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Non-Agricultural markets for nitrogen

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TFI Outlook and Technology Conference

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The secret life of nitrogen

Nitrogen has a diverse and often prosaic range of uses outside of agriculture

Agenda

- How big is the market?
- Global breakdown and key industrial applications by nitrogen product
- North American breakdown
- Focus on industrial urea and DEF in North America

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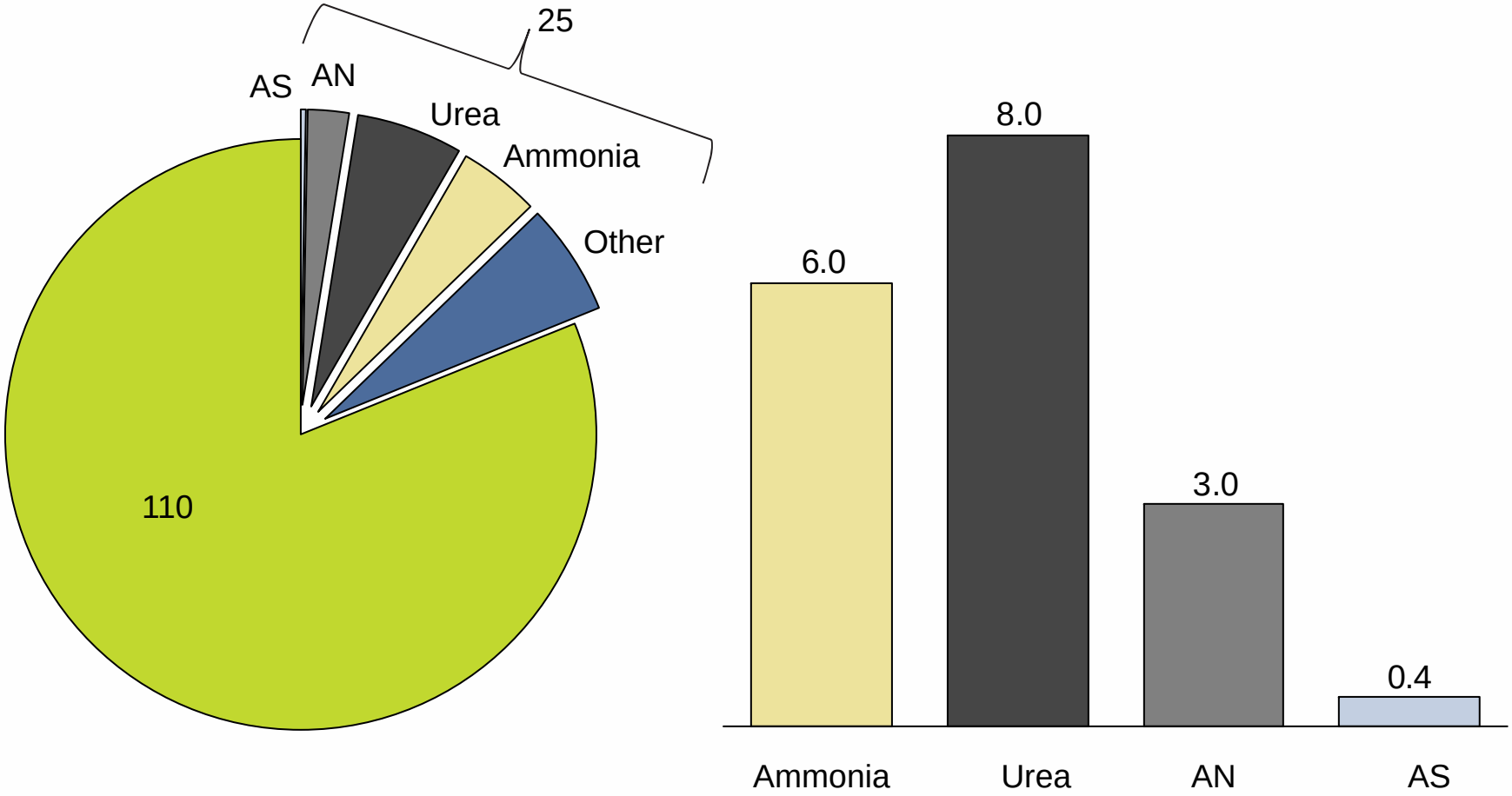
Global Non-agricultural N Market size and breakdown

Non-Agricultural demand historically has accounted for 18% of total nitrogen consumption globally

Agricultural and non-agricultural nitrogen usage by product, Million N tonnes, 2012



Source: IFA, Integer

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Global ammonia breakdown and industrial applications

Non-agricultural demand accounts for roughly 20% of global net ammonia consumption – 7 million product tonnes, with a broad range of applications

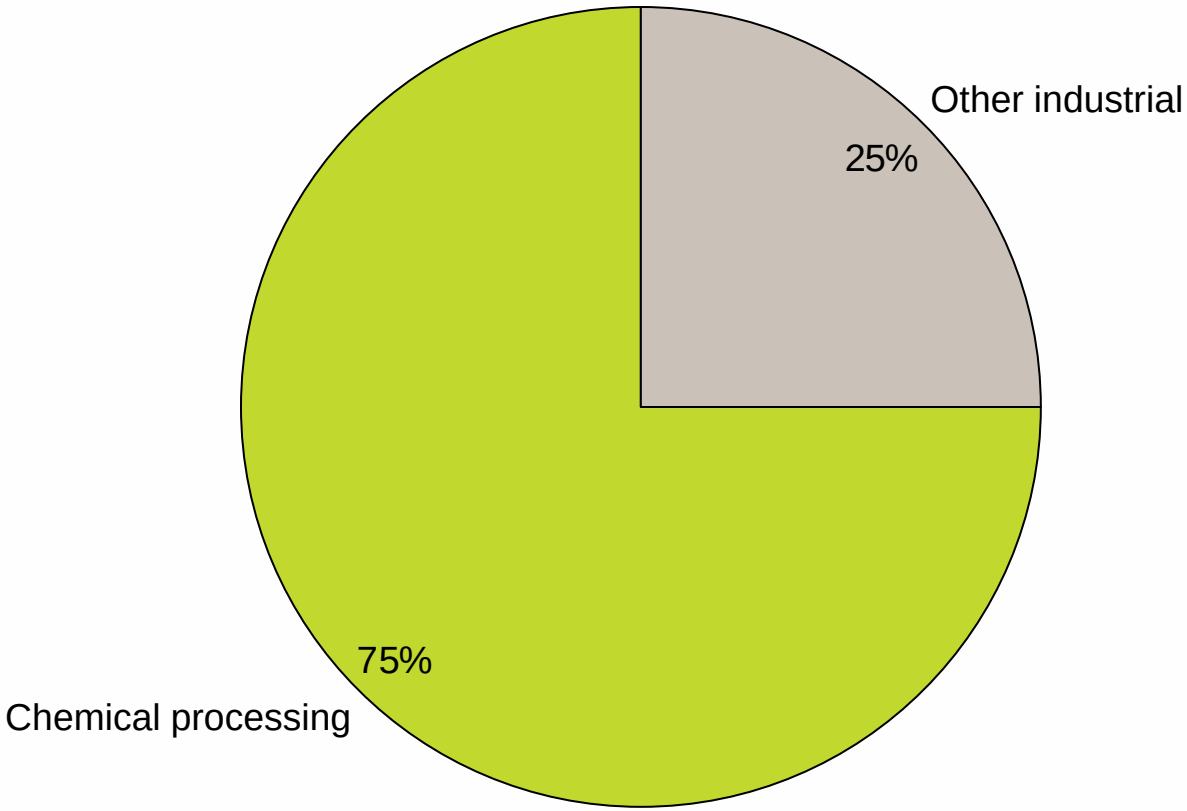
Industrial applications for Ammonia

Industry	Applications
Chemical processing	Manufacture of textiles and plastics through the use of acrylonitrile (ABS) and caprolactam (Nylon)
Power generation	NOx abatement – stationary
Food and beverage manufacturing, petrochemical industries, IT	Refrigeration/ cooling
Metallurgy	Metal treatment - nitriding, annealing etc
Water and wastewater treatment	pH control
Petroleum industry	Neutralising acid constituents of crude oil and protection of equipment from corrosion
Metals and Mining	Extraction of metals such as copper, nickel and molybdenum from their ores
Rubber industry	Stabilization of natural and synthetic latex to prevent premature coagulation
Pulp & paper industry	Pulping wood and as a casein dispersant in paper coating
Leather industry	Curing agent

