INTERCEM Americas 2023

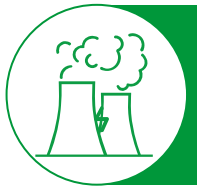
Supplementary Cementitious Materials – Macro Optimism, Micro Caution

December 2023

There are currently ~19M MT of SCMs used for concrete products in the U.S. which results in a ~14% SCM inclusion rate in 2022

Demand

U.S. supplementary cementitious material (SCM) used in concrete production (2022)



~14M MT of Fly ash (live and harvested)

~3M MT of Slag (domestic and imported)

~1M MT of Natural pozzolans

<1M MT of Calcined clay & silica fumes

~19	~14%
Metric tons of SCMs	Implied inclusion rate*

Note: *Defined as SCM consumption / total binder consumption – excludes limestone
Source: ACAA; USITC: USGS; NPA; L.E.K. research and analysis

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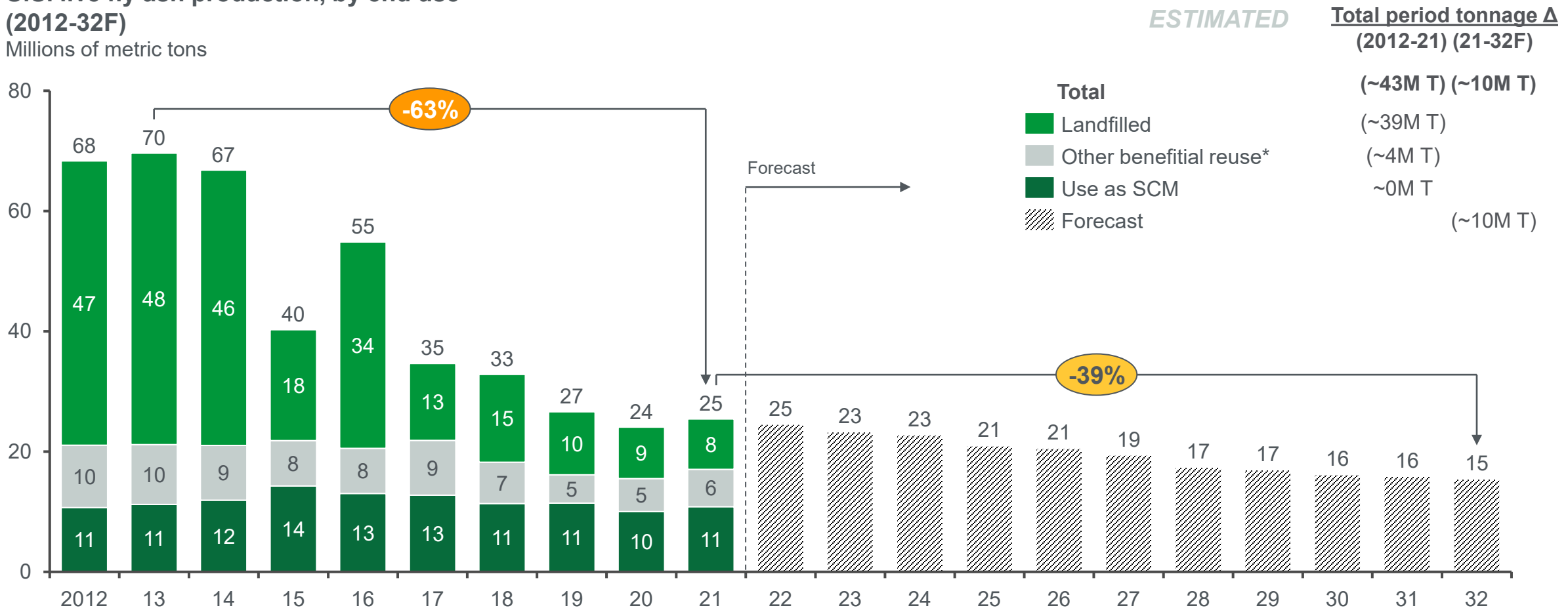
However, almost 2/3rd of U.S. fly ash production is already gone, and fly ash shortages will only get worse from here

Demand

U.S. live fly ash production, by end use (2012-32F)

Millions of metric tons



Notes: * Includes waste and road stabilization and solidification, CCR pond closure activities, and clinker making
Source: ACAA; S&P; L.E.K. research and analysis

