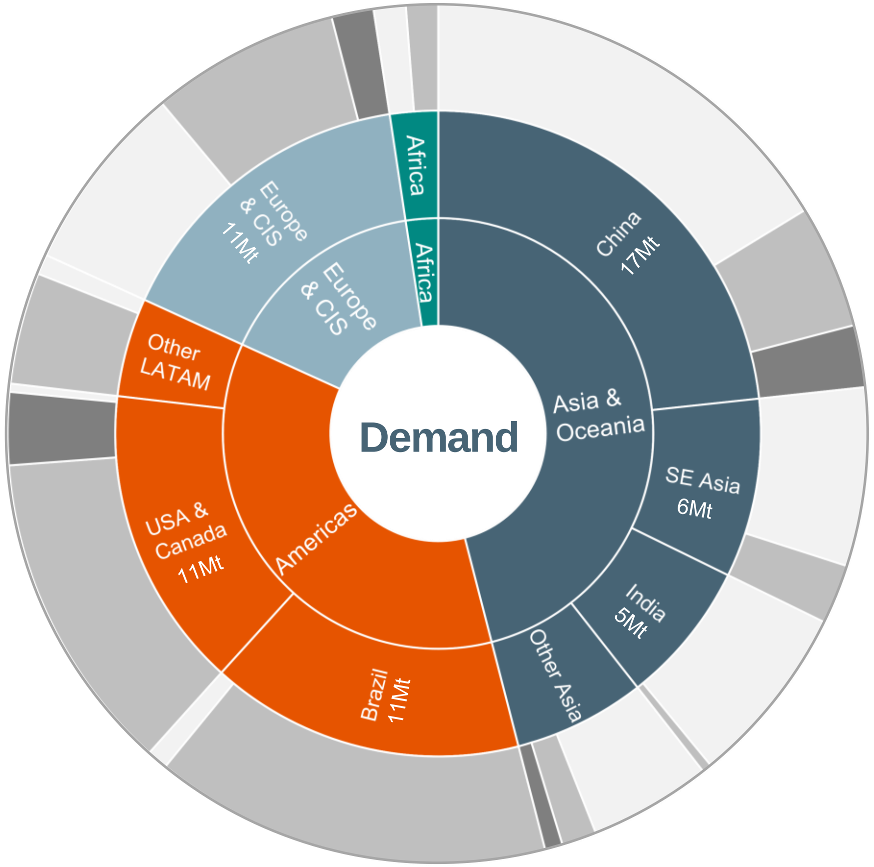

**Jansen product is suitable for straight application or combination into multi-nutrient fertilisers (NPKs)**

Data: BHP analysis based on multiple sources.

# Geography of supply and demand

**Production concentrated in Canada, Russia and Belarus; Biggest consumers China, Brazil, United States and India**



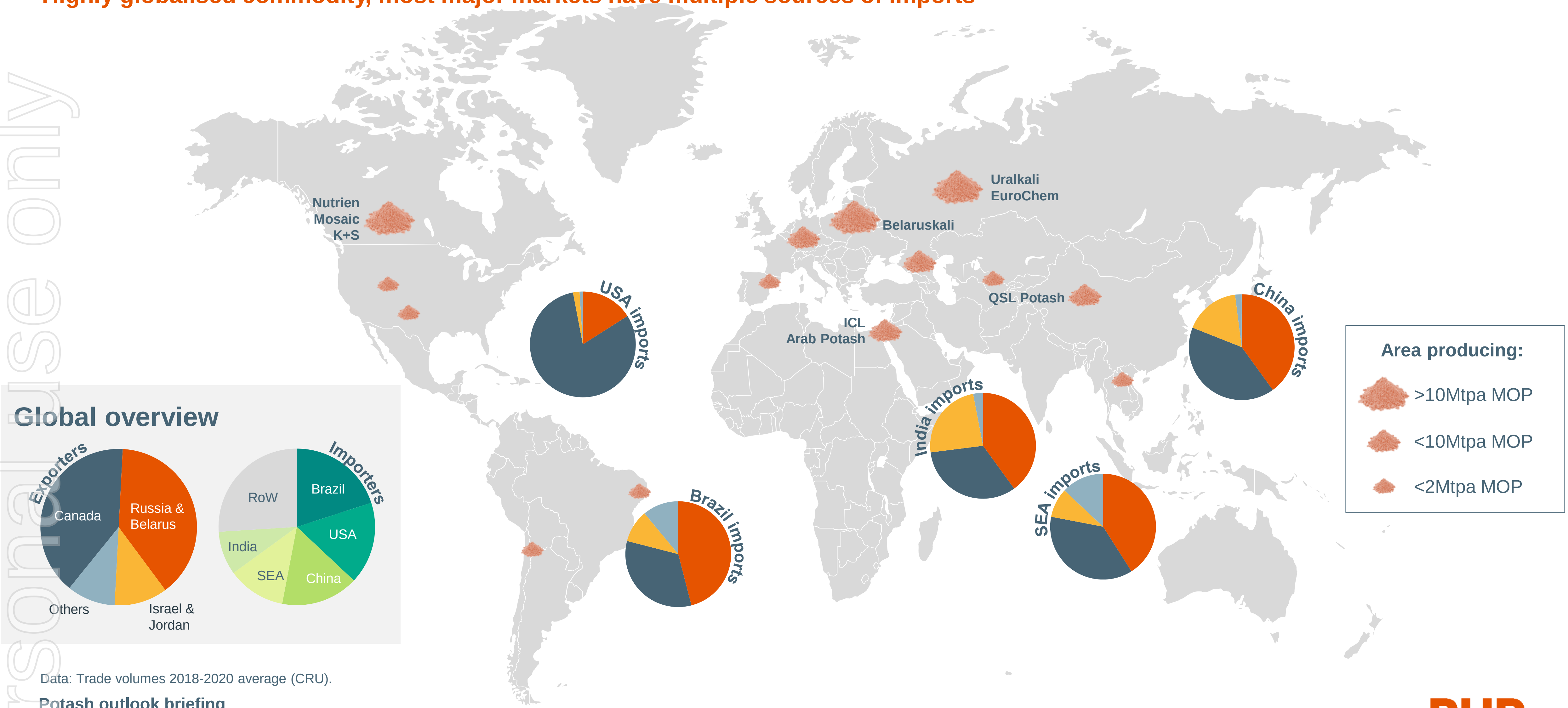

Conventional mining (~70%) Surface brines (~25%) Solution mining (~5%)

Standard/fine (~45%) Granular (~45%) Industrial (~10%)

Data: BHP analysis based on multiple sources.
Note: 2020, 70 Mt MOP production, 72 Mt MOP sales (CRU). Split by grade is approximate.

# Major producers and trade flows

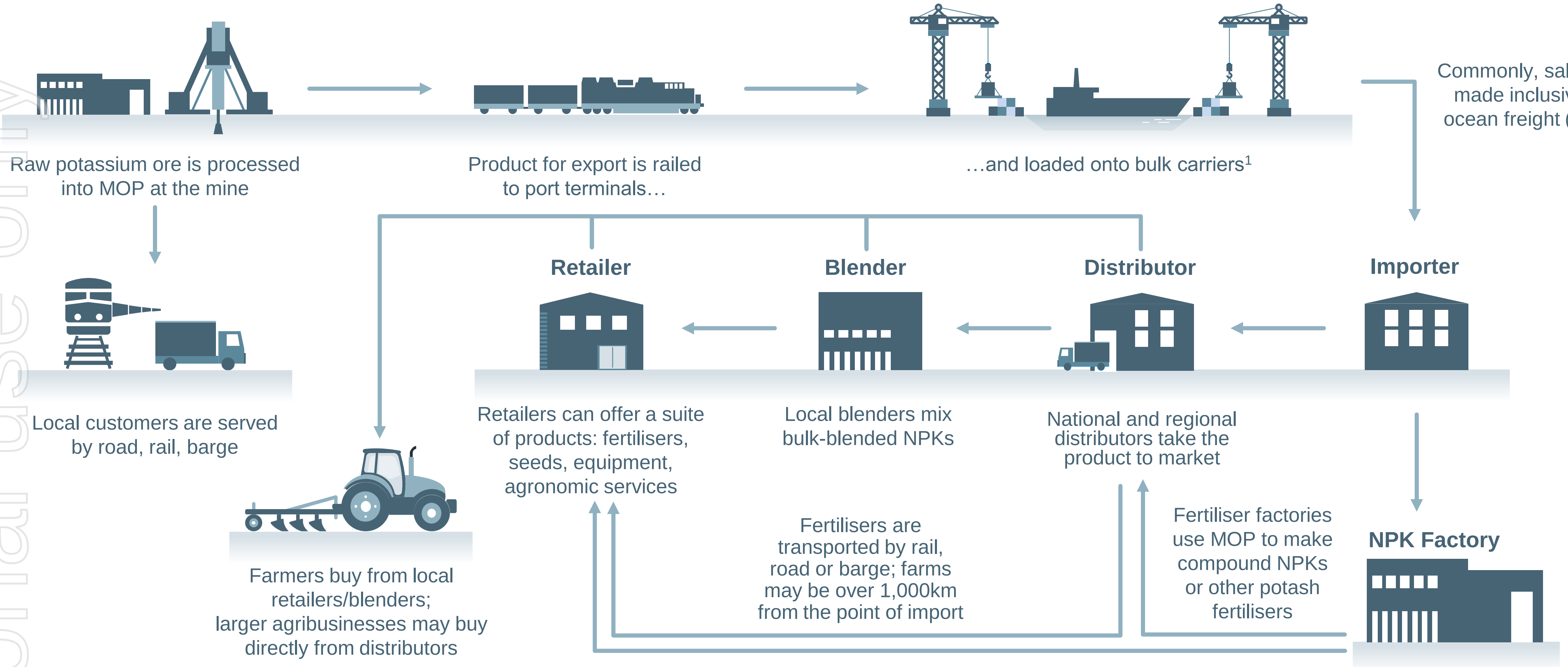
**Highly globalised commodity, most major markets have multiple sources of imports**




Data: Trade volumes 2018-2020 average (CRU).

# Potash supply chain

## Supply chains are long with several steps even in-market




**Jansen product will be sold both onshore and offshore into upstream supply chain**

1. MOP is commonly shipped in Handysize, Handymax, Supramax or Panamax vessels (20,000-80,000dwt).

# Potash: a low emission, biosphere friendly fertiliser

**MOP is a critical nutrient with a modest environmental footprint, with conventional flotation route advantaged over solution mining**

| | MOP (flotation-based) | MOP (solution mining) | Nitrogen fertilisers | Phosphate fertilisers |
|---|---|---|---|---|
| **Production footprint** | | | | |
| Low Scope 1+2 emissions (<100kg $CO_2$e/t) | ✓ | ✗ | ✗ | ✗ |
| Low water consumption (<1t/t) | ✓ | ✗ | ✗ | ✗ |
| **Consumption footprint** | | | | |
| High nutrient content, minimises relative transportation emissions | ✓ | ✓ | ●[1] | ●[1] |
| No energy-intensive downstream processing required | ✓ | ✓ | ✓ | ✓ |
| No $N_2O/CO_2$ release upon use[2] | ✓ | ✓ | ✗ | ✓[3] |
| No risk to waterways | ✓ | ✓ | ✗ | ✗ |
| Enables higher crop yields, reducing need to cultivate virgin land[4] | ✓ | ✓ | ✓ | ✓ |

1. Varies for different fertilisers.
2. Nitrogen fertiliser use releases $N_2O$ directly via leaching/volatilisation and indirectly through microbial denitrification. This contributes 10% of $CO_2$-equivalent emissions from the global food system.[5]
3. Some common phosphate fertilisers also contain nitrogen, which generates $N_2O$ upon use.
4. Land-use and land-use change (LULUC), mainly in the form of deforestation, contributes 32% of $CO_2$-equivalent emissions from the global food system and 11% of all anthropogenic emissions.[5]
5. Crippa, M., Solazzo, E., Guizzardi, D. et al. *Food systems are responsible for a third of global anthropogenic GHG emissions*. Nat Food 2, 198–209 (2021). https://doi.org/10.1038/s43016-021-00225-9.