Source: Integer

We estimate that 75% of industrial ammonia consumption is for chemical processing

Non-agricultural net ammonia usage, Million tonnes, 2012



7 million tonnes

- Ammonia used for the production of caprolactam - for the manufacture of nylon – and acrylonitrile - for the production of ABS plastics – accounts for the lion share of industrial ammonia demand. Approximately 7 million tonnes.
- The next largest area of usage is NOx abatement for industrial activity.

Source: IFA, Integer

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Global urea breakdown and industrial applications

Industrial demand accounts for around 11% of urea consumption worldwide, around 18 million product tonnes

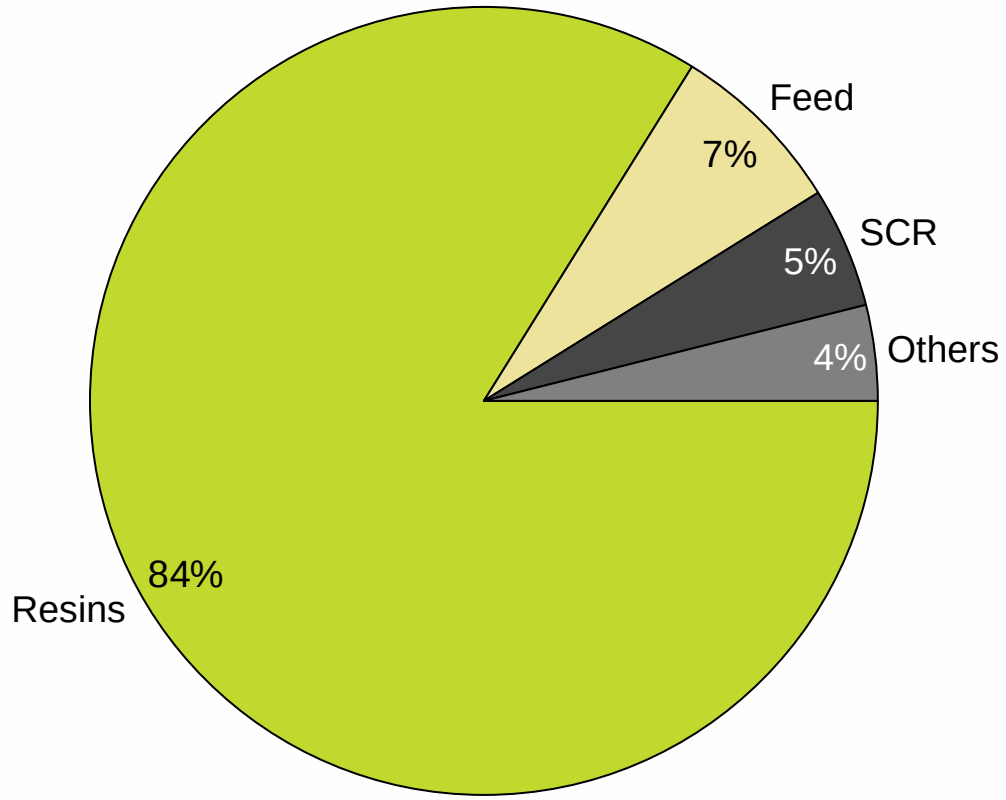
Industrial applications for urea

Industry	Applications
Wood-working	Resins and adhesives
Chemical processing	Melamine
Automotive and Industrial pollution controls	Environmental controls
Medicine and cosmetics	Hydrazine
Water treatment	Cyanuric acid
Specialty fertilizer	Foliar applications

Source: Integer

UF and MUF resins represent just over 80% of the industrial urea market globally

Non-agricultural urea usage, Million tonnes , 2012



18 million tonnes

- Just over 80% of consumption is represented by resins. UF and MUF resins are used by the wood-working industry as adhesives and glues in furniture and buildings.
- The second largest use for urea in industrial applications is as a protein supplement in animal feed
- Growing fast, the third use is as urea solution or AUS 32 in SCR-equipped vehicles, targeted at lowering NO_x emissions from on and off –highway vehicles, as well as from stationary sources such as power stations, cement factories and industrial boilers and incinerators. SCR is also a good choice to meet 2014 GHG targets.
- Other uses include pharmaceuticals and other minor segments.

Source: IFA, Integer

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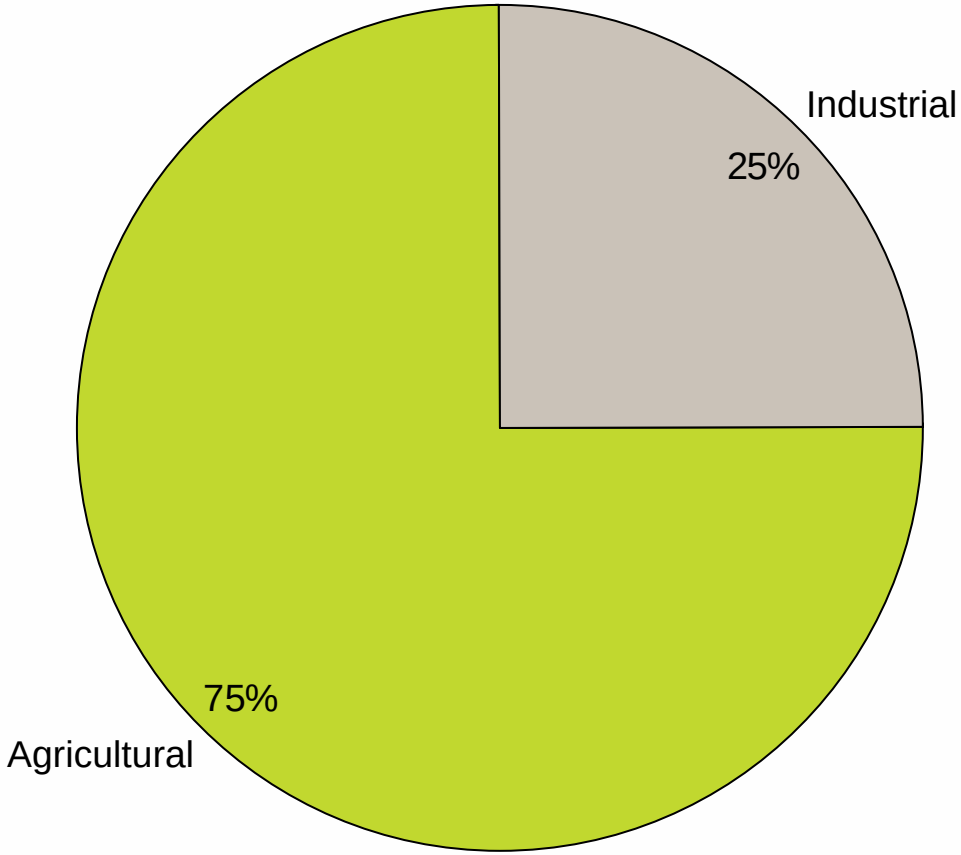
Global AN breakdown and industrial applications

Non-agricultural demand for AN accounts for around 25% of total demand, 10 million product tonnes, and is primarily consumed by the mining sector for explosives

Agricultural and non-agricultural AN usage, Million tonnes, 2012



39 million tonnes

- Ammonium nitrate is the main component of an explosive Ammonium Nitrate Fuel Oil. It is an explosive mixture which is used widely in mining.
- ANFO is composed of 94%ammonium nitrate and 6% fuel oil. The ammonium nitrate serves as the oxidizing agent for the fuel.