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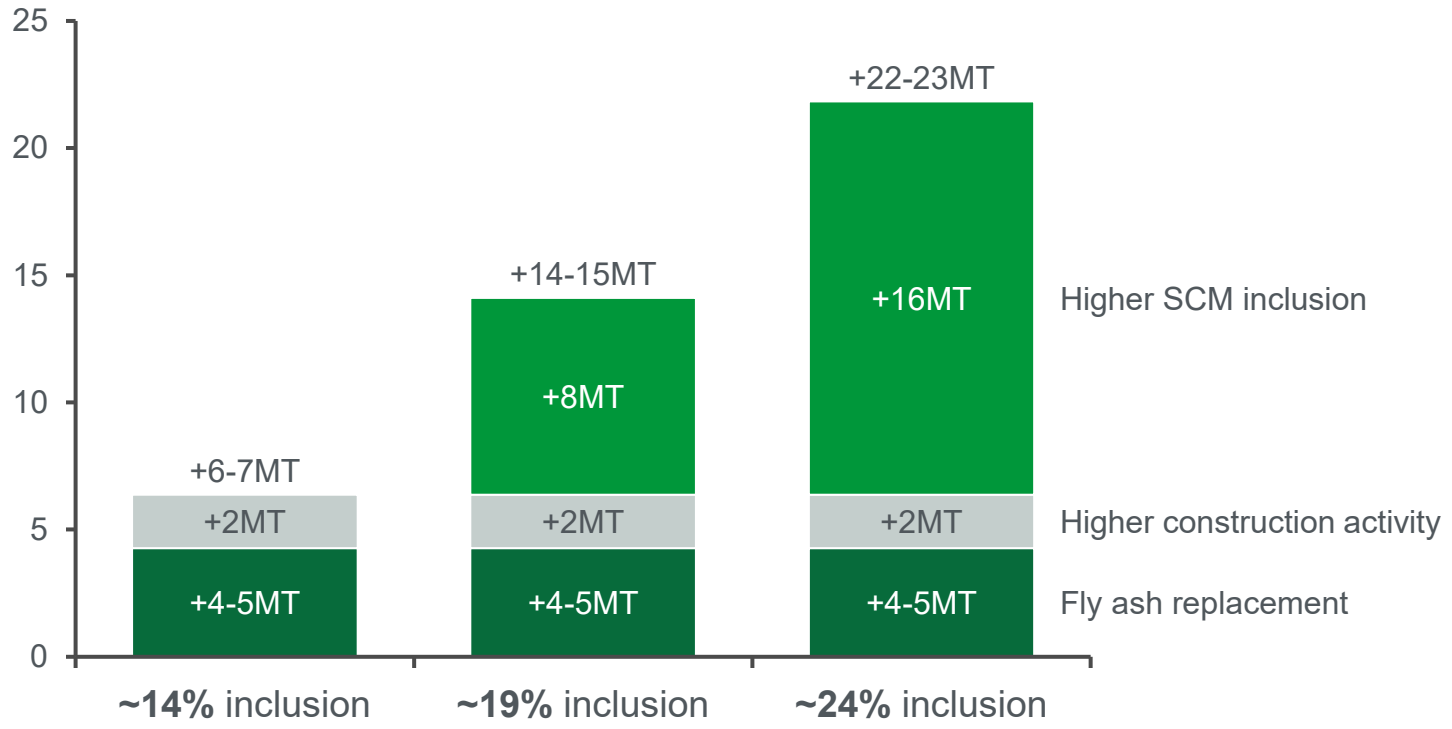
The U.S. will need to find at least 6-7M MT of SCMs to maintain its current ~14% inclusion rate, 22-23M MT to increase it by 10 percentage points

Demand

Additional SCM needs in the U.S. by 2032

Millions of metric tons



Δ vs. 2022	Unchanged	+5 percentage points	+10 percentage points

Assumptions:

- No decline in slag production (conservative)
- No coal plant closures beyond what has already been announced (conservative)