# Pricing realisation calculation

**Prices are influenced by grade and volume, but there are also (fluid) variations between prices in different regions**

**Selling price**
Brazil CFR
China CFR
US FOB w/house

- Most sales are made on a delivered basis
- Sales may be spot or contract
- Transacted prices are monitored by specialist price-discovery services
- Prices vary by product (e.g. standard/granular)

–

**Discounts**

- Sellers may offer volume-based discounts, conditional rebates or extended credit

–

**Seaborne freight**

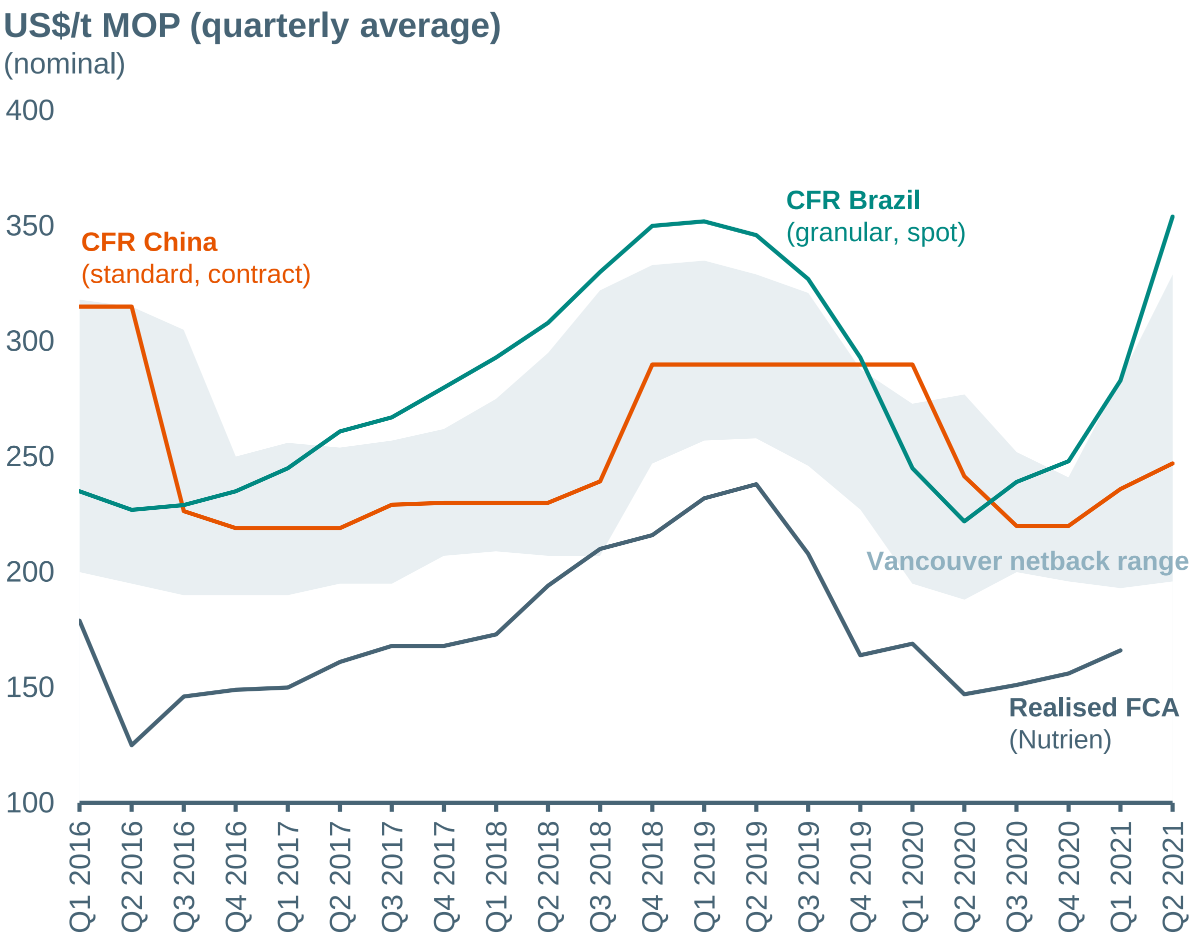
- For CFR sales, sellers arrange ocean freight either using spot or long-term charter

–

**Port costs and inland freight**

=

**Realised price FOB mine**




There is no single "potash price": for example, this chart shows a 5-yr history of Nutrien's realised price (FCA, offshore sales only) against benchmarks reported by CRU *Fertilizer Week*

Data: CRU *Fertilizer Week*; Nutrien.

BHP

# The outlook for potash

# Demand drivers: from demographics to fertiliser demand

## Forecasting long-term MOP demand is a 3-step process

**Socio-economic drivers** → **Crop production** → **Potash fertiliser demand** → **Potassium chloride demand**

### Step 1

From **population** and **income** to **crop production**

- How much do people eat?
- Which crops are needed to meet that requirement?
- Where are those crops grown?
- What about crops for fuel and fibre?

### Step 2

From **crop production** to **potash fertiliser**

- How much potassium nutrient do crops take up?
- Where does that nutrient come from?
  - ✓ Potash fertilisers
  - ✓ Nutrient recycling
  - ✓ Native potassium
- How much nutrient is lost in-situ?

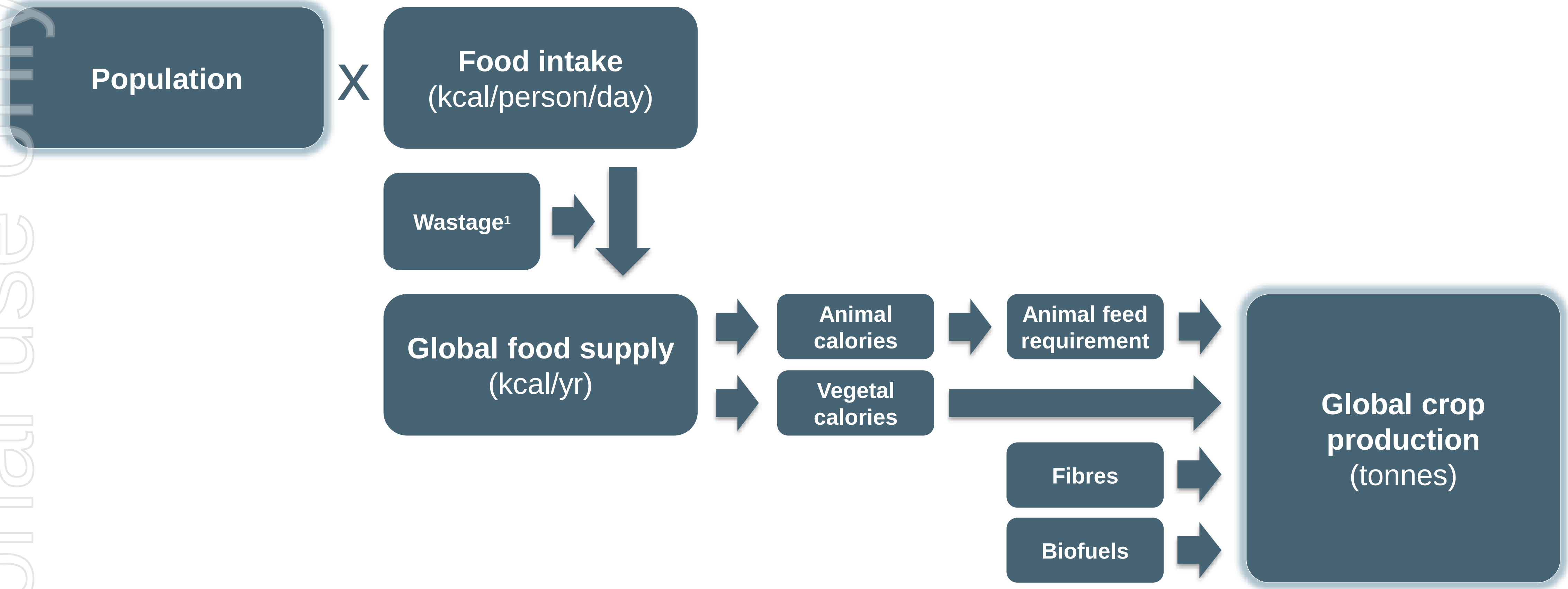
### Step 3

From **potash fertiliser** to **potassium chloride**

- How much potash fertiliser comes from other primary sources?
- What about non-fertiliser applications?

# Forecasting Demand: Step 1 – crop requirements

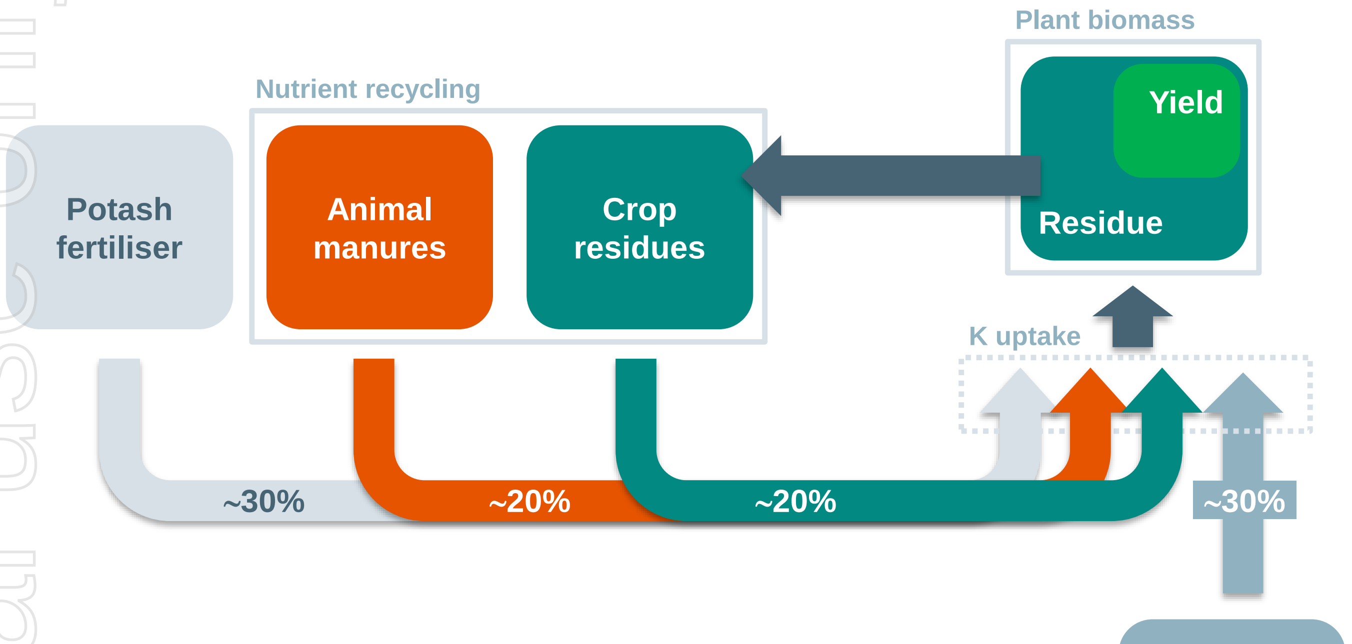
**Estimate the quantity of each crop required to meet demand for the 4Fs: food, feed, fibre, fuel**




1. Wastage includes inbound supply-chain losses and post-retail waste.

# Forecasting Demand: Step 2 – potash requirements

**Estimate the quantity, and source, of potassium nutrient needed to support crop production**




Intensity-of-Use = $\frac{\text{potash use}}{\text{crop production}}$

**Observed K balance**
**= Observable K input**
**– K output**

This "equality" is frequently negative as farmers "mine the soil" for the required potassium and do not provide sufficient external sources to maintain soil quality.