Source: IFA, Integer

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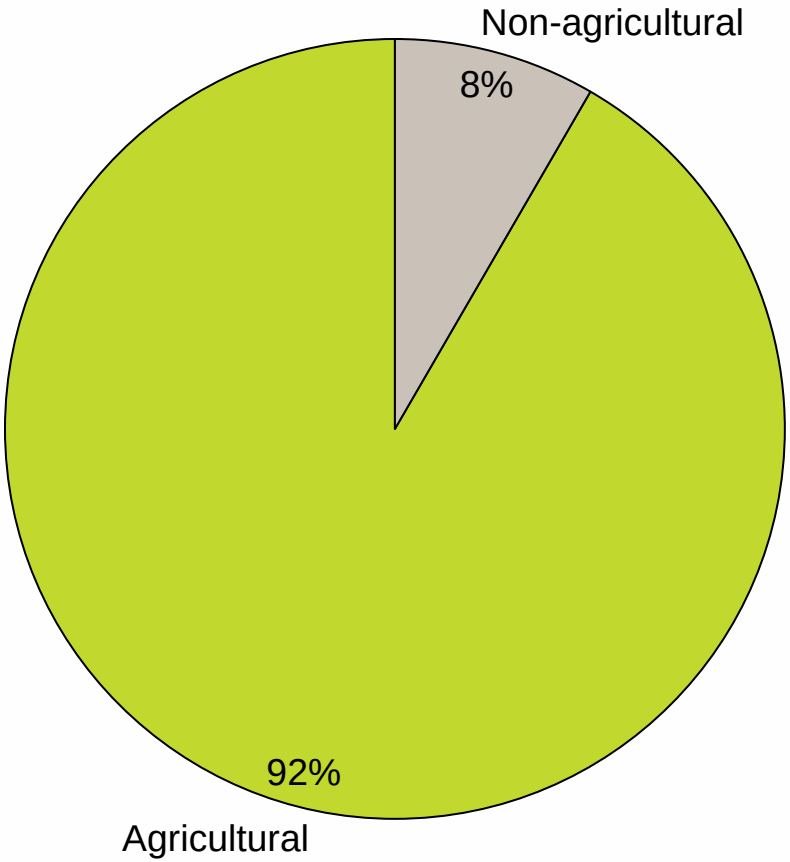
Global AS breakdown and industrial applications

Industrial demand for ammonium sulphate comprises less than 8% of total consumption, around 2 million tonnes

Agricultural and non-agricultural AS usage, Million tonnes, 2012



22 million tonnes

Industrial applications for AS

Industry	Applications
Food and beverages	Food additive as an acidity regulator in bread and flour
General manufacturing and industrial	Used as a flame retardant
Healthcare	Used as an ingredient in vaccines to fractionate complex protein mixtures

Source: IFA, Integer

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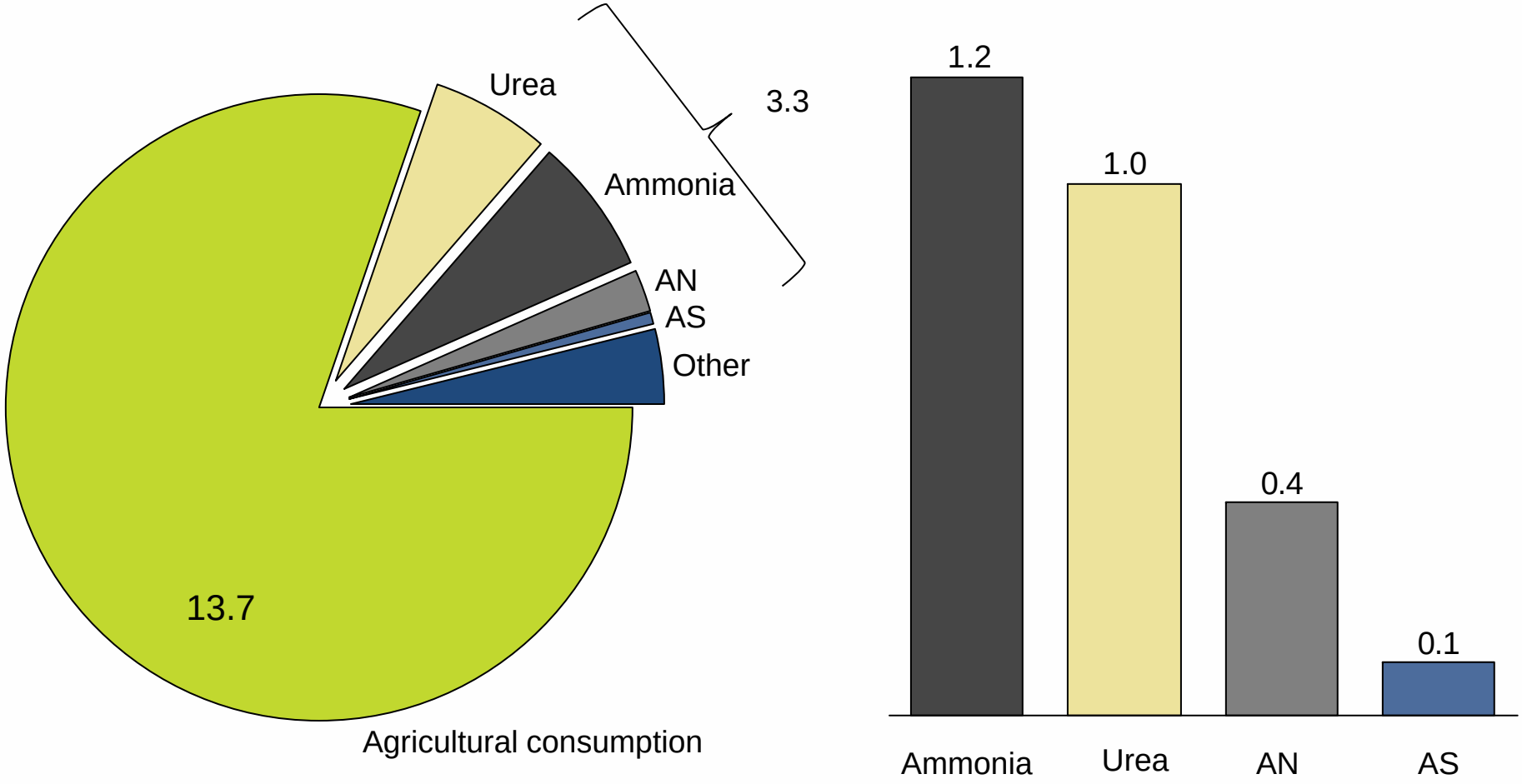
Non – agricultural nitrogen market in North America

In North America industrial demand for nitrogen accounts for around 20% of total demand