Source: L.E.K. research and analysis

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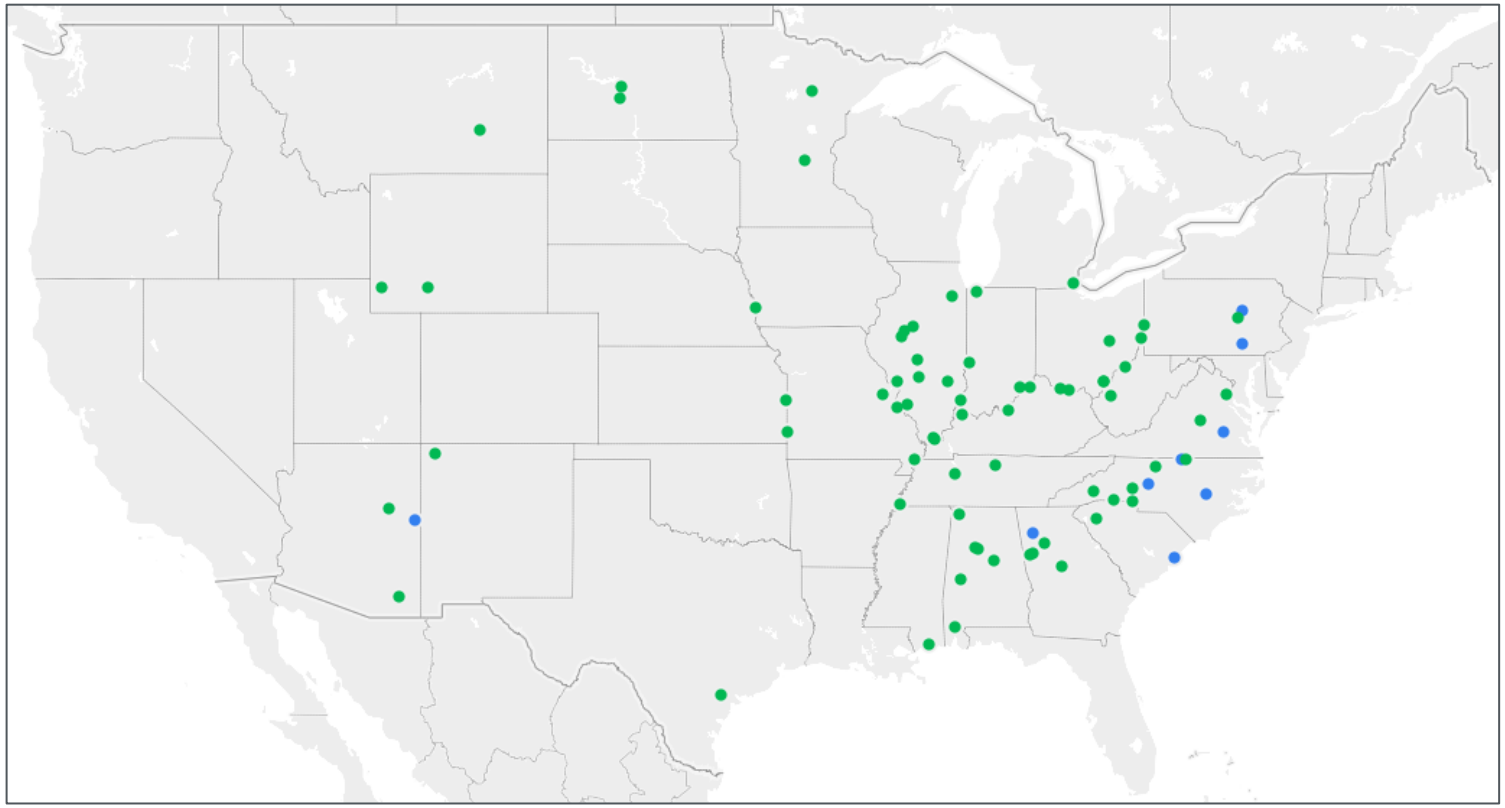
Fly ash harvesting will help in the Eastern Midwest and parts of the Southeast, but that's mostly it

Supply

Fly ash ponds with >2M MT of reserves* (2022)



- Not all ponds are viable: fly ash quality is not well documented
- Maximum inclusion rate of ~20% with PLC
- Fly ash landfills may be reopened over time – but speculative for now
- Very little potential West of the Mississippi, in the Northeast or in Florida

Notes: * Excludes landfills, gypsum, bottom ash, or any pond with less than 2M metric tons of reserves
Source: Earthjustice; Company websites; L.E.K. research and analysis

