Best Practices For Production and Distribution Of AdBlue

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Emission Control Technology for Sustainable Growth
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NPL BlueSky Automotive

Pioneer of AdBlue Manufacturing in India. Plant established in 2011.

NPL BlueSky Automotive Pvt Ltd is a Technical Joint Venture between Nandan Petrochem Ltd (NPL) and KRUSE Automotive GmbH, Germany.

Manufacturing plant is in Silvassa near Gujarat.
The plant is imported from Germany and is same being used all over the world by KRUSE. It is patented by KRUSE and is certified by German Automobile Association "VDA" to produce AdBlue meeting ISO 22241 standards.

The objective of setting up this company is to supply AdBlue to Automotive OEMs in India for their first fill as well as aftermarket requirement.

NPL BlueSky Automotive
Technical JV between Nandan Petrochem and KRUSE Automotive GmbH, Germany

KRUSE Automotive GmbH

KRUSE Automotive is a part of the Stockmeier Group which was founded in 1920

Stockmeier Group turnover is about €1.25Bn, of which KRUSE accounts for roughly 20%

Kruse Automotive has a market share of about 25% in the German AdBlue market

KRUSE offers custom-made filling solutions (packaged and dispensing) and
In house fleet of tank trucks for timely supplies of bulk deliveries

Contents

- Manufacturing
  - Manufacturing processes
  - Specification of AdBlue, Urea and De-Ionized water
  - Storage and handling of AdBlue
- Distribution
  - Evolution of AdBlue distribution in Europe
  - Distribution possibilities in India
  - Dispensing solutions
  - IT linkages to distribution network
- Opportunities and Potential
  - Consumption pattern
  - AdBlue potential
  - Opportunities and Challenges

Manufacturing Processes

- The two most widespread production processes for AdBlue are :

1. ***Integrated process:***

   Dilution of 'Hot-melt virgin urea' in pure water. The molten urea before the prilling stage is mixed with pure water to produce AdBlue.

2. ***Non-integrated process:***

   Dissolving solid urea (also known as urea prills) in de-ionized water using agitating dissolvers at a location close to where AdBlue is needed.

- There is no difference in the quality of the AdBlue obtained through the above two processes.
- To comply with the ISO 22241 standard specification for the AdBlue product, meticulous quality inspections are undertaken throughout the entire chain of production - from the raw material to the final product.

Urea Policy – India

- Fertilizer urea is subsidized by the Govt of India
- Reimbursement of losses by the Govt.
- Subsidies and low interest loans provided for plant and machinery procurements
- India is a net importer of urea.
- Urea manufacturers in India have to necessarily sell urea only for fertilizer applications.
- Integrated AdBlue manufacturing at urea plants does not seem possible in the current situation.
- AdBlue dissolving plants will be the way ahead to make AdBlue available in India.
- AGU needs to be imported from International markets which are having surplus capacity and will be able to cater to Indian AdBlue requirements.

AdBlue Specification

Characteristics	Unit	Limits		Test methods
		min.	max.	
Urea content [a]	% (m/m) [d]	31,8	33,2	ISO 22241-2 Annex B [e] ISO 22241-2 Annex C [e]
Density at 20 °C [b]	kg/m^3	1 087,0	1 093,0	ISO 3675 or ISO 12185
Refractive index at 20 °C [c]	—	1,381 4	1,384 3	ISO 22241–2 Annex C
Alkalinity as NH_3	% (m/m) [d]	—	0,2	ISO 22241–2 Annex D
Biuret	% (m/m) [d]	—	0,3	ISO 22241–2 Annex E
Aldehydes	mg/kg	—	5	ISO 22241–2 Annex F
Insoluble matter	mg/kg	—	20	ISO 22241–2 Annex G
Phosphate (PO_4)	mg/kg	—	0,5	ISO 22241–2 Annex H
Calcium	mg/kg	—	0,5	ISO 22241–2 Annex I
Iron	mg/kg	—	0,5	
Copper	mg/kg	—	0,2	
Zinc	mg/kg	—	0,2	
Chromium	mg/kg	—	0,2	
Nickel	mg/kg	—	0,2	
Aluminium	mg/kg	—	0,5	
Magnesium	mg/kg	—	0,5	
Sodium	mg/kg	—	0,5	
Potassium	mg/kg	—	0,5	
Identity	—	identical to reference		ISO 22241–2 Annex J