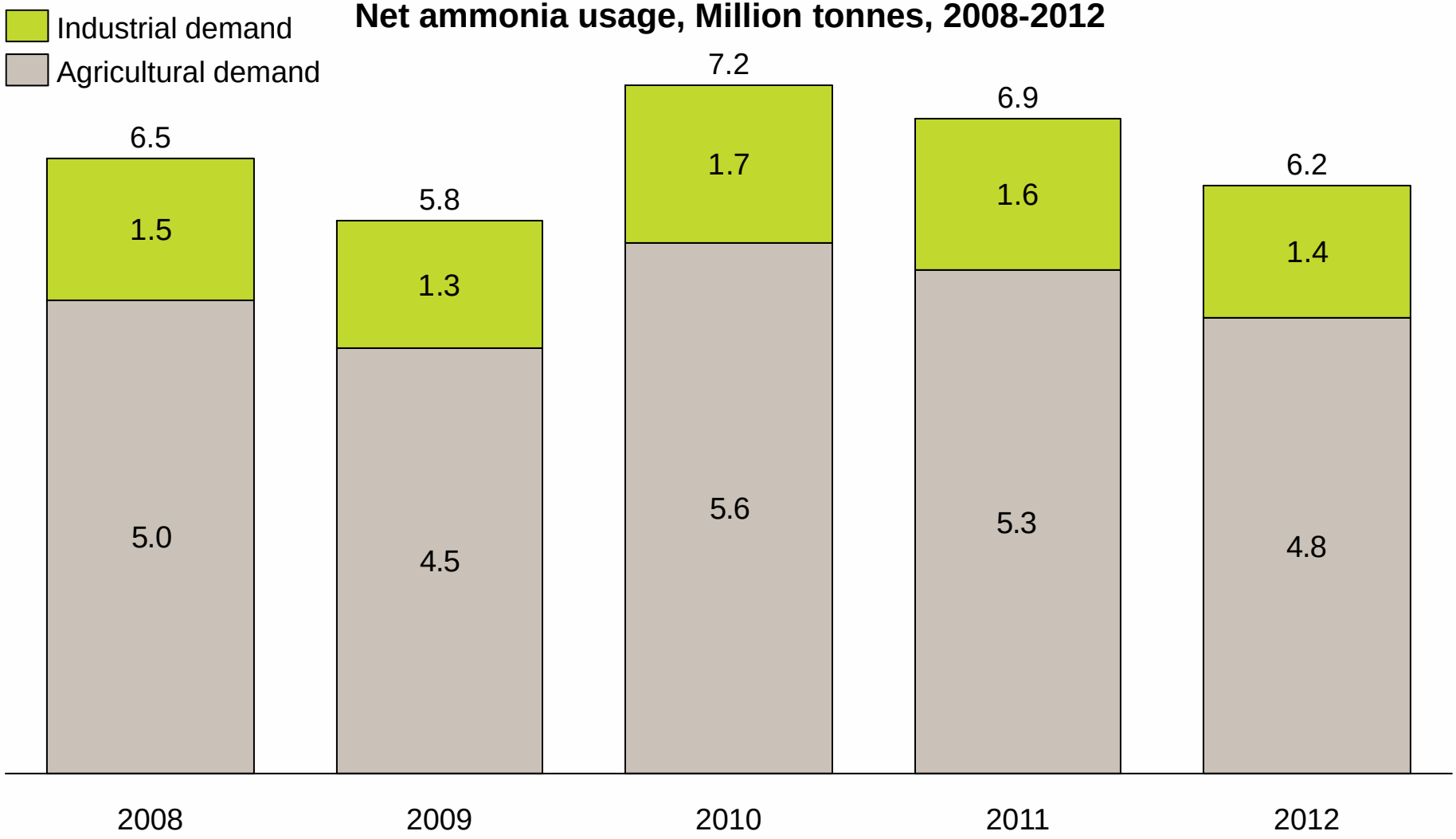
Agricultural and non-agricultural nitrogen usage by product, Million N tonnes, 2012



Source: IFA, Integer

We estimate that industrial demand accounts for 23% of all net ammonia consumption in North America

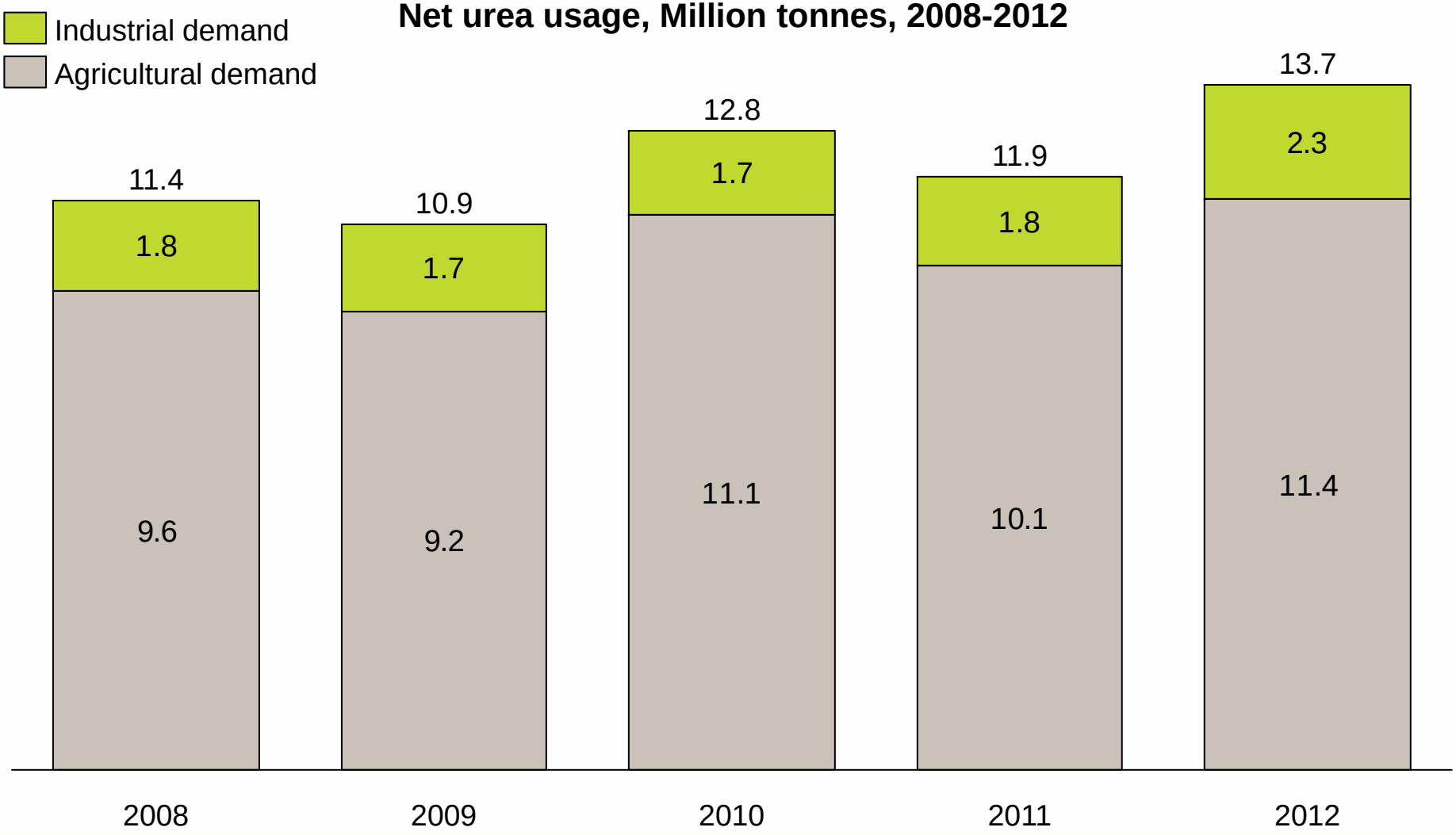
Net ammonia usage, Million tonnes, 2008-2012