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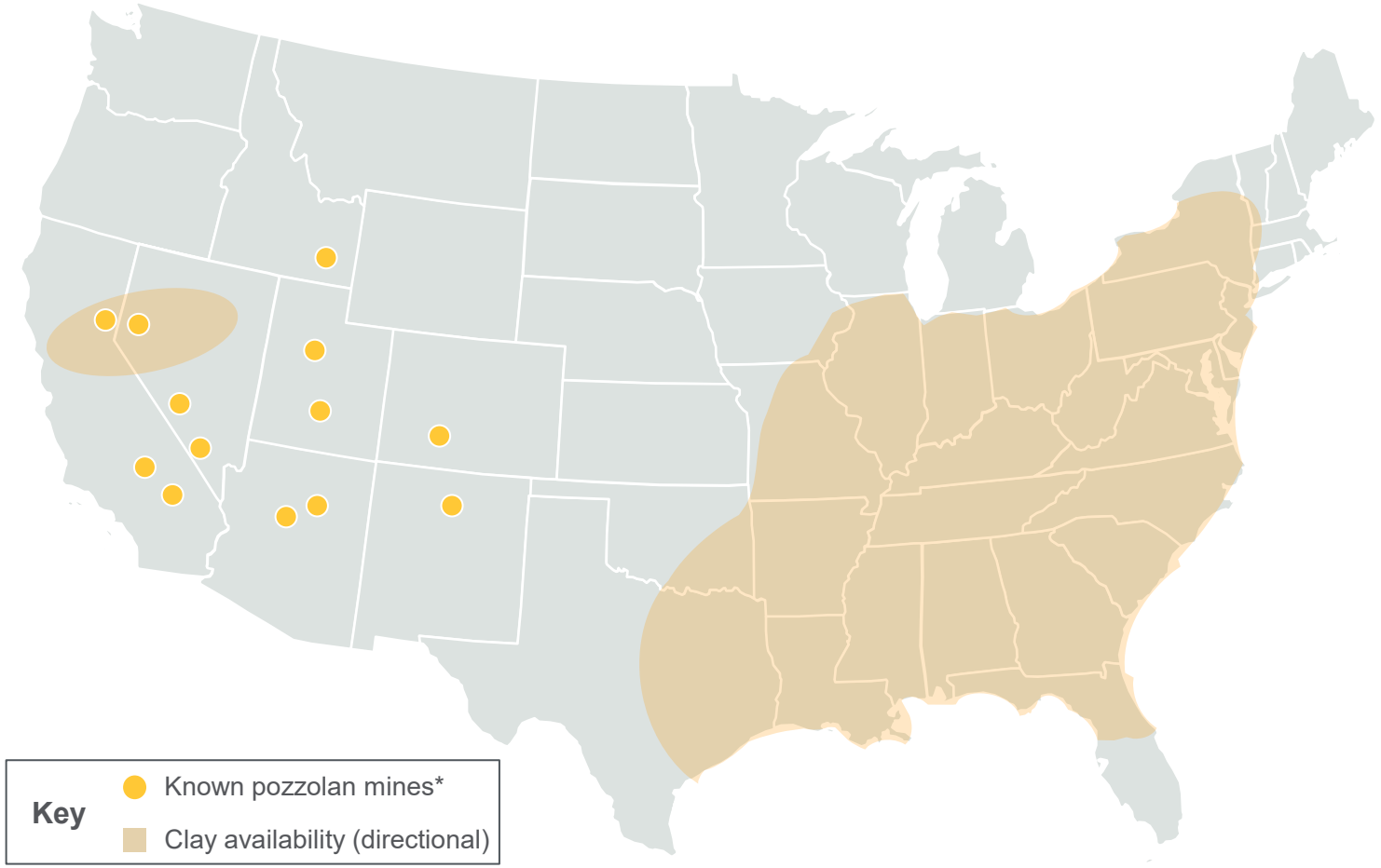
Natural pozzolans offer opportunities in the West, while clay is available in much of the Eastern U.S.

Supply

Known U.S. pozzolan* and clay locations (2023)



Pozzolans

- Natural pozzolans are **widely available in the Western U.S.** and relatively inexpensive to extract
- Pozzolanic reactivity levels and water demand can **limit their inclusion potential**

Calcined clay

- Clay has **significant potential in the Eastern U.S.**, and can achieve cement substitution rates higher than those of fly ash or typical natural pozzolans
- However, the **capex required** for flash calciners in the U.S. makes calcined clay **challenging**

Notes: * Does not include permitting quarries
Source: Kline Consulting; USGS; L.E.K. research and analysis