Urea Specification

Characteristics	Limit: Fertilizer Grade Urea (IS: 5406)	Limit: Automotive Grade Urea (ISO 22241)
Total nitrogen, percent by mass, Min	46	46
Moisture, percent by mass, Max	1	0.2
Biuret, percent by mass, Max	1.5	0.8
Aldehydes	Coated with formaldehyde/Neem	< 5 ppm
Source	Locally manufactured, import through STE's	Import in 1000 Kg Bags

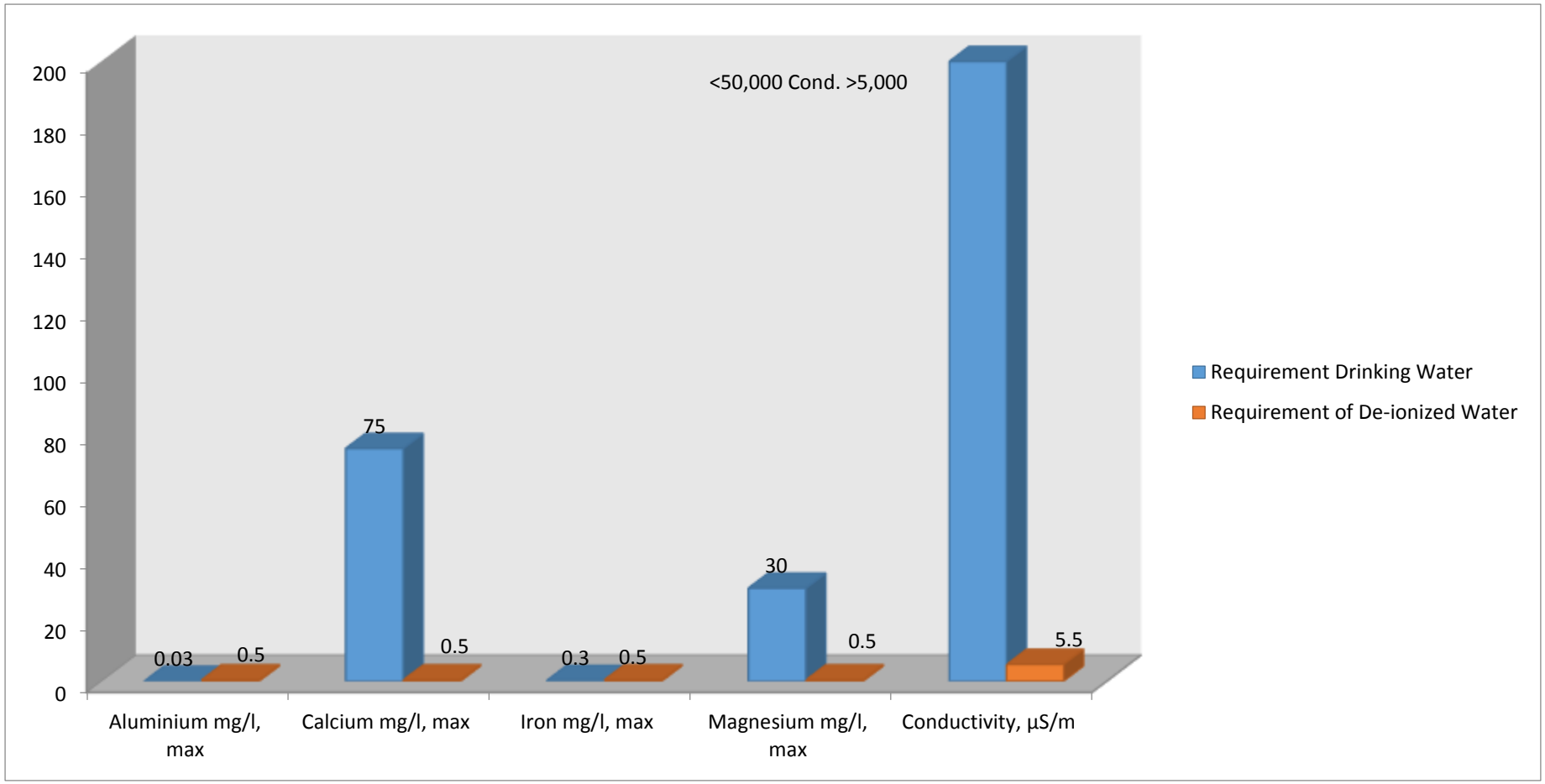
Source: Indian Standard IS 5406:1979 & ISO Standard 22241