Source: IFA, Integer

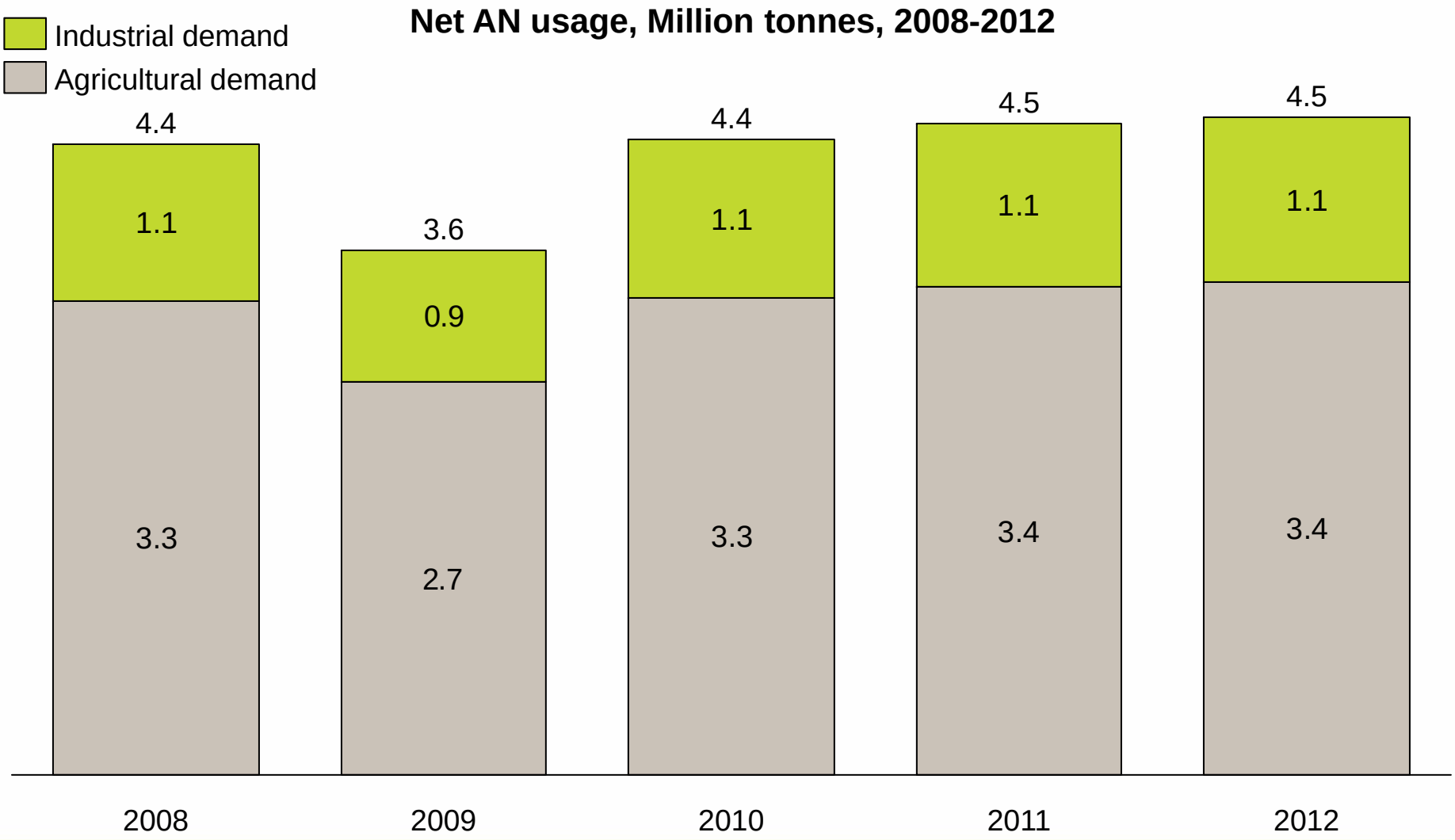
We estimate that industrial demand accounts for 17% of all net urea consumption in North America

Net urea usage, Million tonnes, 2008-2012



Source: IFA, Integer

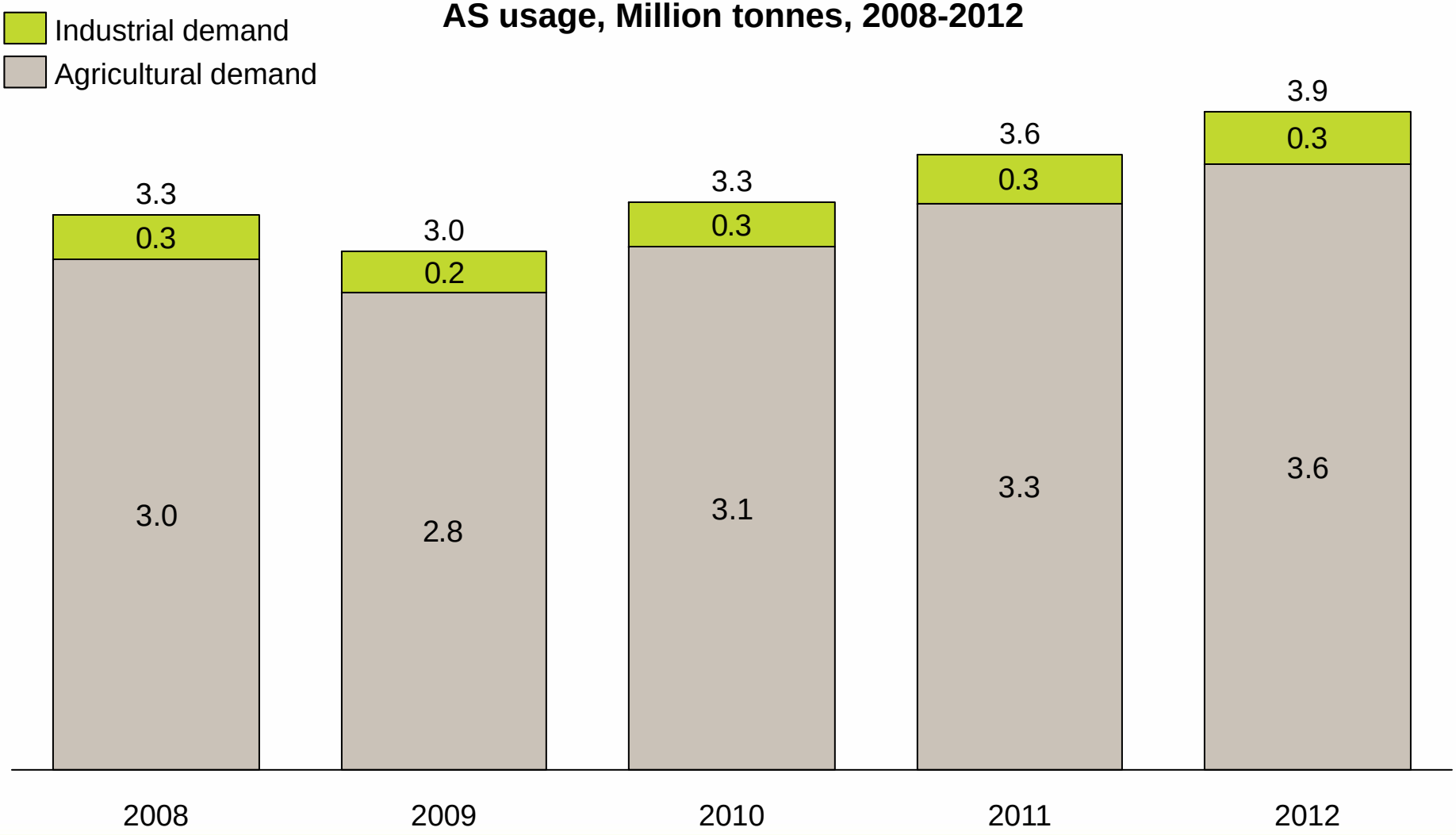
We estimate that industrial demand accounts for 25% of all net AN consumption in North America