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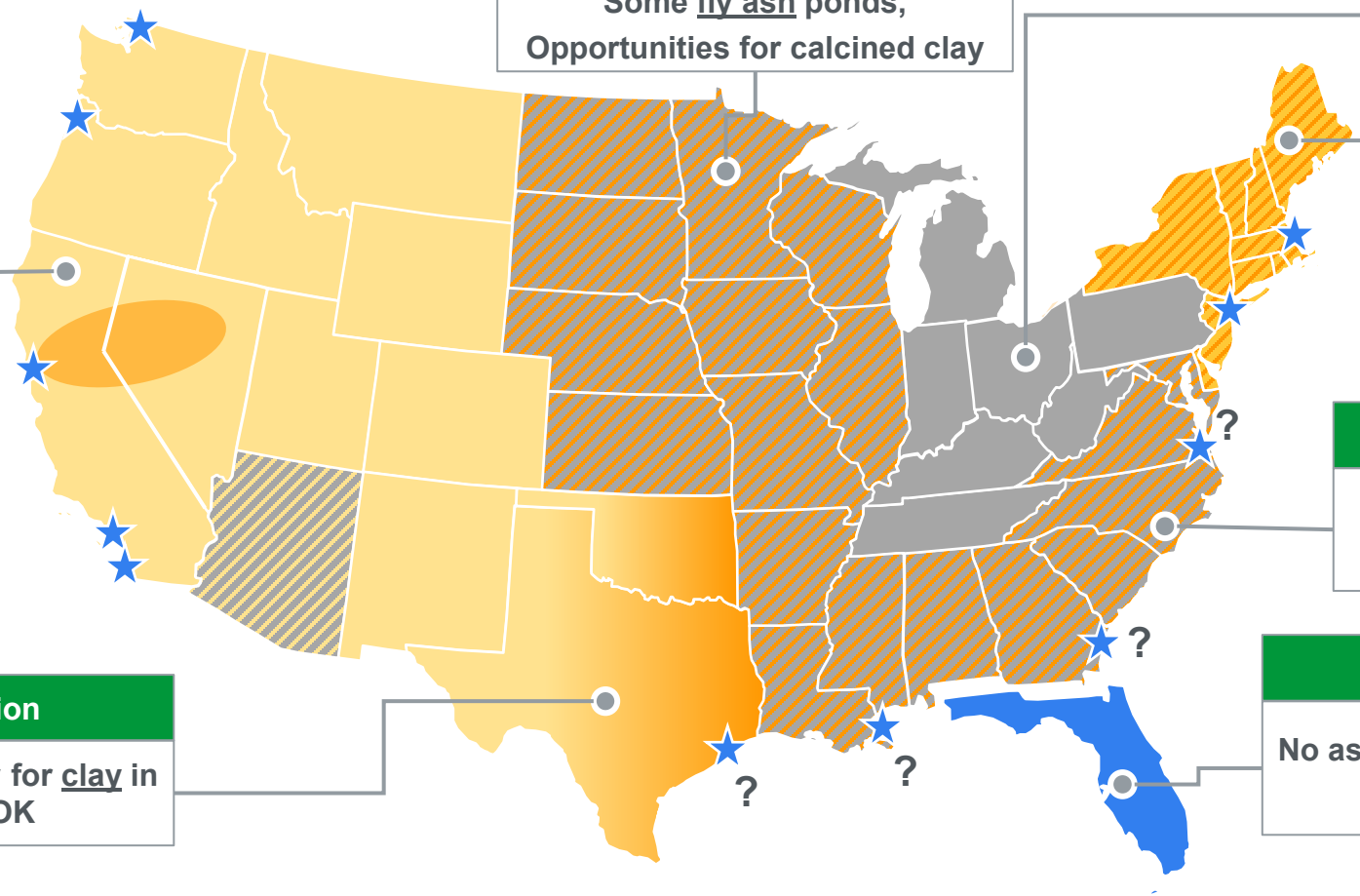
Overall, supplying this volume of SCMs will be challenging, and creates a wide range of different opportunities – domestically and for imports

Supply



West

Lots of pozzolans – some good, some bad

Some clay, not much ash

High import needs

River / Upper Midwest

Some fly ash ponds,

Opportunities for calcined clay

Eastern Midwest

Lots of fly ash ponds

Northeast

Some clay potential

High import needs

Southeast / Mid-Atlantic

Prime region for harvested ash

Best clay deposits in the U.S.

Florida

No ash, clay or pozzolan: prime import market

Texas region

Prime opportunity for clay in East TX, OK

Primary sources of new SCMs: Pozzolans | Clay | Harvested FA | Imports

Key import opportunities: ★

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So, what could go wrong? A lot. And most of it isn't about product strength or production issues.