Deionized water specification

Characteristics	Limit: Drinking Water (IS: 10500)	Limit: Deionized Water (ISO 22241)
Aluminium mg/l, max	0.03	0.5
Calcium mg/l, max	75	0.5
Iron mg/l, max	0.3	0.5
Magnesium mg/l, max	30	0.5
Conductivity, µS/m	5,000-50,000	5.5

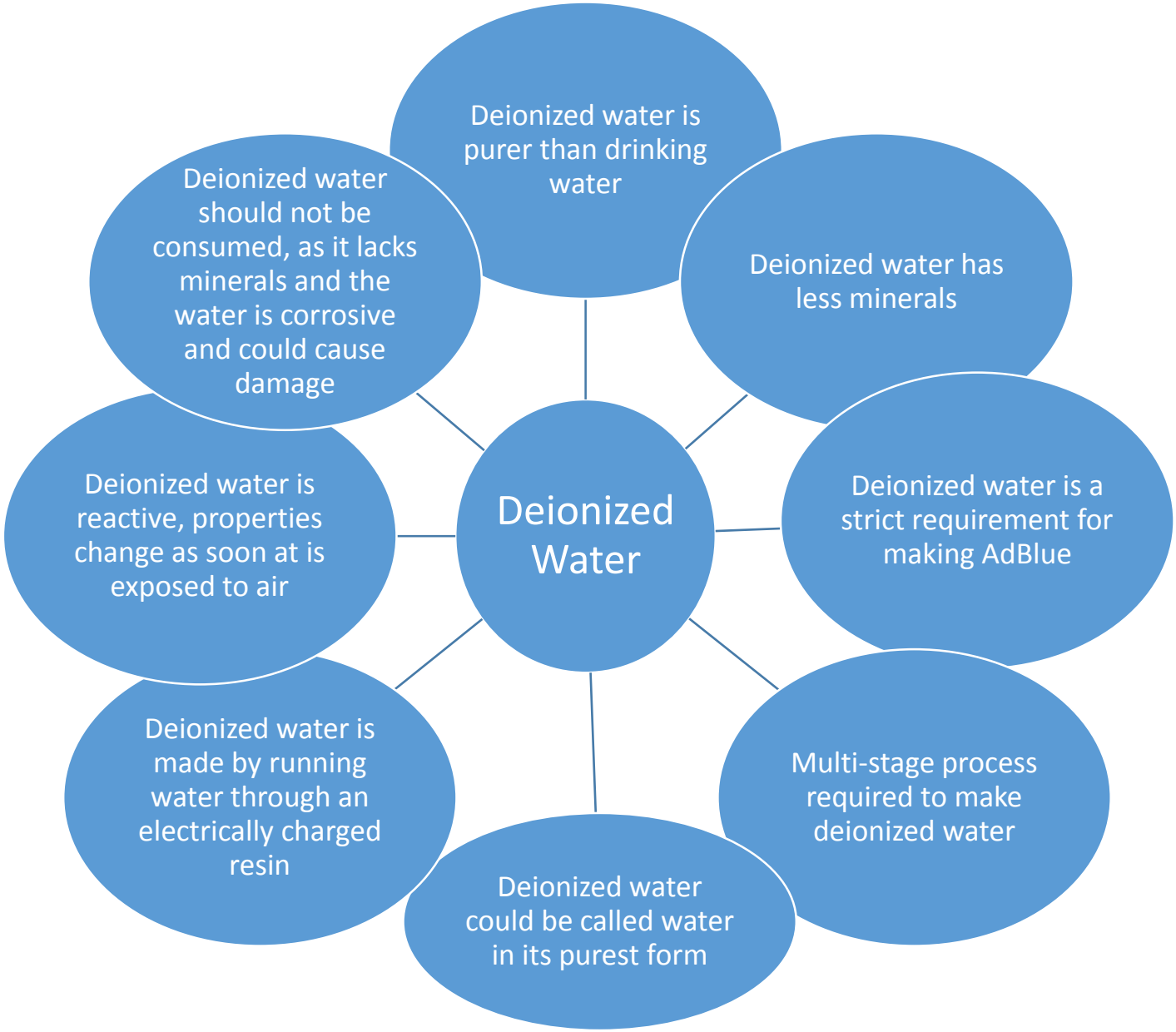
Source: Indian Standard IS 10500:2012 & ISO Standard 22241