Source: IFA, Integer

We estimate that industrial demand accounts for 8% of all AS consumption in North America

AS usage, Million tonnes, 2008-2012



Source: IFA, Integer

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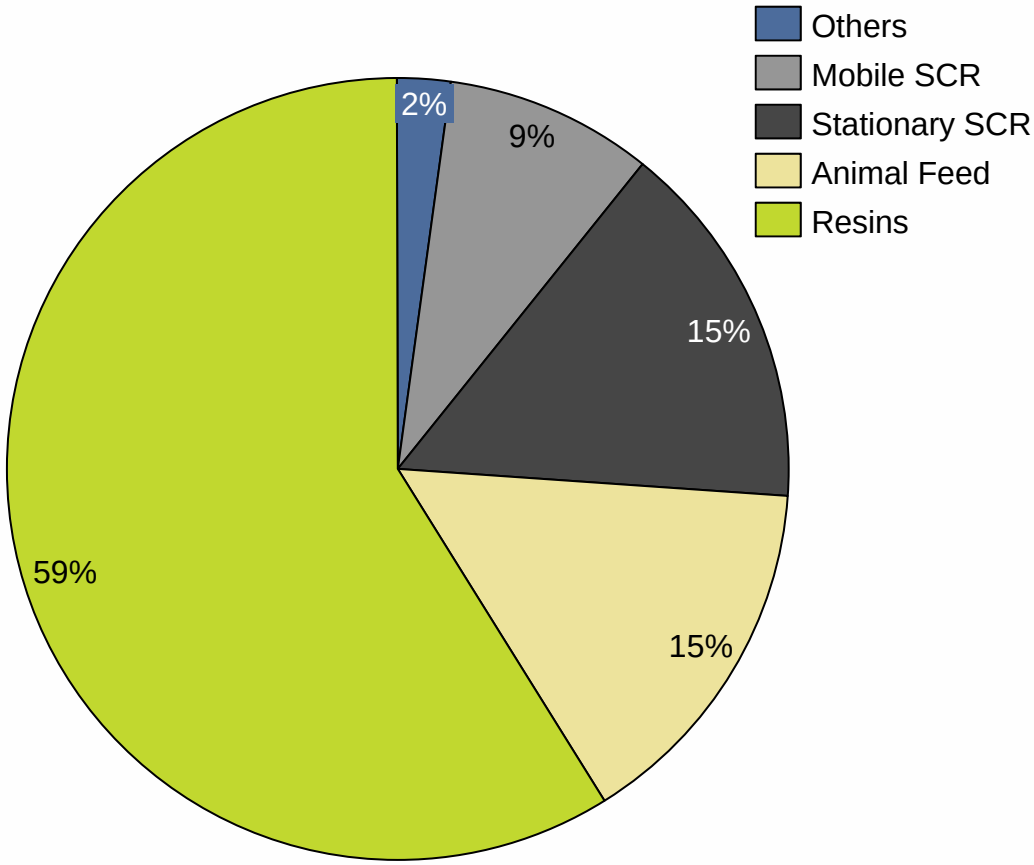
Focus on urea and DEF

In North America, the share of resins has shrunk since the peak of urea consumption in 2006/2007. Environmental use is the fastest growing

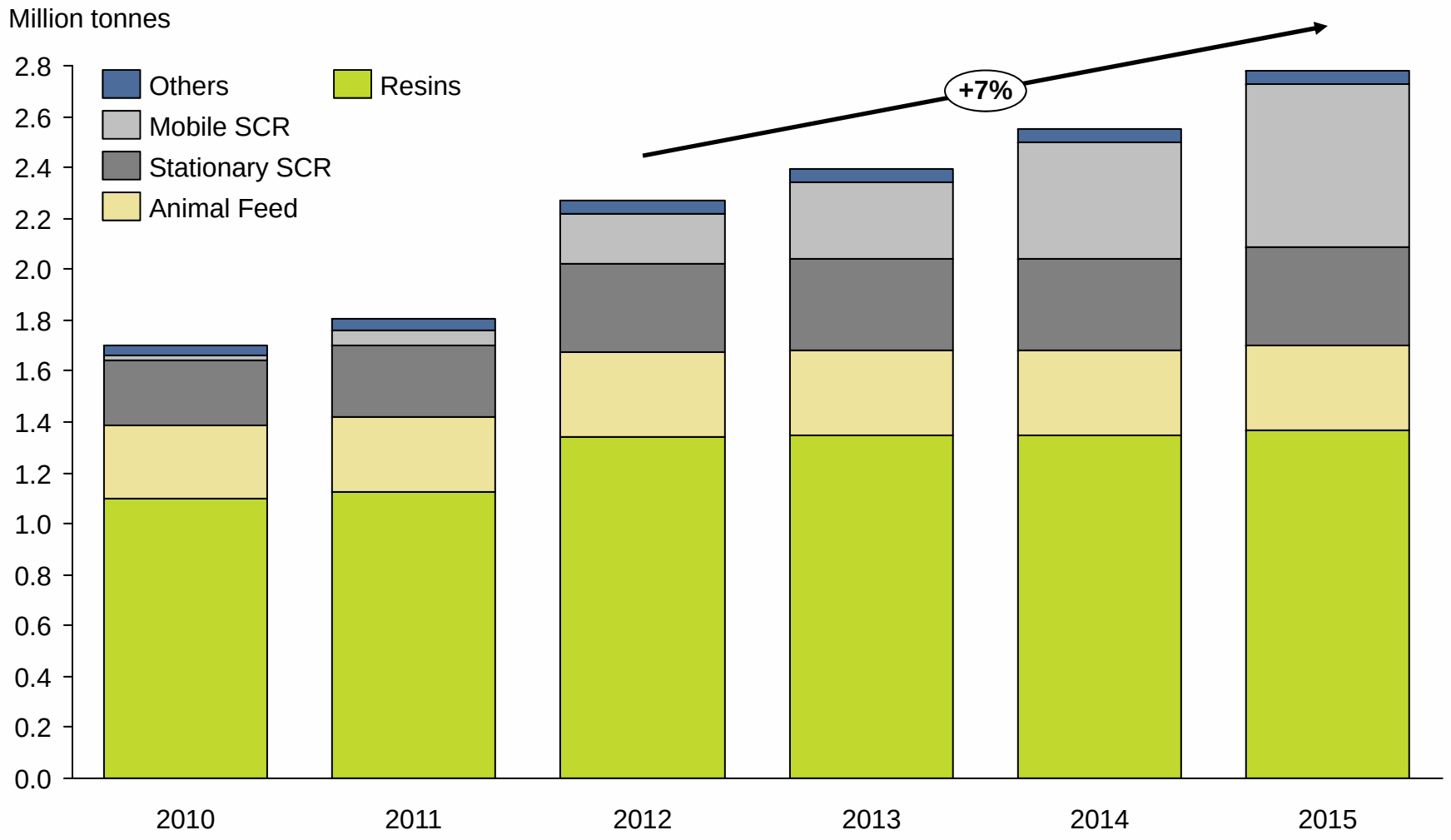


2012: 2.3 million tonnes

- Resins and glues/adhesives used to represent 80% of the market for industrial-grade urea in North America before the recession of 2008/2009 took hold of the building and construction industries, prompting a major step change in consumption for these products.
- Demand for all types of resins, adhesives and sealants used in the building and construction sectors peaked in 2006-2007, with the abrupt end of the housing boom and has shrunk dramatically since 2008 and 2009, in some extreme cases even by as much as 50% in some areas of the region, and at least by 30% in others.
- SCR applications - stationary and mobile - are now a larger segment for urea consumption and represent around 24% of the market. Cattle feed comes in at around 15% and pharmaceuticals and others at 2% - with pharmaceuticals accounting for around 1.4%.