Risks

Supply / demand issues

- SCM markets are **up to 5 times smaller than cement ones**, and SCMs can have **much more volatile prices** than cement
- Demand in many local markets is **overheated** or inflated by a single large project
- Many new capacity projects are **not yet public**
- One of two coal plant generators closing does **not** mean a 50% reduction in fly ash production

Go-to-market issues

- **Water demand**, **freeze/thaw resistance**, and **initial set times** can be as important to customers as strength
- Many RMX plants only have **2 silos available**
- **Vertically-integrated or affiliated operators** are unlikely to purchase from a new supplier
- **Blended cements** may be preferred – or not

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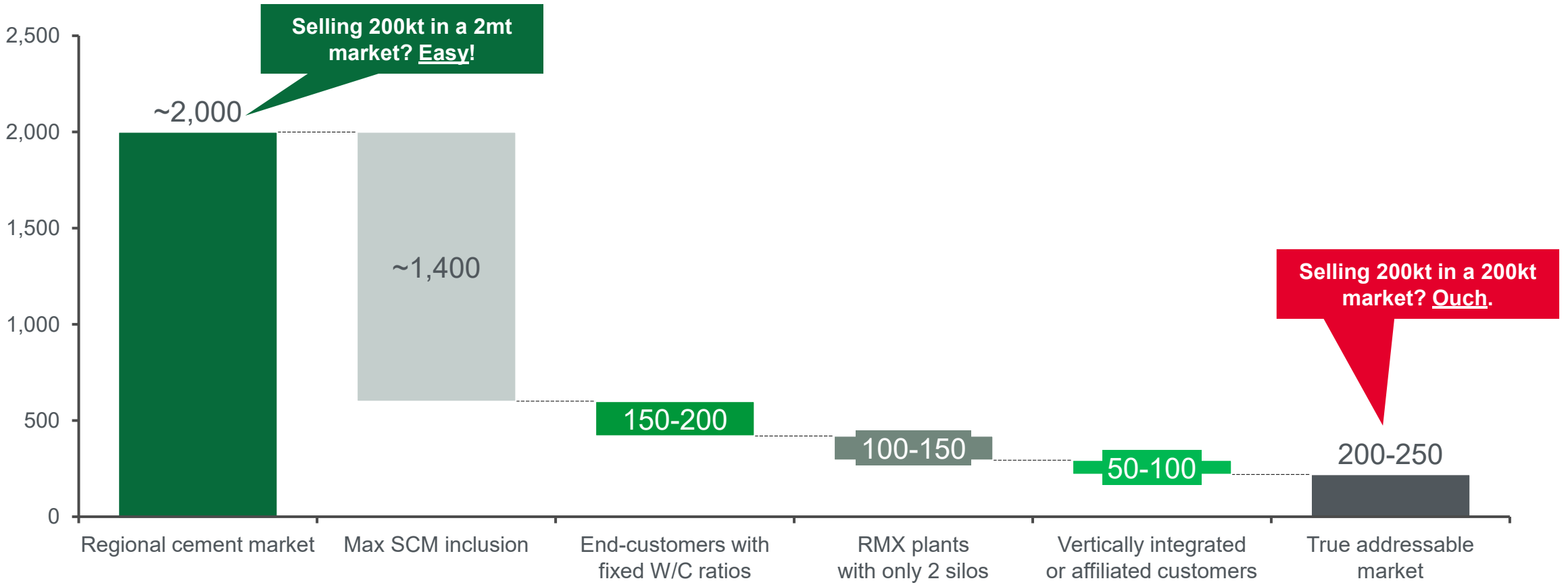
Smaller-than-expected addressable markets + volume commitments with suppliers (utilities, steel mills) = recipe for pricing fireworks

Risks

Illustrative

Stages of grief of a new 200kt SCM project

Thousands of metric tons



Source: L.E.K. research and analysis

All of these risks can be remediated

Risks

Supply / demand

- ✓ Understand **realistic demand prospects** of regional markets
- ✓ Understand the current environment: **what is being sold, by whom, at what price**?
- ✓ Understand the **realistic effects of coal generator closures**
- ✓ Gather market intelligence on **competitive projects** and **potential competitive threats** (economics of a potential new project)

Go-to-market

- ✓ **Map out the potential customers**, their volumes, and ownership
- ✓ **Gauge their interest** in a new product – **blended or straight**
- ✓ Understand the **needs of customers and end-users** by segment (resi, non-resi, DoT, other infra)
- ✓ **Count the silos** (thank you, Google Maps) and assess the **economics of silo-leasing options** if need be

Clear-eyed view of 1. How much can be sold 2. To whom 3. At what price 4. How (blended/straight)

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