**Inferred K balance**
**= Observable K input**
**+ Inferred soil K mining**
**– K output**

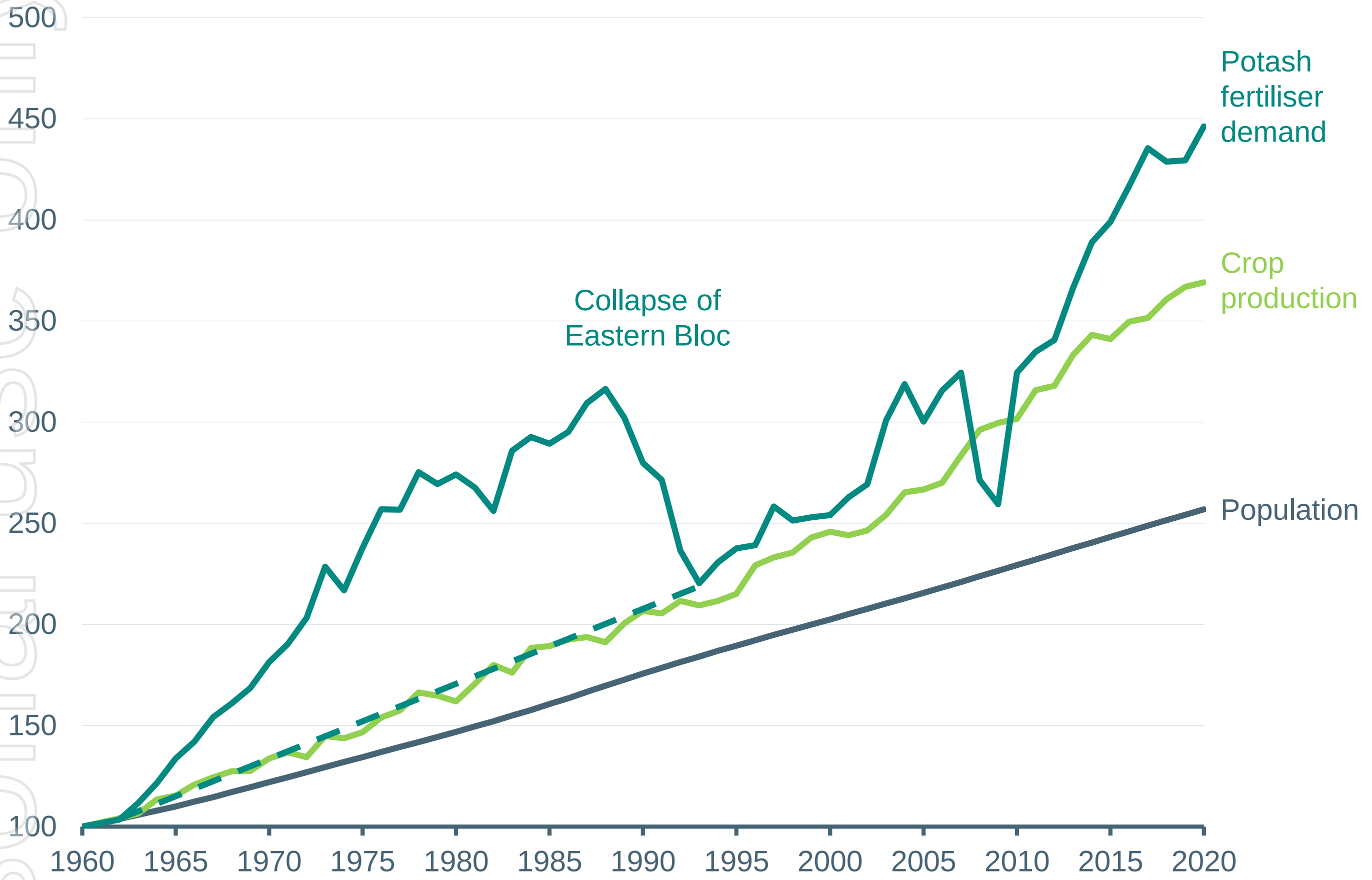
This requires a step up in the supply of external potassium sources if yields are to be maintained, leading to a rising intensity of potash use.

Data: BHP analysis based on multiple sources.
Note: Figures are approximate estimated global average; regional/local contributions to K uptake vary widely.

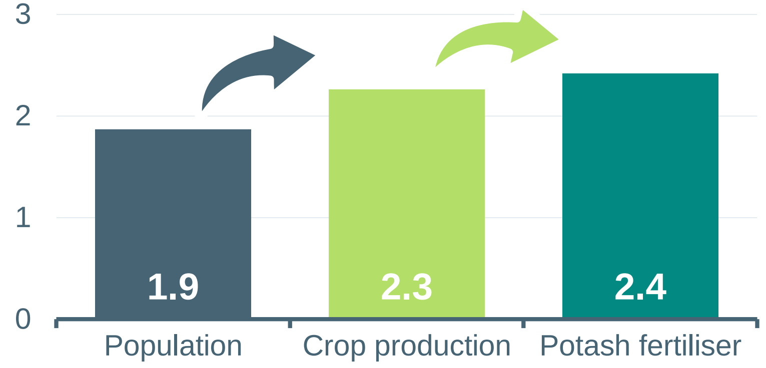
# Fundamental relationships are extremely reliable

## Crop production growth has exceeded population growth in the long run: potash has in turn exceeded growth in crop production

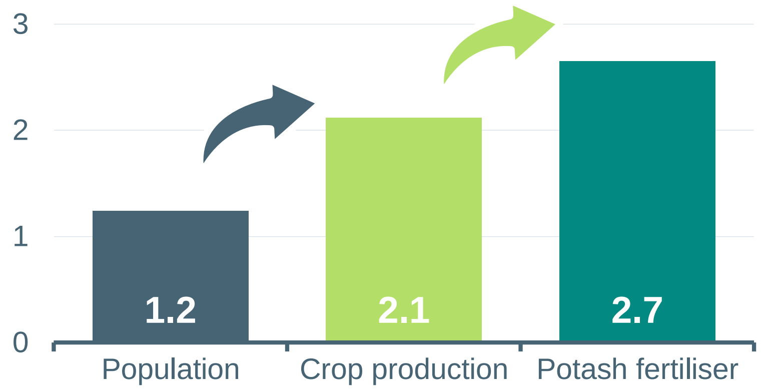
**Population up ~2.5 fold since 1960, crops ~3.5 fold, potash ~4.5 fold**
(Index, 1960 = 100)




**CAGR, 1960-1993**
(%)




**CAGR, 1993-2020**
(%)



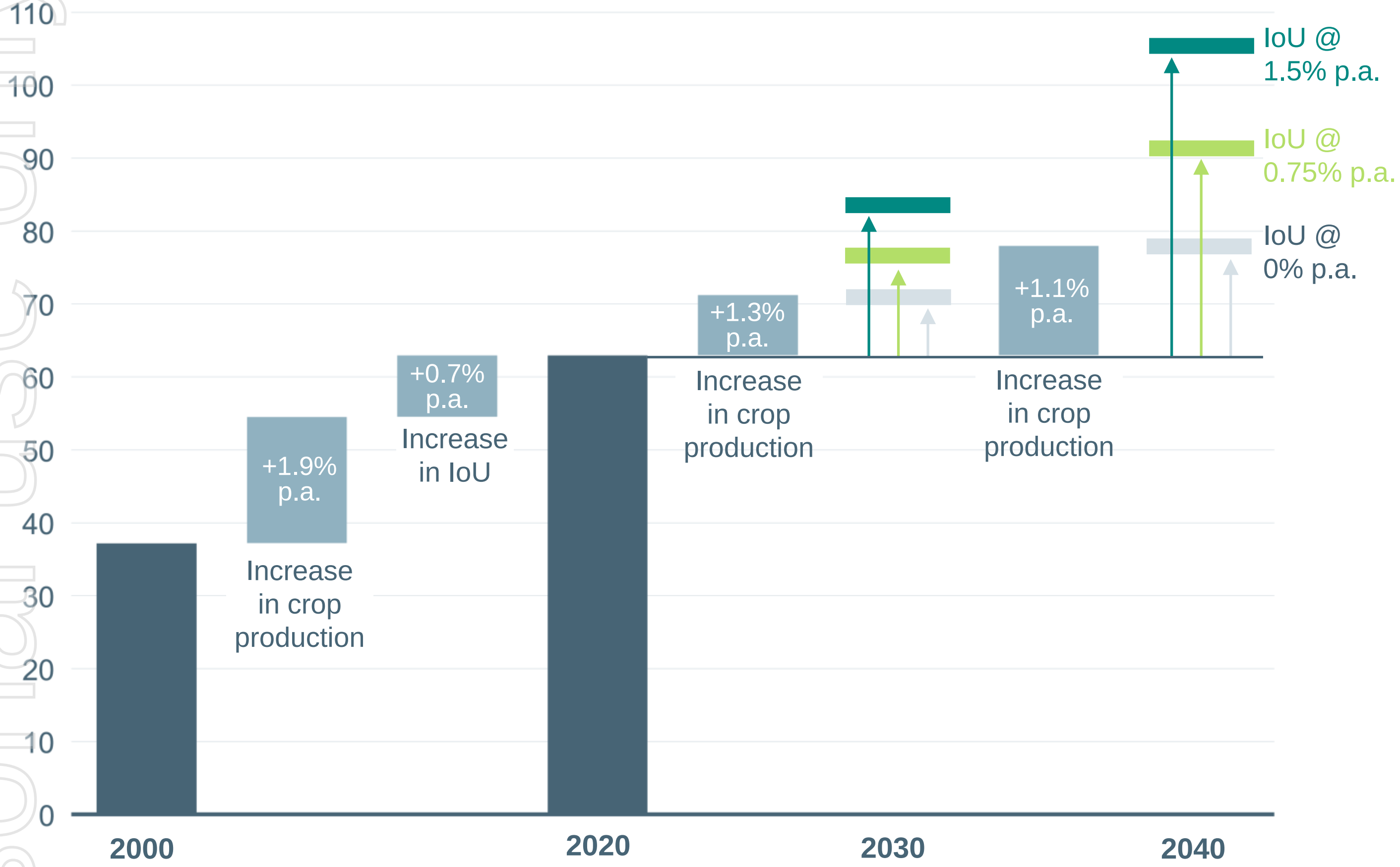

Data: UN World Population Prospects 2019; International Fertilizer Association; BHP analysis based on multiple sources.
Note: 'potash fertiliser demand' relates to estimated underlying consumption at the farm-level rather than to upstream MOP shipments.

# Rising Intensity of Use (IoU): indicative ranges

**Historical norm of potash growth exceeding crop growth is not under plausible threat. Attractive upside should IoU accelerate further.**

**Potash fertiliser demand: both rising crops and rising IoU have/will contribute**

(Mt MOP-equivalent)




Data: BHP analysis based on multiple sources.

| | |
|---|---|
| To reduce rates of soil K depletion, IoU will have to accelerate; growth of 1.5% p.a. corresponds to incremental demand of 42Mt | Trend annual growth of **~2 Mt** |
| If IoU continues to rise at roughly the historical trend, this corresponds to incremental demand of 28Mt | Trend annual growth of **~1.5 Mt** |
| We expect crop production to slow as a result of demographic factors; crop production alone is forecast to require 15Mt incremental potash fertiliser demand by ~2040 | Trend annual growth of **<1 Mt** |

# Potash demand outlook to 2030 by region

## Soil depletion a global phenomenon, underscoring our belief that IoU is likely to rise across multiple regions

### Additional tonnes 2020-2030

| NORTH AMERICA | |
|---|---|
| Historical demand growth[1] | 0.2% |
| BHP forecast growth[2] | 1-3% |
| External forecast growth[3] | 1.7% |
| Soil nutrient imbalance[4] | Poor, deteriorating |
| Potash contribution to K uptake[5] | 30-35%, recently improving |

| EUROPE & CIS | |
|---|---|
| Historical demand growth[1] | 0.2% |
| BHP forecast growth[2] | 1-3% |
| External forecast growth[3] | 1.1% |
| Soil nutrient imbalance[4] | Poor |
| Potash contribution to K uptake[5] | 20-25%, stable |

| ASIA & OCEANIA | |
|---|---|
| Historical demand growth[1] | 4.3% |
| BHP forecast growth[2] | 1-4% |
| External forecast growth[3] | 2.0% |
| Soil nutrient imbalance[4] | Poor, deteriorating |
| Potash contribution to K uptake[5] | 30-35%, improving |

| CENTRAL & SOUTH AMERICA | |
|---|---|
| Historical demand growth[1] | 4.4% |
| BHP forecast growth[2] | 2-4% |
| External forecast growth[3] | 2.9% |
| Soil nutrient imbalance[4] | Poor, deteriorating |
| Potash contribution to K uptake[5] | 35-40%, stable |

| AFRICA | |
|---|---|
| Historical demand growth[1] | 6.1% |
| BHP forecast growth[2] | 5-10% |
| External forecast growth[3] | 2.9% |
| Soil nutrient imbalance[4] | Poor, deteriorating |
| Potash contribution to K uptake[5] | ~5%, improving |

| WORLD | |
|---|---|
| Historical demand growth[1] | **2.7%** |
| BHP forecast growth[2] | **1-3%** |
| External forecast growth[3] | **2.0%** |

1. Average growth per annum of MOP shipments 2000-01 to 2019-20 (CRU).
2. Forecast average growth per annum of MOP shipments 2019-20 to 2030 (BHP range).
3. Forecast average growth per annum of MOP shipments 2019-20 to 2030 (Argus; CRU; IHS).
4. Status of the World's Soil Resources (FAO and ITPS, 2015).
5. BHP analysis based on multiple sources.