Deionized water specification



Source: ISO Standard IS 10500:2012 & ISO Standard 22241

Deionized water



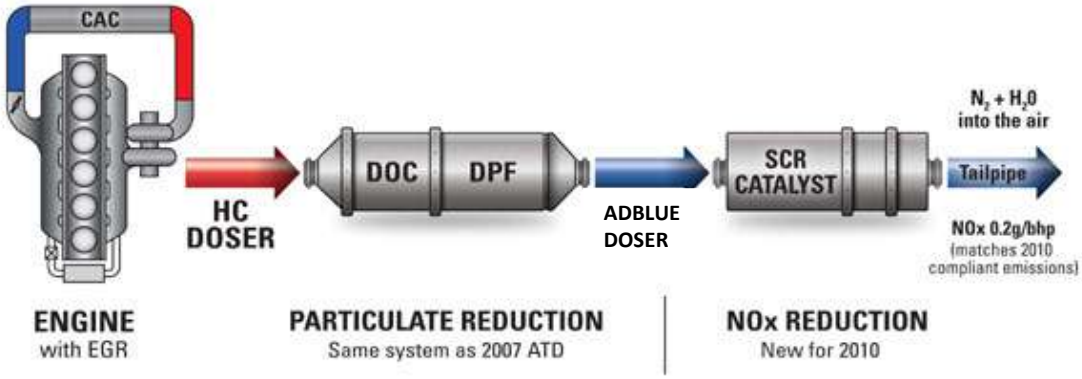
Storage and Handling

- AdBlue is corrosive to non-ferrous metals, their alloys and carbon steel.
- It should be blended, stored and refilled in compatible materials.
- AdBlue should be stored in plastic without additives and only specific types of steel
- AdBlue should be stored in the manufacturer’s original container
- AdBlue should ideally be stored within a temperature range between 0°C & 30°C and kept under covered roof with good ventilation protected from direct sunlight
- AdBlue quality deterioration could be a major risk to the SCR system as it could damage it
- The storage area must be clean and free from dust to avoid any contamination especially when a vehicle is being filled with AdBlue
- AdBlue is colorless, transparent and non hazardous chemical liquid. It it safe even if it spills on body or clothes
- AdBlue, if spilled on ground, will do the work of a fertilizer
- When using AdBlue, there is no need to wear protective clothing. However wearing gloves is advisable to prevent irritation to sensitive Skin

Implications of using wrong AdBlue

- Contaminants are the biggest cause of damage to an SCR System and the repair costs are expensive

- Major components that can be damaged include:
  - AdBlue Dosage Pump
  - Urea Injector
  - The Catalyst



- Effective NOx conversion does not take place which will lead to engine torque reduction