Source: IFA, Integer

Environmental uses are likely to continue to drive industrial urea growth in North America but resins have recovered with the economy



Source: IFA, Integer

Influencing factors for environmental uses: legislation

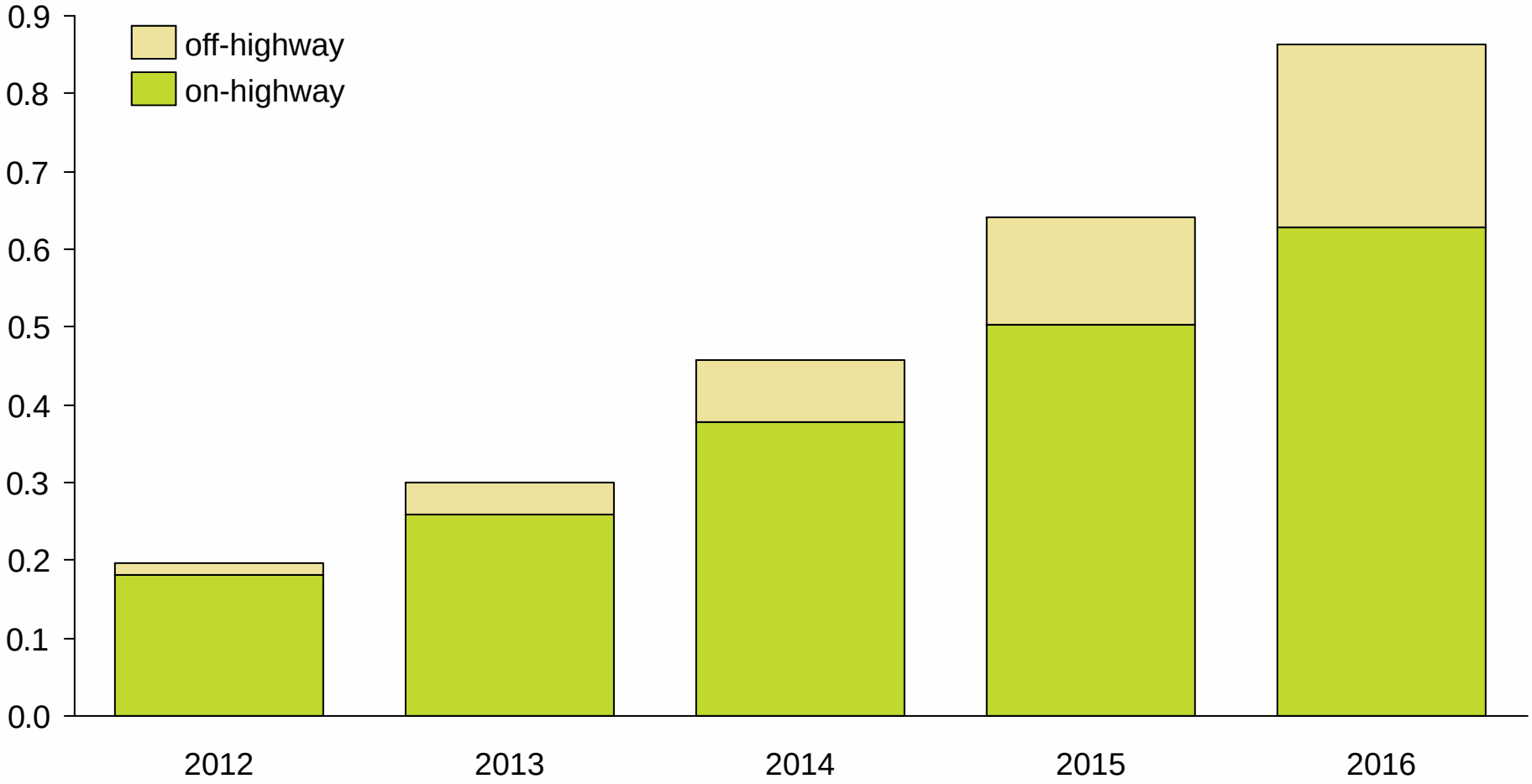
NOx Abatement Legislation timeline (USA)

Application	Legislation	Targets	Start date
ON-HIGHWAY APPLICATIONS	Use of DEF compulsory to reduce NO_x emissions	New heavy-duty vehicles	EPA 2010 - January 2010
OFF HIGHWAY APPLICATIONS	Reduction of NO_x and other pollutants	Ag/construction and mining machinery	Transition 2010-2014 from T4 interim to T4 final
STATIONARY APPLICATIONS	NO_x and mercury emissions reduction	Power plants	'Transport Rule' approved 2010 and aiming to reduce NO_x emissions by 52% by 2014
	NO_x and mercury emissions reduction	Cement factories	Approved 2010 to reduce mercury, soot, smog and NO_x emissions. Comes into effect 2013
	NO_x and mercury emissions reduction	Industrial boilers and waste incinerators	Approved 2011 to establish work practice standards. Public review closing July 2011
MARINE APPLICATIONS	Reduction of NO_x and other pollutants	Ships and ocean-going vessels	US EPA Tier 4 from 2016 for US flagged vessels

Source: U.S. EPA, Integer

Urea demand for use in DEF is forecast to rise with the off-highway sector expected to rise sharply

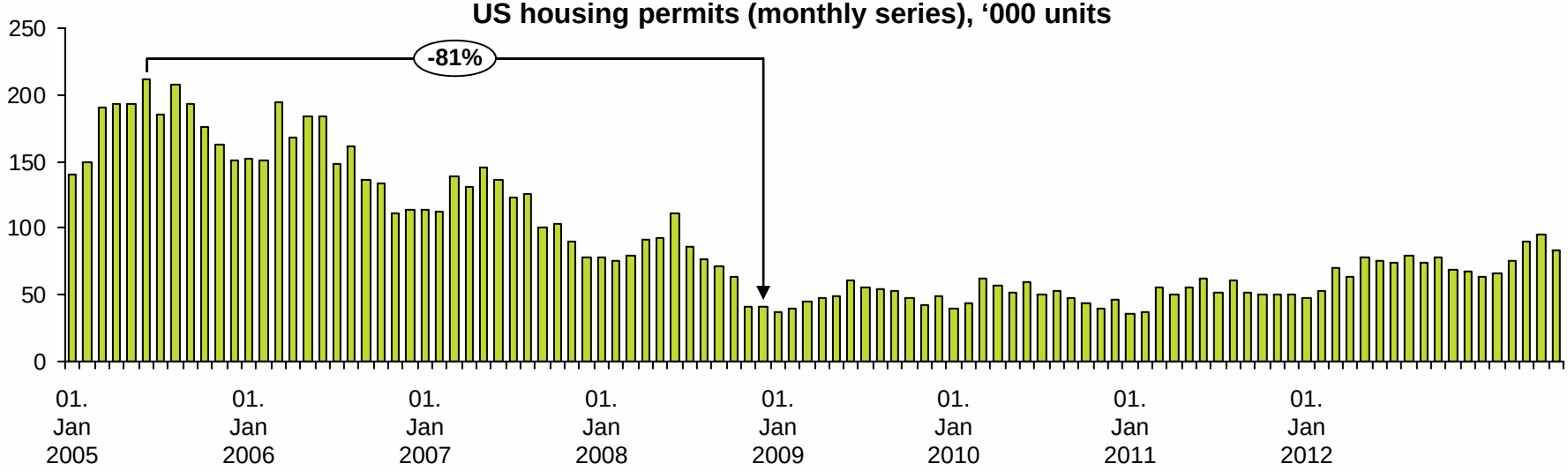
Urea consumption for use in DEF in North America, Million tonnes