# Big picture themes in agriculture

## Climate change and "Precision Ag" are both principally opportunities for potash, in our view

### Climate change

- Rapid decarbonisation:
  - Greater pressure on land use
  - Possible resurgence of biofuels
- Physical impacts of climate change:
  - Harvests vulnerable to extreme weather events
  - Changing temperatures and rainfall

→

- Intensification positive for potash IoU
- Biofuels still heavily dependent on crop-fed 1st-gen tech
- Crop failures may become more frequent
- Potassium aids drought tolerance

- **Rapid decarbonisation offers potential upside for potash**
- **Adaptation (technology and farm practice, cultivated area, crop choice) expected to prevent supply constraint on crop production**
- **Any supply constraint would likely push up food prices and potash IoU**

### Precision Agriculture

- Leverage advanced tech to optimise farm practice
  - Improve application efficiency
  - Better identify nutrient deficiency
  - Adopt 'nutrient-budget' approach

→

- In-situ losses of K are much lower than N+P, so less potential efficiency gain
- Correcting K deficiency, reducing reliance on N fertiliser, 'nutrient-budgets' are all supported by Precision Ag

- **There are many barriers to global adoption of Precision Ag, particularly if labour is cheap, but even in the US farmers don't always see positive cost:benefit in some technologies**
- **But for potash, Precision Ag presents net upside and could accelerate potash IoU**

# Big picture themes in agriculture

**If the world cuts its meat intake, it is not a negative for potash demand. Food waste is likely to get worse before it gets better.**

## Meat consumption

- Negative aspects of meat consumption are in the headlines:
  - Major emitter of GHGs
  - Uses lots of land and water
  - Ethical concerns
- Possible solutions include:
  - Reduce meat consumption via substitutes / flexitarianism
  - Intensify livestock production to reduce land use and manage emissions

- Replacing meat calories with plant-based calories lowers overall crop production, but also removes K input from animal manure
- Intensification will require greater use of animal feed crops versus grazing

- **Pace of dietary change is extremely slow**
- **Per capita meat consumption still rising in many parts of the world**
- **When/if meat consumption does start to decline this is not negative for potash: livestock currently supplies tens of millions of tonnes of K into agriculture that would have to be replaced with potash**

## Food waste

- Up to one-third of food supply is lost or wasted
- Upstream waste is highest in developing economies:
  - Lack of cold-chain infrastructure
  - Slow / inefficient distribution
  - Often hot / wet climates
- Consumer waste is highest in developed economies:
  - Diversified diets, including perishables
  - Food cheap relative to income
  - Strict food hygiene regulations

- Tracking food waste over time is difficult – not commonly reported
- Cutting waste requires both major investment and behavioural change
- Developed economies have not made significant inroads on consumer waste
- Can developing economies cut upstream waste while avoiding rising consumer waste?

- **Cutting food waste would reduce crop production required per capita**
- **Unfortunately global food waste is likely to get worse before/if it gets better, given the interplay between economic development & food consumption behaviour**



BHP

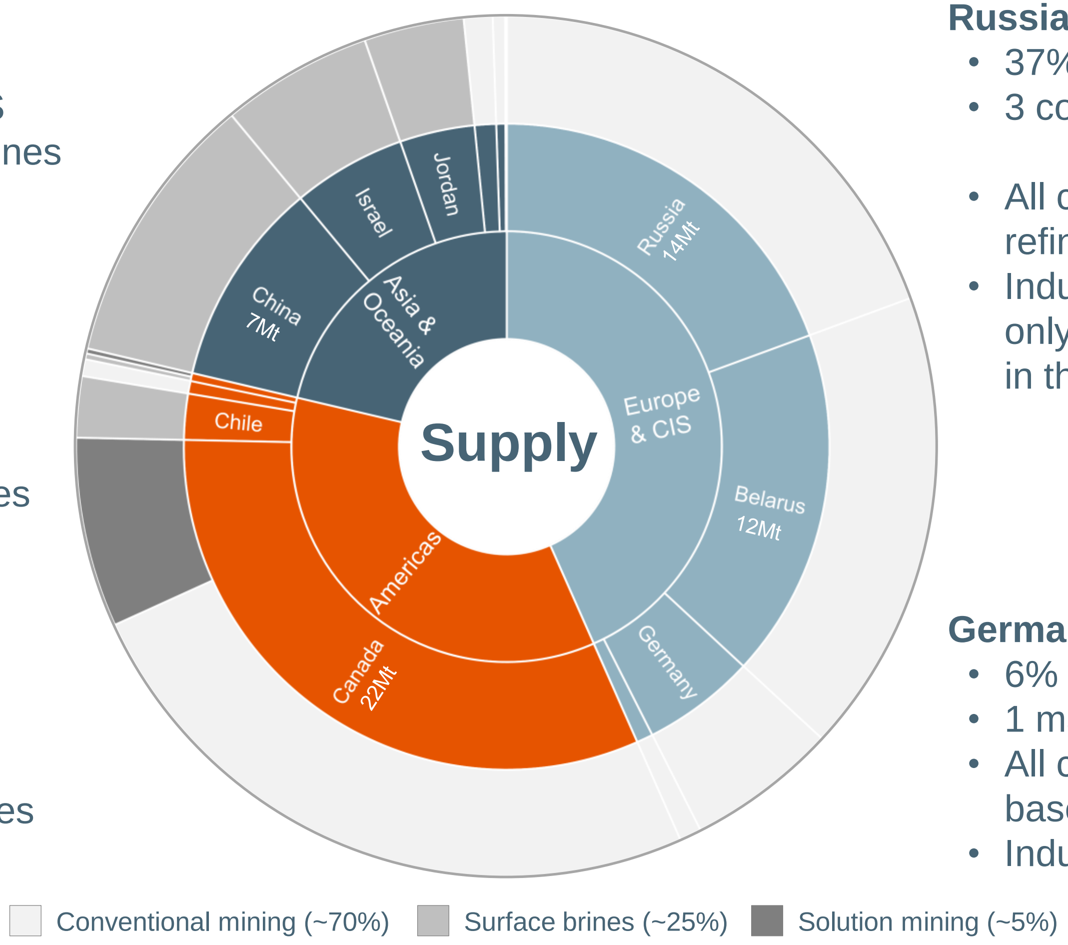
# Geography of supply

## Production concentrated in Canada, Russia and Belarus

**Canada** (Saskatchewan)
- 32% of production in 2020
- 3 companies: Nutrien, Mosaic, K+S
- 7 conventional mines, 3 solution mines
- Industry dates back to 1950s

**China** (Qinghai)
- 10% of production in 2020
- 1 major company: QSL Industry (+numerous smaller producers)
- Production is based on natural brines
- Industry dates back to 1990s

**Middle East** (Dead Sea)
- 9% of production in 2020
- 2 companies: ICL, Arab Potash
- Production is based on natural brines
- Industry dates back to 1930s



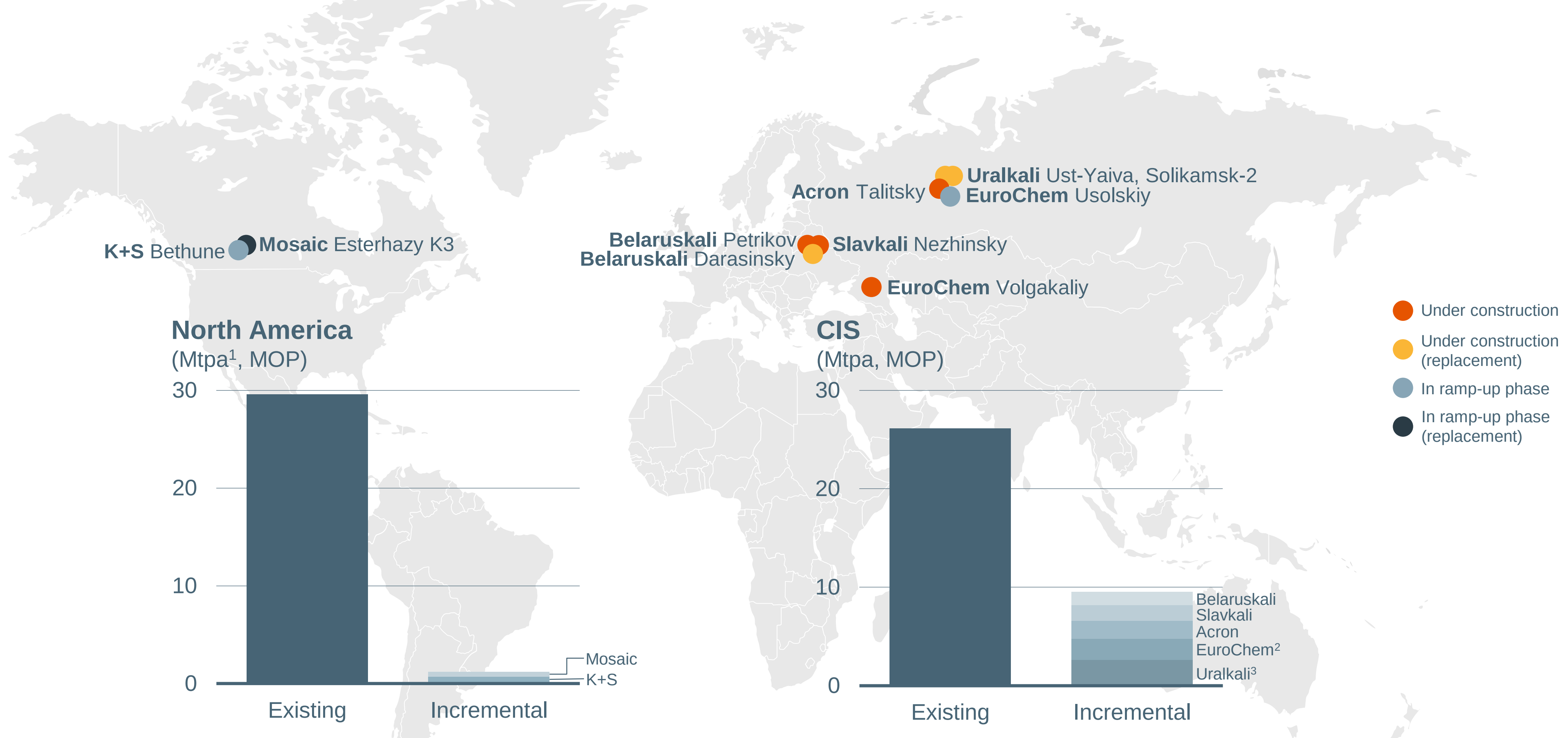

**Russia and Belarus**
- 37% of production in 2020
- 3 companies: Uralkali, Belaruskali, EuroChem
- All conventional mines, but some refineries use thermal processing
- Industry dates back to 1930s, but only returned to the seaborne trade in the 1990s

**Germany**
- 6% of production
- 1 major company: K+S
- All conventional mines, most production based on *Hartsalz* ore
- Industry dates back to 19th century

Data: 2020, 70Mt MOP production (CRU).

# Recent and forthcoming greenfield additions to supply

## Centred on the three major basins: other deposits are either small, inaccessible or already extensively developed

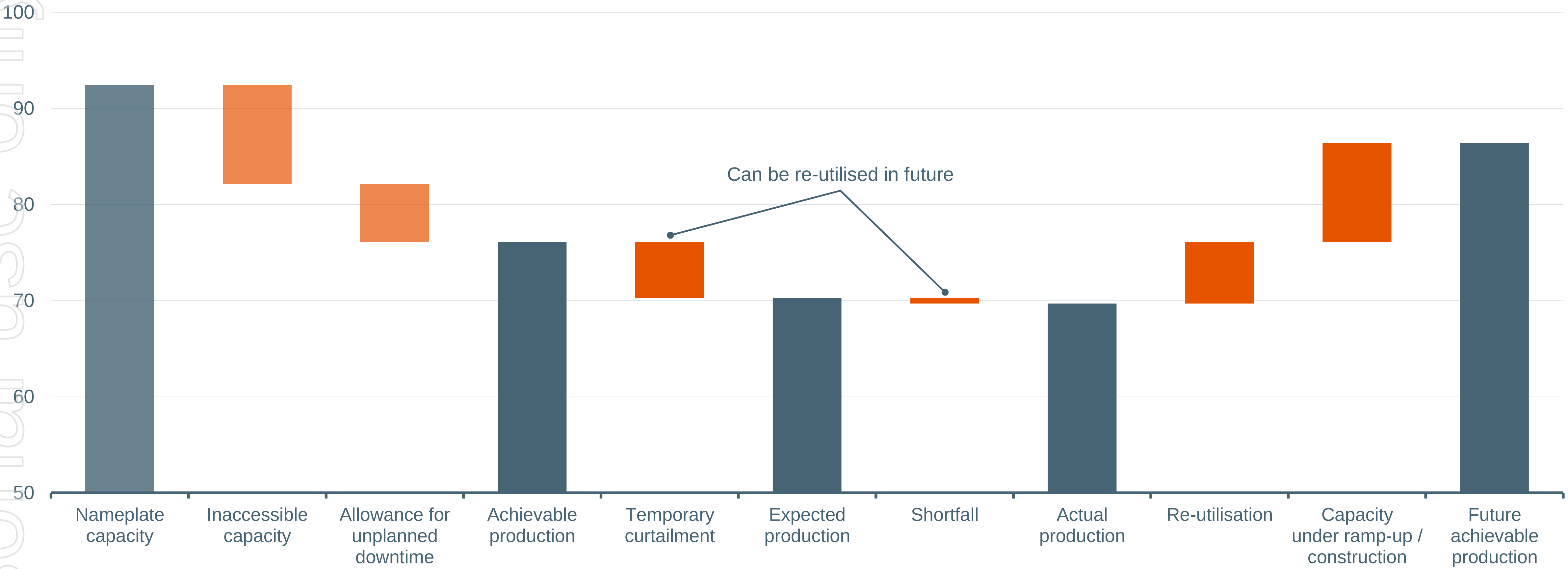



Data: BHP analysis based on multiple sources.
1. Estimated Achievable Production (after disruption allowance but before voluntary curtailment).
2. Includes Phase I capacities only.
3. Includes new mine to recover lost capacity at Solikamsk-2.