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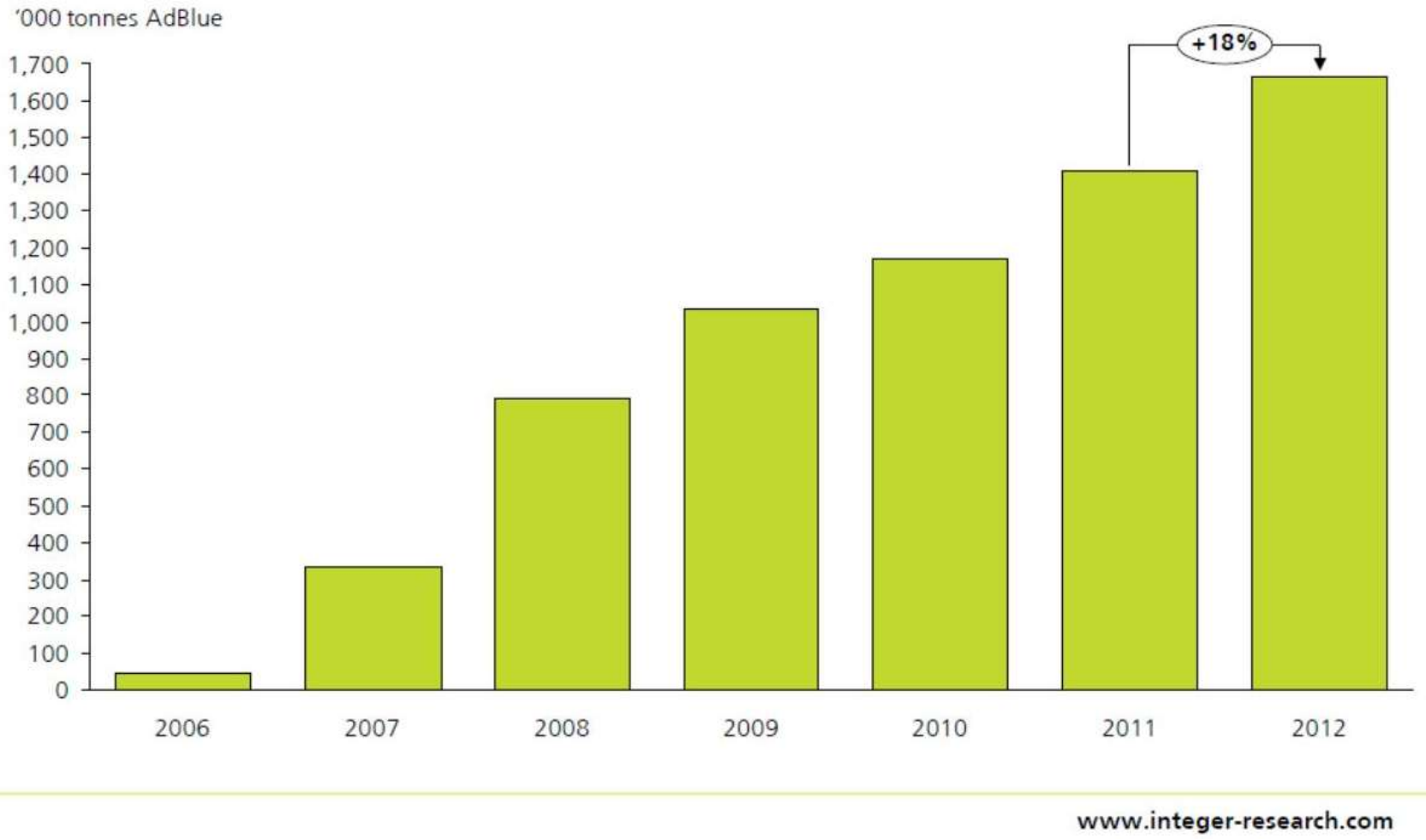
AdBlue Distribution in Europe

- AdBlue is available in Europe market since October 2006.
- There are 6,717 AdBlue dispensing units all over Europe and 10,902 other supply points
- To meet Euro IV to VI norms most of the major European truck makers offer SCR equipped vehicles
- AdBlue is available in Europe via
  - fuel centers,
  - dealer network of the AdBlue manufacturer,
  - OEM service centers,
  - garages or direct supplies to transporter with large fleets
- For passenger cars normally it is refilled at oil change or servicing.
- Online portal also exists which provides exact location to customers where AdBlue is available