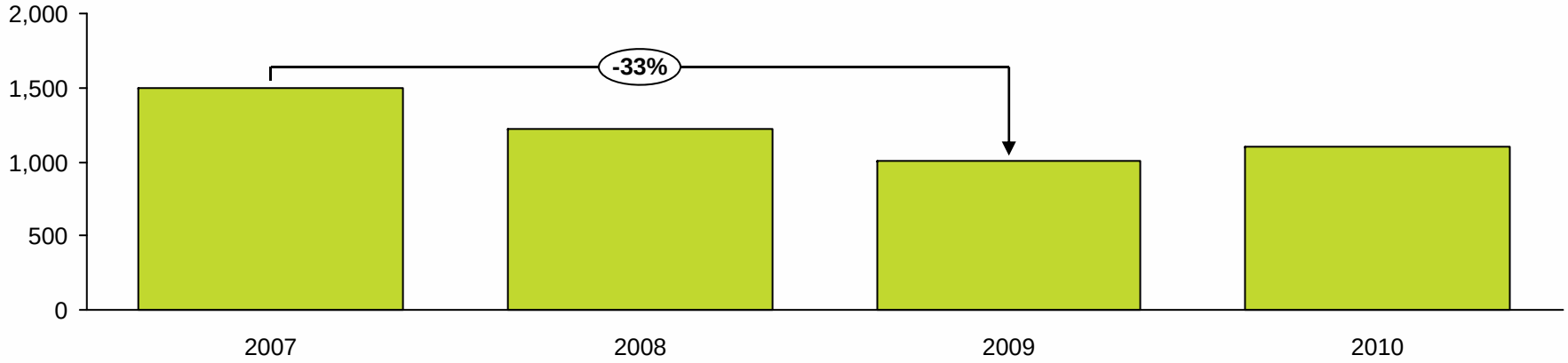
Source: Integer

The shift in market structure towards environmental uses for urea has also been in part due to a fall in consumption into resins falls in 2008-2009 as housing starts collapsed following the financial crisis

US housing permits (monthly series), '000 units



Urea consumption into resins, '000 tonnes

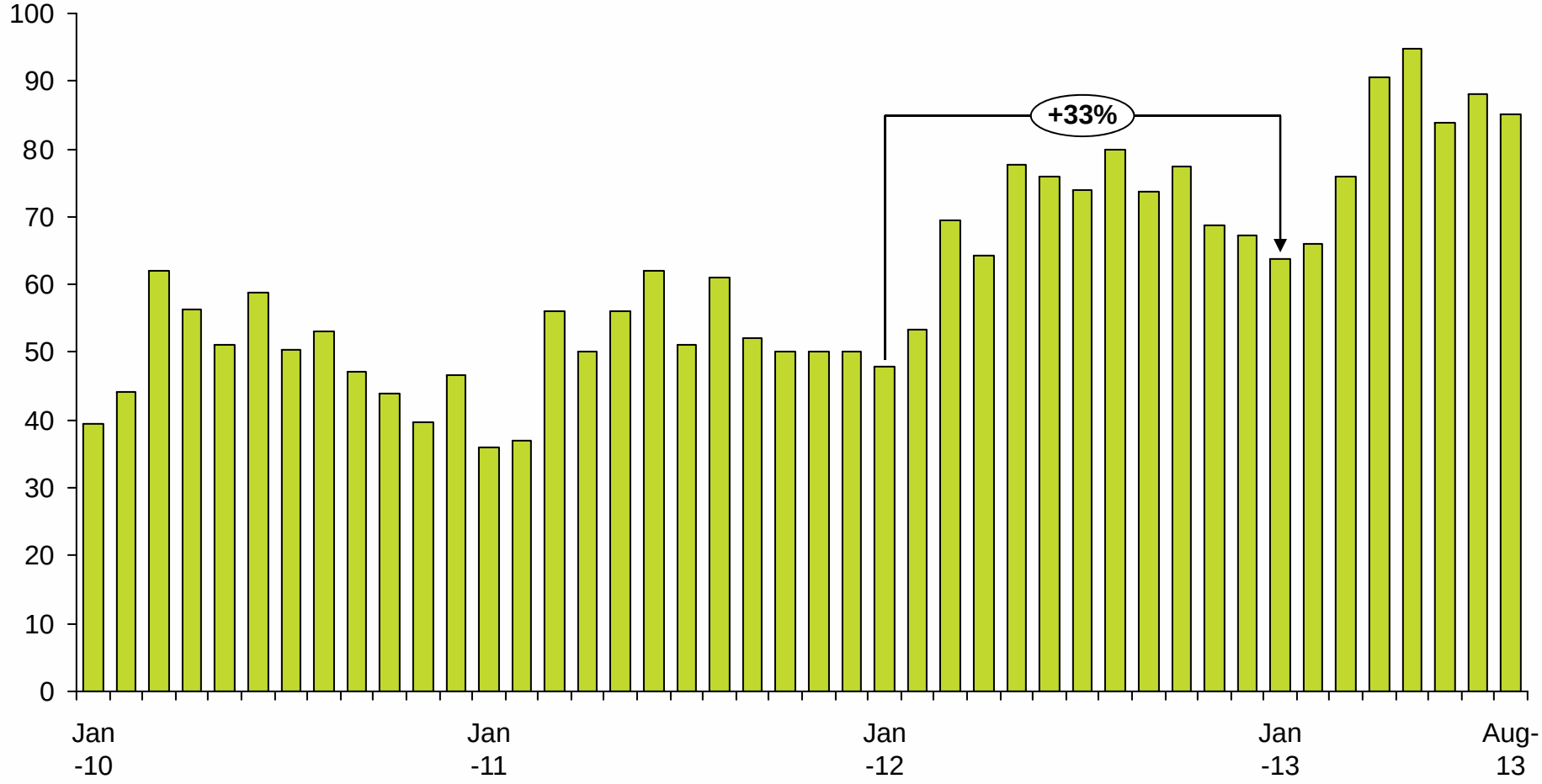


Source: US Census Bureau, Integer

Source: IFA, Integer

However, there has been a strong revival in housing permits in 2012, continued into 2013, how will this affect resin demand going forward?

US housing permits (monthly series), '000 units



Source: US Census Bureau, Integer Industrial Urea Market Report

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Thank you!

For more information:
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Data and analysis from:
Nitrogen Cost & Profit Margin Service
Industrial Urea Market Survey
AdBlue & DEF Monitor/DEF Tracker
The Emerging DEF Market