# Identifying available capacity

## Estimated ~76t Achievable Production in 2020, rising to ~86Mt with forthcoming additions

**CY2020 capacity**
(Mtpa MOP)



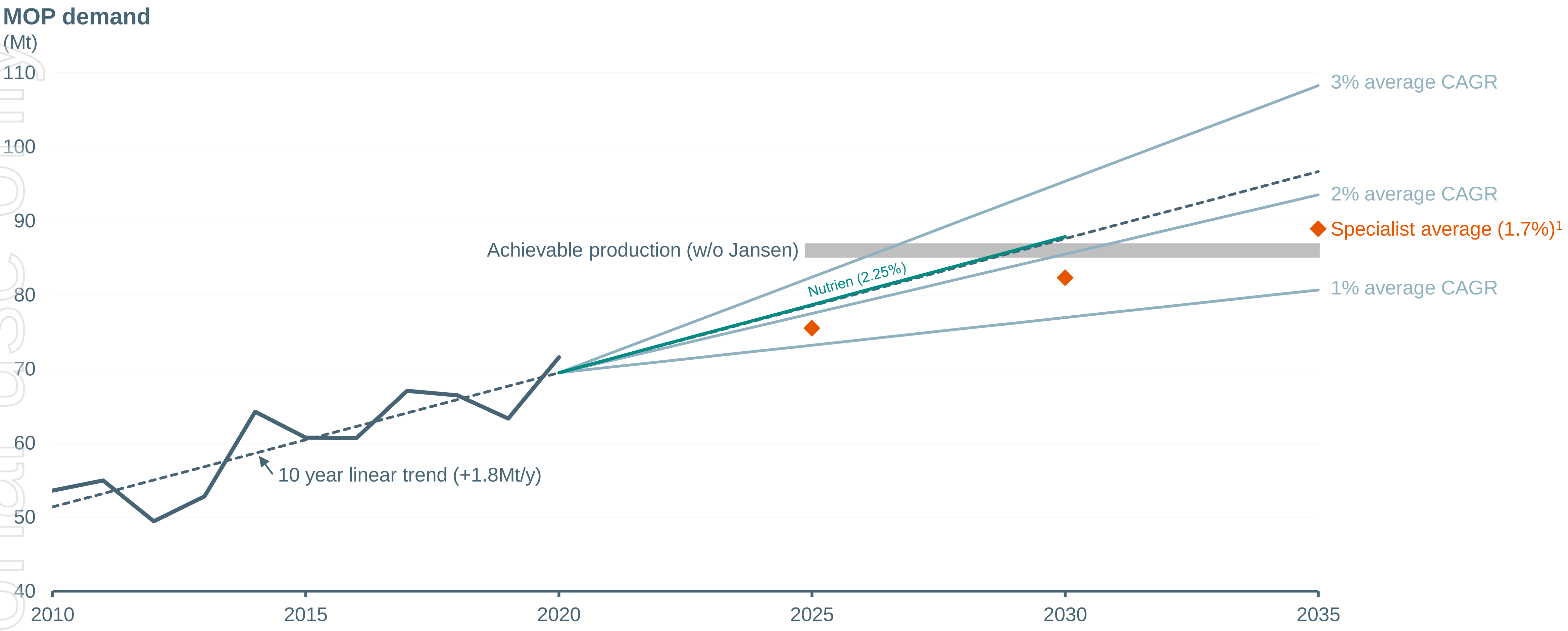

Data: BHP analysis based on multiple sources.



BHP

# How soon will demand catch-up in Wave #4?

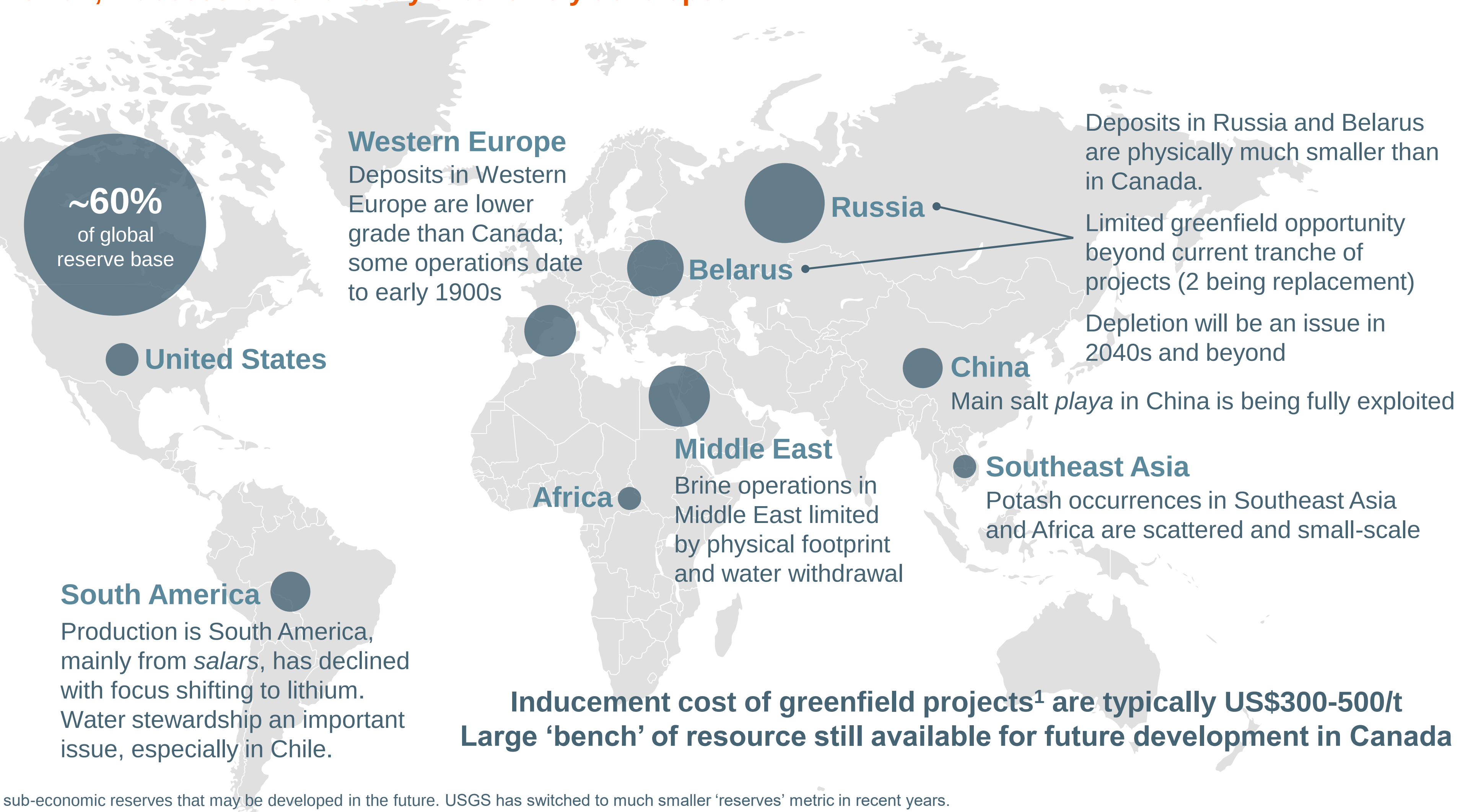
**Consensus view is that demand will catch-up in the late 2020s/early 2030s**




Historical data: CRU. Nutrien range of 2.0 to 2.5% in the 2020s as disclosed in 2021 Q1 earnings call. Achievable production is BHP analysis based on multiple sources.
1. Specialist average based on CRU, Argus, Fertecon (IHS Markit). 2020-2035 CAGR calculated relative to trend level in 2020 (69.5Mt) not to actual level estimated by CRU (71.6Mt).
Note that the chart shows linear interpolations that result in the same 2020-2035 aggregate tonnage increment as the stated CAGRS.

# Canada is well placed to meet long-term demand growth

## Other deposits are either small, inaccessible or already extensively developed




### Canada

Canada is home to more than half of global reserve base

Options for conventional mining and solution mining

Ore body is generally flat, thick and high-grade

**~60%** of global reserve base

### Western Europe

Deposits in Western Europe are lower grade than Canada; some operations date to early 1900s

Deposits in Russia and Belarus are physically much smaller than in Canada.

Limited greenfield opportunity beyond current tranche of projects (2 being replacement)

Depletion will be an issue in 2040s and beyond

### China

Main salt *playa* in China is being fully exploited

### Middle East

Brine operations in Middle East limited by physical footprint and water withdrawal

### Southeast Asia

Potash occurrences in Southeast Asia and Africa are scattered and small-scale

### South America

Production is South America, mainly from *salars*, has declined with focus shifting to lithium. Water stewardship an important issue, especially in Chile.

**Inducement cost of greenfield projects[1] are typically US$300-500/t**
**Large 'bench' of resource still available for future development in Canada**

Data: USGS (2009). 'Reserve base' includes sub-economic reserves that may be developed in the future. USGS has switched to much smaller 'reserves' metric in recent years.
1. Greenfield inducement cost is all-in opex plus capital servicing, expressed in real US$ per tonne production, FOB Vancouver-equivalent. (CRU, Argus, Nutrien).

# Potash fundamentals: key messages

**A future facing commodity with attractive long term fundamentals from multiple angles**

| | |
|---|---|
| **A Future Facing Commodity** | • Potash sits at the **intersection** of **global demographic, social and environmental megatrends**<br>• The **environmental footprint of potash** is **considerably more attractive** than other major chemical fertilisers<br>• Conventional mining with flotation is **more energy and water efficient** than other production routes |
| **Reliable base demand with attractive upside** | • Traditional demand drivers of **population** and **diet** are reliable and slow moving<br>• Attractive upside over basic drivers exists due to the **rising potash intensity-of-use** needed to support **higher yields** and offset **depleting soil fertility**<br>• **On top of the already compelling case,** decarbonisation could amplify demand upside[1] |
| **The industry's 4th wave is underway: demand to catch-up over the course of the 2020s** | • **Demand is catching up** to excess supply, and major **supply basins are mature**<br>• Price formation regime accordingly expected to transition from current SRMC to **durable inducement pricing,** with Canada well placed to meet market growth longer term at LRMC in the mid $300s<br>• Post the balance point, long-run geological and agronomic arguments skew probabilistic risks upwards (LRMC plus fly-up) rather than downwards (SRMC), in our view |

Note: Short Run Marginal Cost (SRMC); Long Run Marginal Cost (LRMC).
1. Based on BHP's 1.5°C Scenario. Refer to the BHP Climate Change Report 2020 for information about this scenario and its assumptions.