Source: www.findadblue.com

AdBlue Growth in Europe

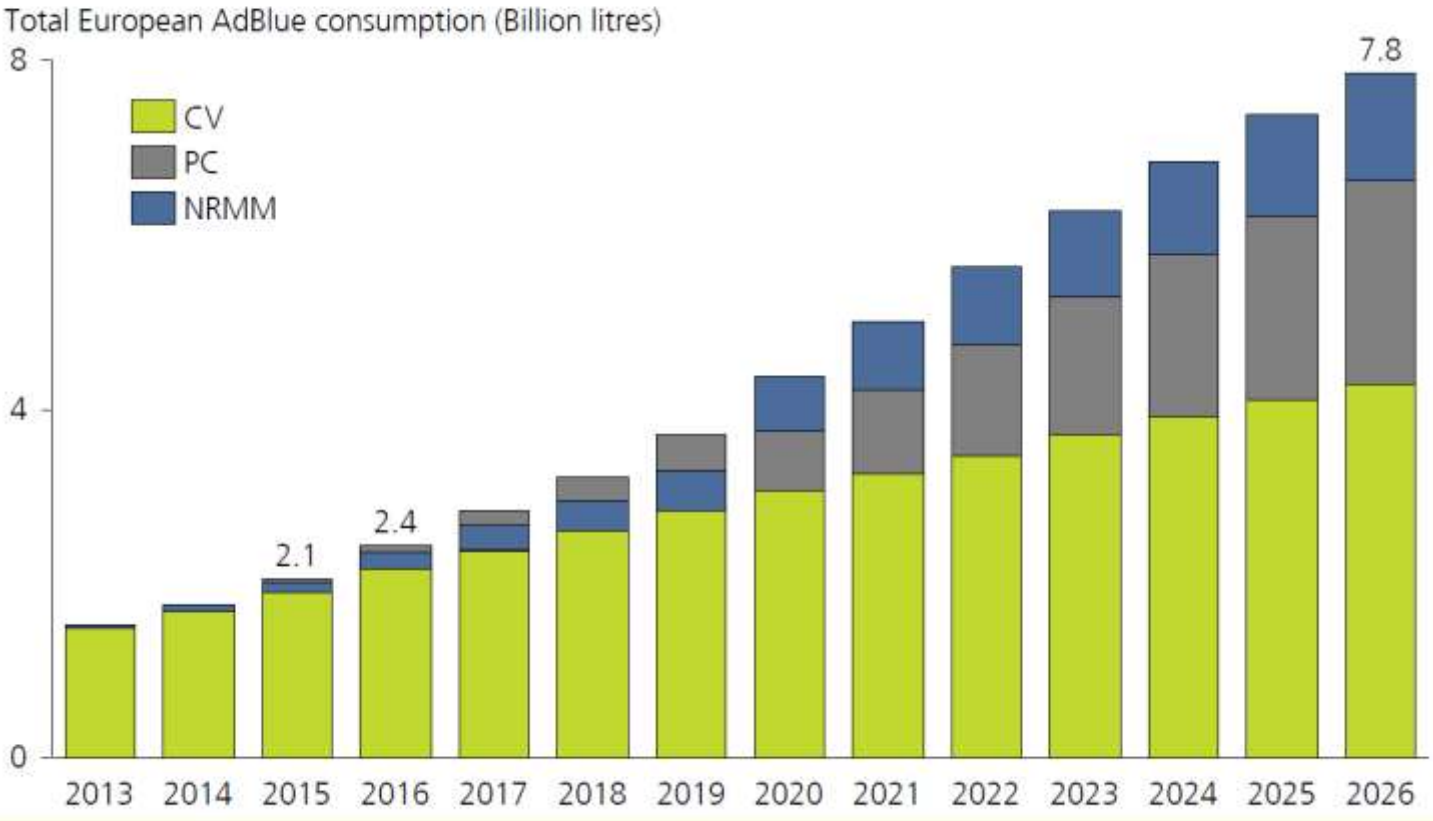


European AdBlue demand has increased steadily since the outset of the market

AdBlue Growth in Europe

integer

AdBlue consumption in Europe is forecast to reach 7 billion litres by 2024 under the Base Case scenario

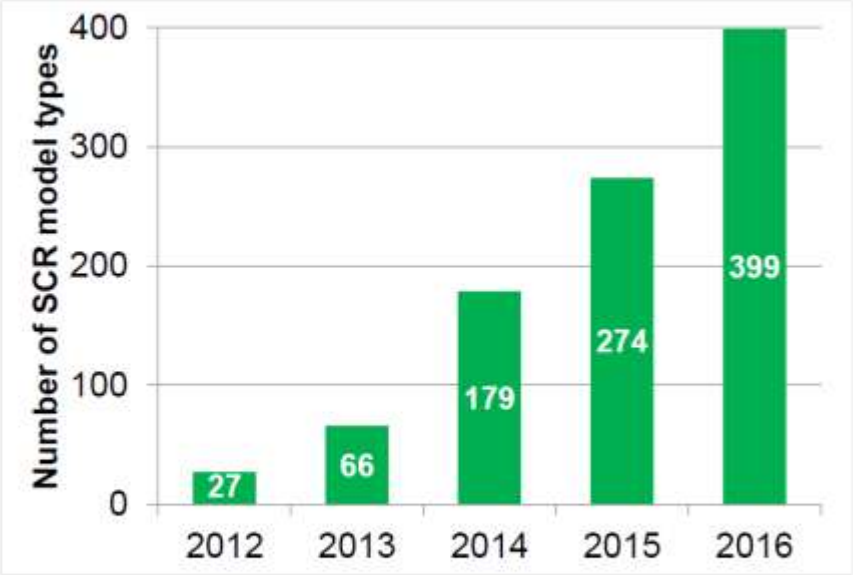


Forecasts is provisional, and will be finalised with publication of The European SCR & AdBlue Forecast Service in July 2016.
Please contact us for more information.