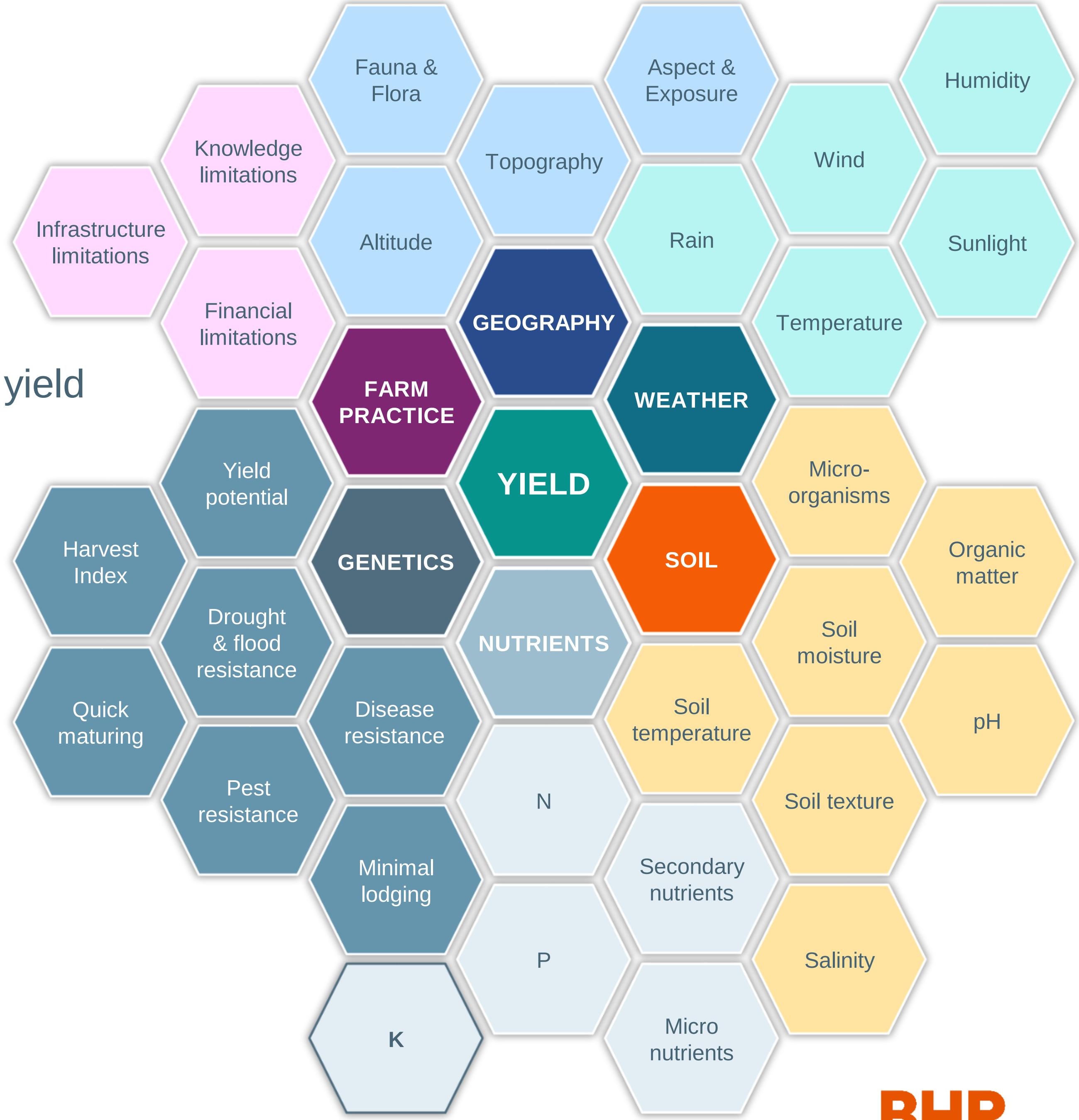
# Appendix

# What governs crop yields?

**Potassium availability is one of many factors**

There are many interacting factors that influence crop yield
Any one factor may be yield-limiting

- The **potential yield** is determined by genetics
- The **attainable yield** is limited by external factors – aspects of climate, soil type and geography
- The **achieved yield** depends on farm practice to optimise availability of water and nutrients, to minimise the impact of pests, disease and bad weather, and to condition the soil



# Themes in agriculture

## Good or bad for potash demand?

### Climate change

Shifts in average temperature and more frequent extreme weather poses a risk to future food security.

We expect that adaptation – both through biotechnology and farm practice – will avoid food production becoming supply constrained.

Water stewardship will be vital – adequate potassium helps plant tolerate drought.

Rapid decarbonisation pathways offer potential upside to potash demand, particularly through resurgent growth in biofuels and the pressure to accelerate yield growth if large-scale afforestation diminishes available cropland.

However, outcomes that further decelerate population growth and/or depress income growth are negative for crop demand.

**Global agriculture will have to adapt to changing climate, but this does not alter our basic thesis on potash demand growth. A 1.5C Paris-aligned pathway provides potential demand upside.**

### Precision Ag

'PA' is a broad term applied to tools or services that leverage advanced technologies to optimise farm practice.

Examples include GPS guidance, telematics, variable-rate technology of seeds, fertiliser and pesticides, and aerial imagery.

PA technologies seek to reduce the cost of labour and/or crop inputs, or increase revenue via the quantity and/or quality of production.

Some PA technologies are aimed specifically at the efficient use of fertilisers. The main focus is the precise and timely application of nitrogen and phosphate fertiliser, which are it risk of high in-situ loss.

Potassium is applied in smaller quantities, less often and is less mobile in the soil – the potential efficiency gains are thus much less.

**Efficient application poses little threat to potash demand. However, regular and accurate soil testing will help to identify under-application of K that might otherwise be missed. Adoption of a 'nutrient-budget' approach, rather than depleting native K, provides further demand upside.**

### Food waste

Up to one-third of upstream food production is never eaten. Tackling food loss and waste (FLW) is part of the UN's Sustainable Development Goals.

- Developed economies have high rates of wastage at the retail and consumer level.
- Developing economies have high rates of loss in processing and distribution.

There is little data on FLW over time, but it may still be getting worse. Factors that can increase FLW include:

- Varied diets that include many perishable foodstuffs
- 'Cheap' food relative to household income and consumer quality expectations
- Food hygiene regulations

**Tackling FLW should be a global priority and over time will allow the world to feed more people with less crop production. But doing so will need both big investment and big shifts in behaviour, so progress will likely be slow.**

### Plant-based meat

Alternatives to conventional meat, including plant-based proteins, cultured meat and insects have grabbed the headlines. People in some places are choosing to eat less meat for environmental (as well as ethical) reasons.

Livestock practices vary widely but, on average, each meat-based calorie requires more crop input than each plant-based calorie. Usually, beef has more feed-crop input than pork or lamb, which in turn have more than poultry.

Reduction of meat consumption is thus associated with lower crop production for the same calorie intake. However, animal manure contributes millions of tonnes of K to crops every year. The substitution of animal manure with potash negates the impact on potash demand of lower crop production.

**Meat consumption patterns change very gradually. Despite temporary dips resulting from swine fever and the COVID-19 pandemic, meat consumption is still on an upward trend globally. However, a reversal of this trend is not negative for potash demand.**

### Potash 'holidays'

K does not leach out from soils as easily as nitrogen and phosphate fertilisers. Soils also contain 'native' K from naturally-occurring minerals.

Soils that have been well-maintained may be able to support several harvests without further application.

This gives farmers flexibility to adjust potash purchases from season to season in a way that is not possible with nitrogen (or, to a lesser extent) phosphates. They can 'bank' potash in the soil when it's affordable or skip application when it's not.

Other drivers of demand volatility include weather conditions, seasonality of application, and stock-change through the supply chain.

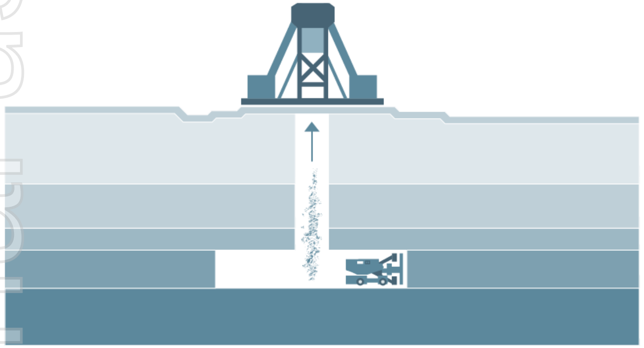
**Farmer response to potash affordability is a key driver of short-term demand volatility. However, K is an essential 'building block' in plants and over the long-term, consumption is driven by agronomic requirement. Crop prices will adjust if necessary to support the appropriate use of fertiliser needed to achieve required crop yields.**

# Potash operations fall into 3 basic types

**MOP is extracted from underground ore deposits or recovered from natural brines**

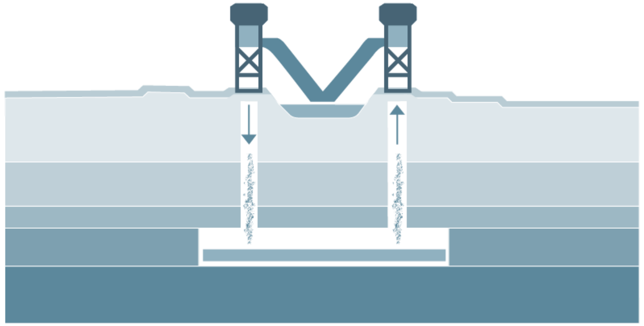
## Conventional mining

- Usually 400m to 1,100m deep and accessed by shaft
- Usually room & pillar with continuous mining machines
- Widely used in Canada, Russia, Belarus



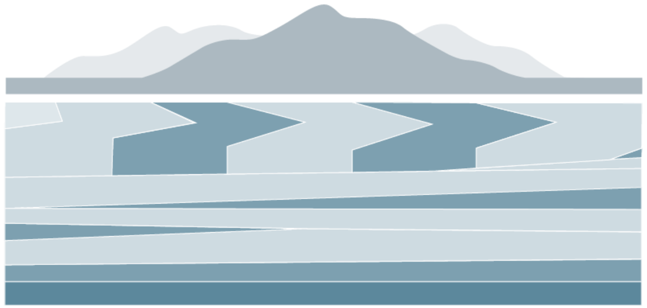
## Solution mining of ore

- Hot water (or brine) is pumped underground to dissolve the potash ore
- Potash brine is pumped back to the surface for processing
- Employed on a large scale only in Canada



## Natural brines

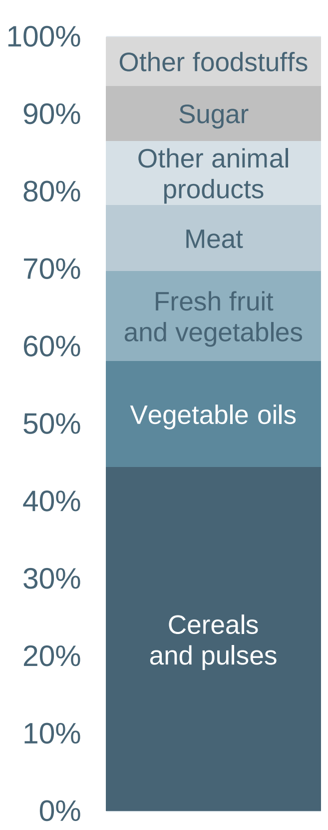
- Potassium-bearing brines are channelled into ponds and concentrated by solar evaporation until potash salts crystallise
- Salts are either harvested by cutting dredges or mechanical shovels
- Employed in China, Israel, Jordan and Chile



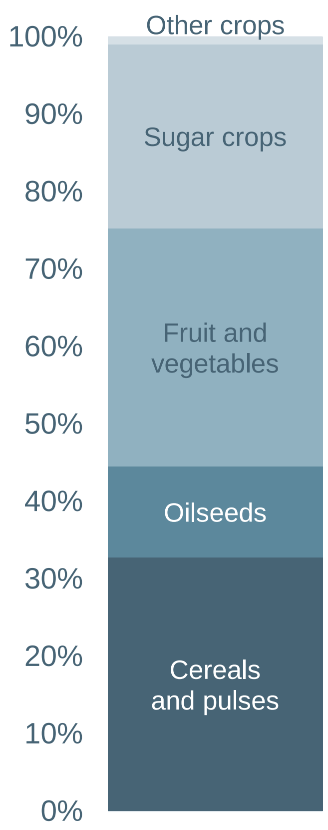
# Food and agriculture in numbers

## Global diets dominated by crop and vegetable products

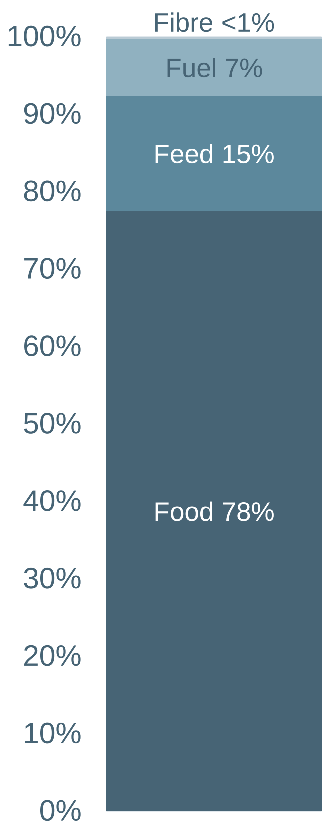
### Global dietary profile[1]