www.integer-research.com

AdBlue Growth in Europe

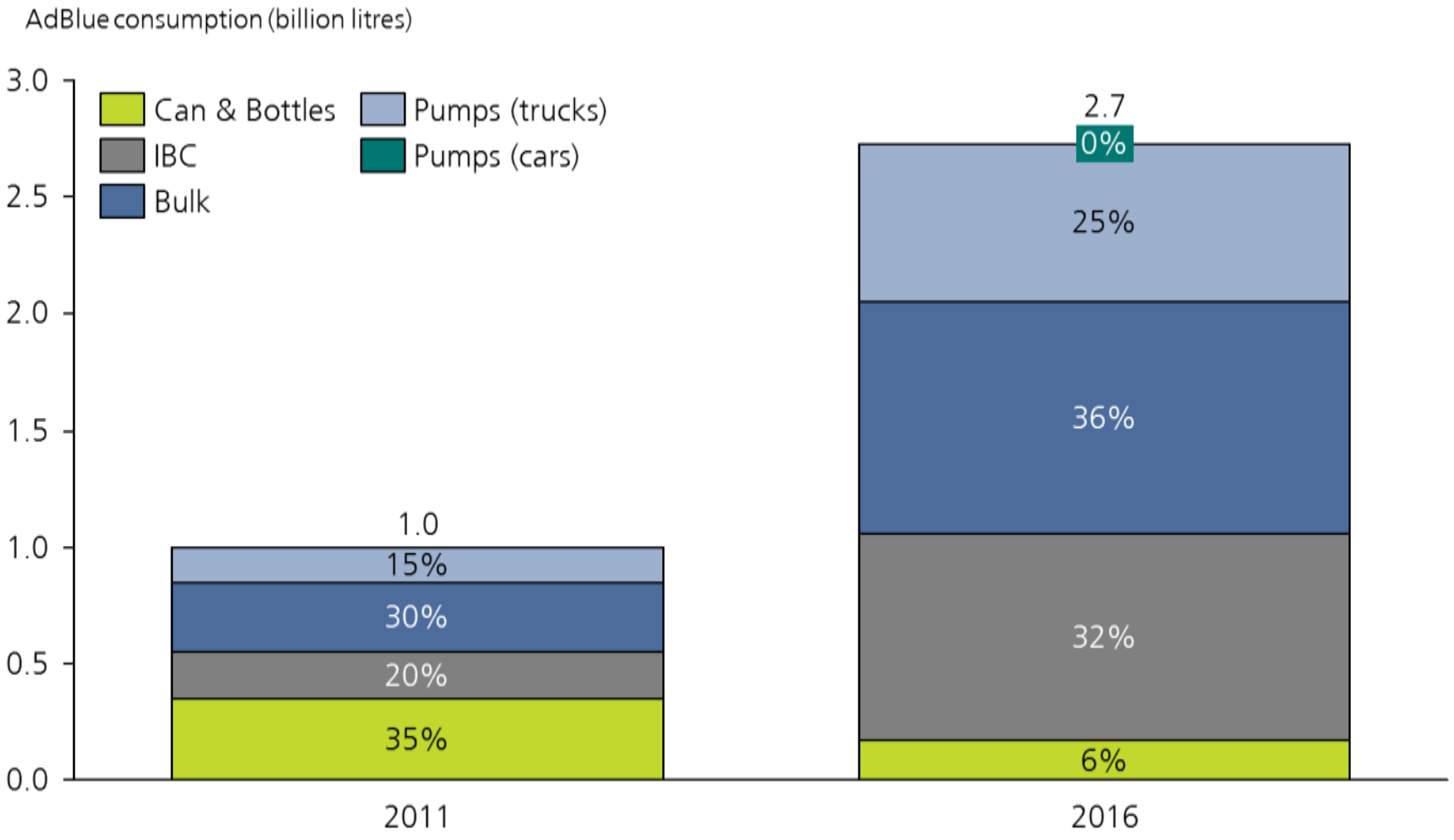
SCR/AdBlue® Vehicles – Growth Figures



Year	Increase in individual model types (absolute and relative)	
2012 to 2013	+ 39	+ 144 %
2013 to 2014	+ 113	+ 171 %
2014 to 2015	+ 95	+ 53 %
2015 to 2016	+ 125	+ 46 %