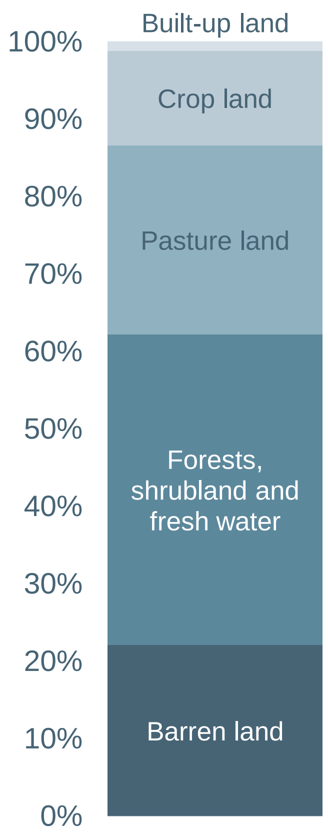

### Global crop production[2]




### Global crop use[3]



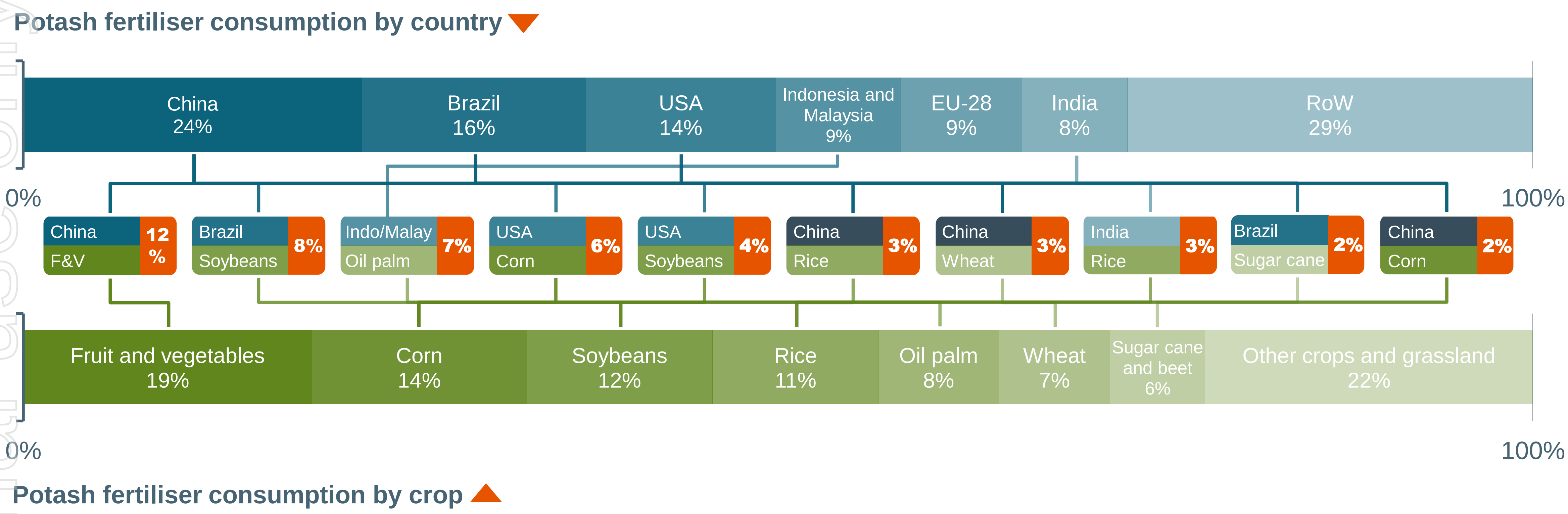

### Global land use[4]




1. IHS Markit (2019).
2. FAO (2019) (excludes hay/silage/forage).
3. BHP estimate (excludes hay/silage/forage).
4. FAO (2018) / ourworldindata.org (2019).

# Potash fertiliser use by crop

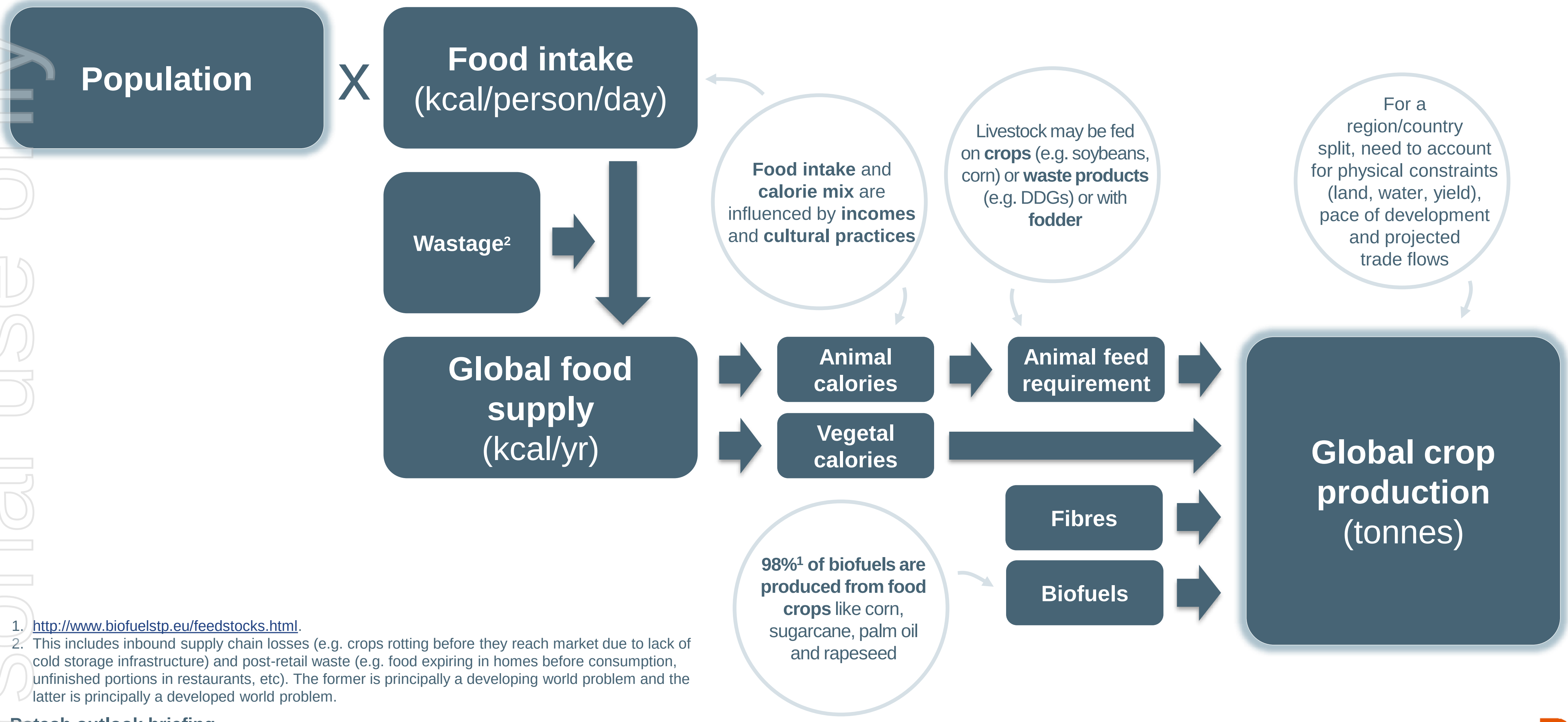
**Global agriculture is fragmented, but top 10 country-crop combinations account for 50%**




International Fertilizer Association "*Assessment of Fertilizer Use by Crop at the Global Level*" (2017).

# Forecasting Demand: Step 1 – crop requirements

**Estimate the quantity of each crop required to meet demand for the 4Fs: food, feed, fibre, fuel**




1. http://www.biofuelstp.eu/feedstocks.html.
2. This includes inbound supply chain losses (e.g. crops rotting before they reach market due to lack of cold storage infrastructure) and post-retail waste (e.g. food expiring in homes before consumption, unfinished portions in restaurants, etc). The former is principally a developing world problem and the latter is principally a developed world problem.



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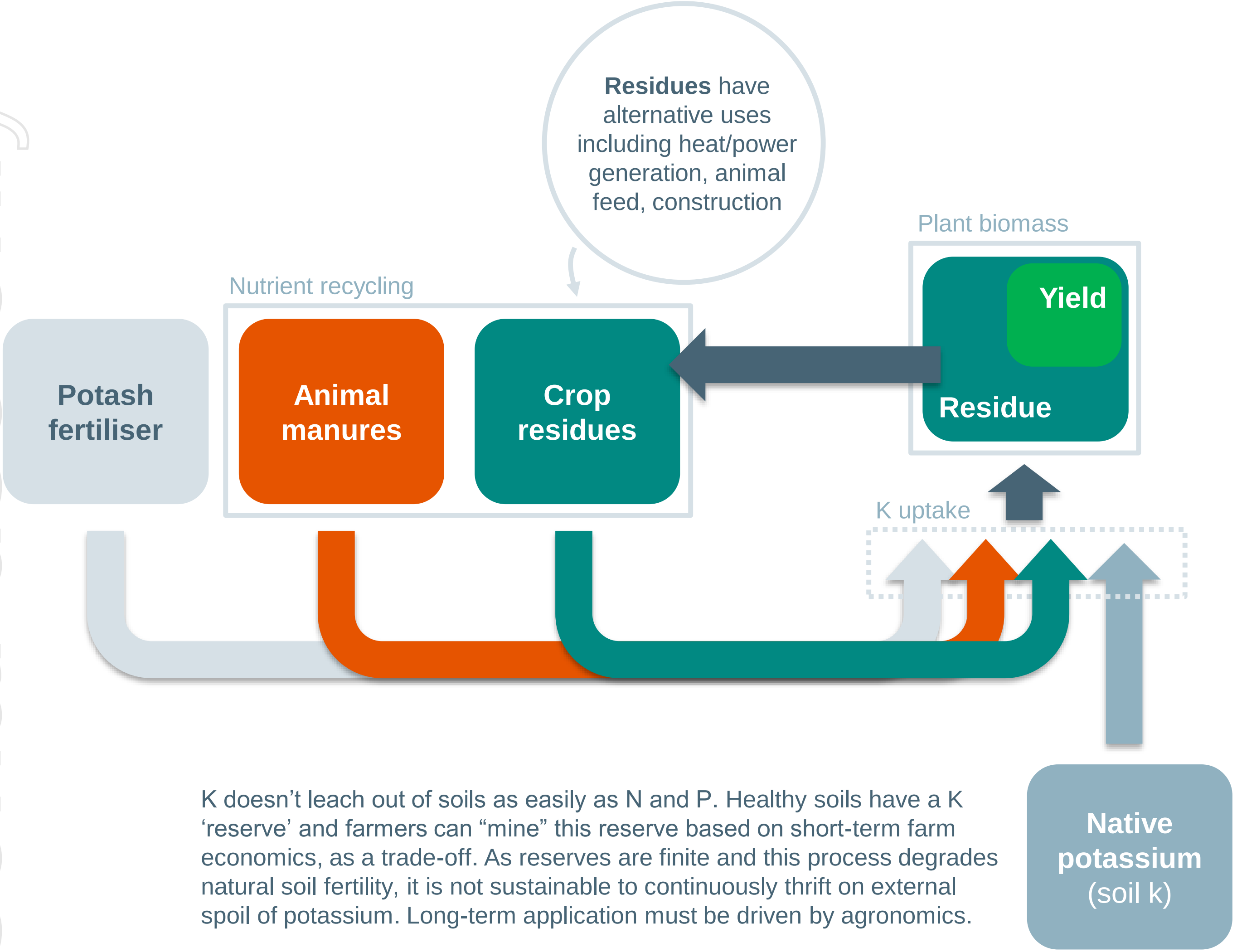
# Forecasting Demand: Step 2 – potash requirements

**Estimate the quantity, and source, of potassium nutrient needed to support crop production**




K doesn't leach out of soils as easily as N and P. Healthy soils have a K 'reserve' and farmers can "mine" this reserve based on short-term farm economics, as a trade-off. As reserves are finite and this process degrades natural soil fertility, it is not sustainable to continuously thrift on external spoil of potassium. Long-term application must be driven by agronomics.

## Observed K balance = Observable K input – K output

Observable K input: Potash fertiliser, Animal manures, Crop residues

K output: Crop K uptake

This "equality" is frequently negative. How so? Because farmers "mine the soil" for a proportion of the required potassium, and do not provide sufficient external sources to maintain soil quality. Which gives the following:

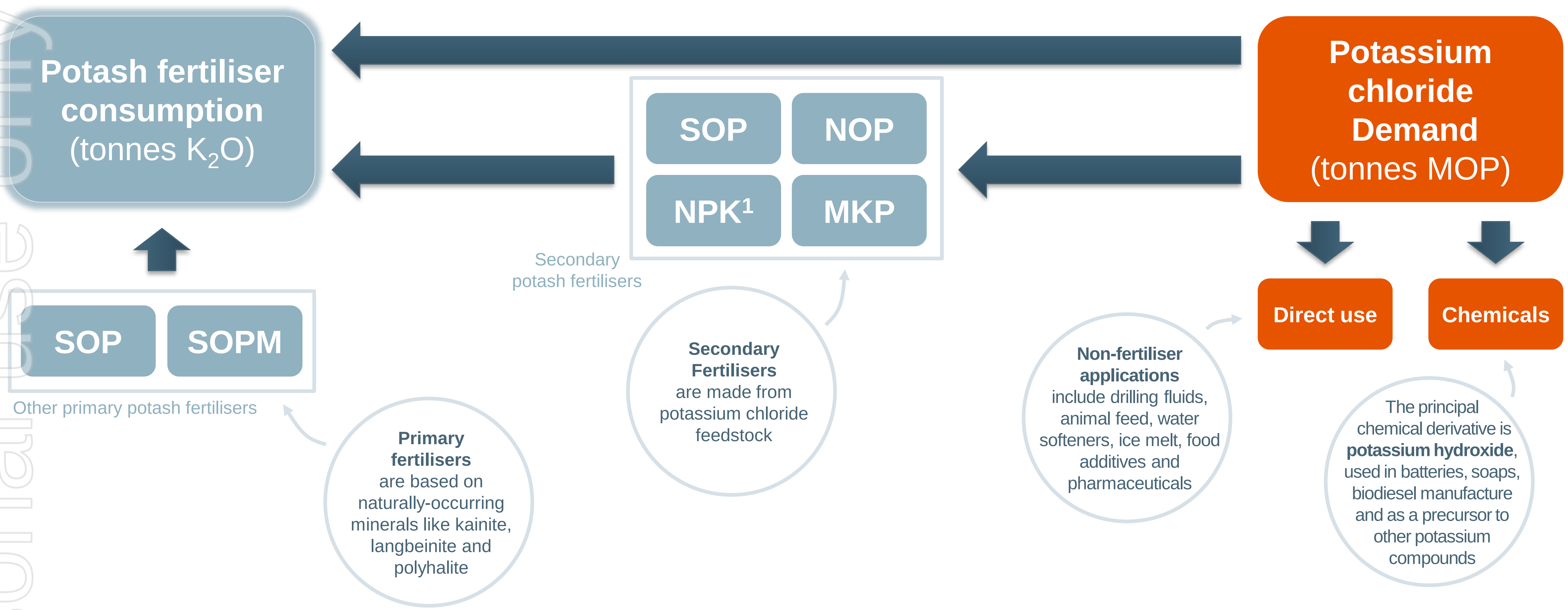
## Inferred K balance = Observable K input + inferred soil K mining – K output

At some point, the ability to "mine the soil" at historical rates will decline, perhaps starkly in some regions. That will require a step up in the supply external sources of potassium if yields are to be maintained, with rising intensity of potash use being the logical conclusion.

**Intensity-of-use = potash use / crop production**

# Forecasting Demand: Step 3

**Estimate the contribution of other primary potash fertilisers; Estimate non-fertiliser consumption of MOP**




1. NPK fertilisers can also be based on other primary potash materials.



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# Potash: a low emission, biosphere friendly fertiliser

## MOP is a critical nutrient with a modest GHG and broader environmental footprint

### GHG emissions intensities inform our investment decisions:

| Scope 1+2 ▶<br>▼Scope 3[1] | **Low**<br><100 kg $CO_2$e/t | **Medium**<br><1,000 kg $CO_2$e/t | **High**<br>>1,000 kg $CO_2$e/t |
|---|---|---|---|
| **Low**<br><100 kg $CO_2$e/t | potash[2] | | |
| **Medium** | | phosphate[3] | |
| **High**<br>>1,000 kg $CO_2$e/t | | | nitrogen[4] |

### Not all fertilisers have the same environmental footprint:

- ✓ Potash **doesn't** have high emissions in production or distribution
- ✓ Potash **doesn't** release $CO_2$ or $N_2O$
- ✓ Potash **doesn't** pollute waterways

1. Scope 3 impact relates only to emissions associated with downstream processing and use, not other considerations such as transportation.
2. Based on MOP produced by flotation and without downstream processing.
3. Based on ammonium phosphates (DAP/MAP).
4. Based on urea.

Note: a) Scope 1+2 emissions for flotation-based MOP ~50-80 kg $CO_2$e/t, other production routes are 100-500kg. High nutrient concentration (60% $K_2O$) maximises efficiency in transportation and spreading.
b) From BHP research conducted so far, nitrogen-based fertilisers rather than potash appear to have a larger downstream emissions impact. However, trying to estimate the GHG contribution impact of fertiliser on soils and crops is very complicated. We continue to develop and improve our knowledge in this area.

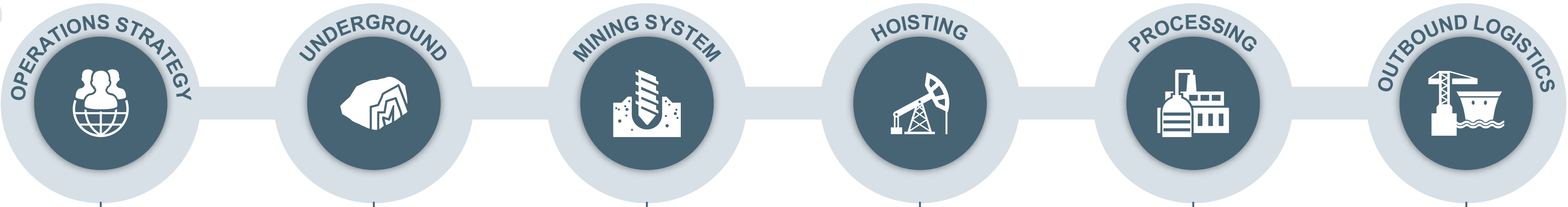
# Jansen fits our strategic framework

**Our strategy identifies how to position the portfolio to maximise long-term value and deliver high returns for shareholders**

| | |
|---|---|
| ✓ **Attractive commodity** | • **Future fit,** exposure to global mega trends: decarbonisation and land use<br>• **Attractive fundamentals,** supply-driven market, growing population and diet<br>• **Durable inducement pricing** transition from short-run marginal cost |
| ✓ **World class asset** | • **High-quality resource,** low-cost, high-margin, long-life in a stable mining jurisdiction<br>• **Capital efficient expansion** options<br>• **Diversification** of commodities, customer base, operating footprint |
| ✓ **Operational excellence** | • **Expertise** in bulk mining, logistics and product marketing<br>• **High-performing culture, latest technology** enabling top quartile operational performance<br>• **Low-carbon footprint** and lower water intensity |

# Jansen offers structural, competitive advantages

**Hard-to-replicate design, could be leveraged further in future stages**




**Performance driven culture**

Culture to drive higher productivity, lower operating costs

**Upfront geological information**

Leveraged 3D seismic technology to gain understanding of underground resource

**60% less equipment highest throughput**

Automation approach resulted in fewer higher producing borers

**Shaft design 40% larger than other producers**

Increased ventilation, capacity for multiple brownfield expansions

**Leading equipment and material handling systems**

Advanced predictive maintenance drives higher plant availability, operating hours

**Continuous, automated loading system**

Automation maximises efficiency and removes all interactions between equipment and personnel

**Across the value chain we have built in structural advantages, incorporated latest proven equipment and digital technologies**





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# Jansen is low-cost, high-margin and long-life

**Simpler, smarter design adopted, while shaft completion de-risks project**

## Final investment decision on track for mid-CY21

- **Project scope:** Shaft equipping, mine development, processing facility, site infrastructure and outbound logistics
- **First production:** ~5 to 6 years construction timeframe, ~2 years from first production to ramp up
- **Volumes:** 4.3 – 4.5 Mtpa (potassium chloride, KCl)

## Cash positive with high margins through the cycle

- **Opex:** US$100 per tonne
- **Sustaining capex:** US$15 per tonne, (real) long term average

## Steps before FID

- Finalise port
- Consider final project risk and return metrics

## Major construction permits in place, port to be finalised

| Major permits | |
|---|---|
| Environmental Impact Study | Approved |
| Mining Plan | Approved |
| Mining Closure Plan | Approved |

| Other key requirements | |
|---|---|
| Construction Water Authorisation | Approved |
| Port and Rail | In progress |

| Shaft progress | |
|---|---|
| Final lining completion | 91% complete[1] |

1. Project scope includes finishing the excavation and lining of the production and service shafts, and continuing the installation of essential surface infrastructure and utilities.

# Jansen must compete for capital

**Stage 1 will be assessed through CAF at both project and portfolio level**

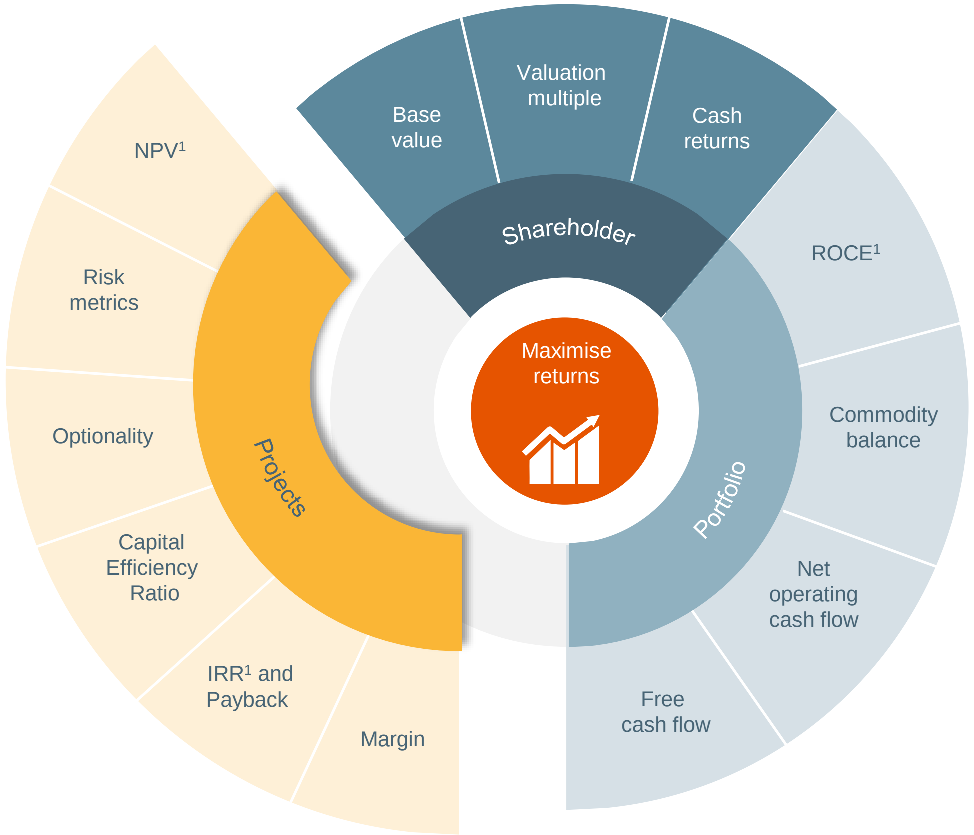
### New capital tested against the CAF framework

- **Project capital:** US$5.3 – 5.7 billion
- Projects need to compete against alternatives with similar risk, time horizons, with life cycle returns also a consideration
- Capex spend over seven years
  - peak spend in FY25 and FY26

### Economic risks considered

- Our assessment incorporate: project specific risks, economic exposure risks, country risks and non-quantifiable risks
- Cash generation at the low point of the cycle underpinned by low industry cost position

### Evaluation approach[1]




1. NPV: Net Present Value; ROCE: Return on average capital employed; IRR: Internal Rate of Return.

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