Perspective with RDE in mind: The SCR technology will become the most widespread technology for NOx reduction in diesel passenger cars and vans in the next future (≥ 2017)

AdBlue Growth in Europe



Source: Integer

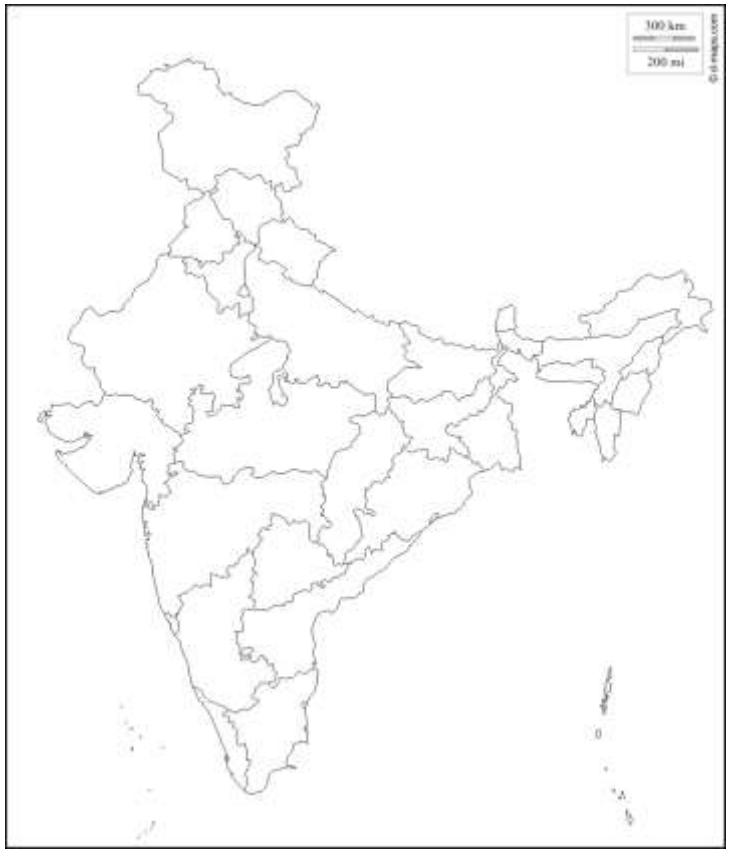
India: Channel options

Channel Options:

- OEM dealership/ franchise workshops
- OEM spare-part distributors
- Oil companies
- Aftermarket auto component suppliers
- Fuel retail outlets

Pack sizes

- Intermediate bulk container (IBC)
- Barrels (200L, 55L)
- Bucket (26L, 20L,10L)
- Containers/Bottles



Dispensing Solutions

IT Linkage to AdBlue Distribution Channel

- Using a website or application to track AdBlue dispensers around the country
- A success story in the form of www.findadblue.com
- Using e-commerce platforms to increase availability
- Essential that all OEMs partner together

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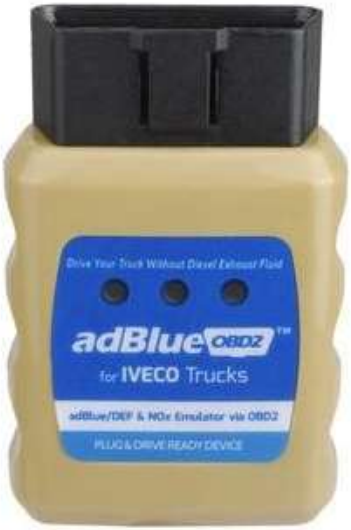
AdBlue consumption

AdBlue Consumption Projection	Monthly Running (Km)	Fuel Consumption Average (Km per Litre)	AdBlue Consumption	AdBlue Requirement per month per vehicle (Litre)	No of 26L cans per month
Buses	6000	4	3.5% of diesel	53	2
HD Trucks	9000	4	4.5% of diesel	101	4

Challenges & Threats

- Uncertainty over acceptance of SCR by the consumer may restrict the full potential
- Most OEMs still providing both after treatment technologies: EGR and SCR
- Current SCR vehicle PARC is a few thousand
- Cheat technologies available online to avoid AdBlue (OBD II emulator)
- Use of agricultural urea or contaminated water for AdBlue production to reduce costs



Adblue OBD2 Emulator for IVECO Trucks Plug Drive Ready Device by OBD2 -
by Generic
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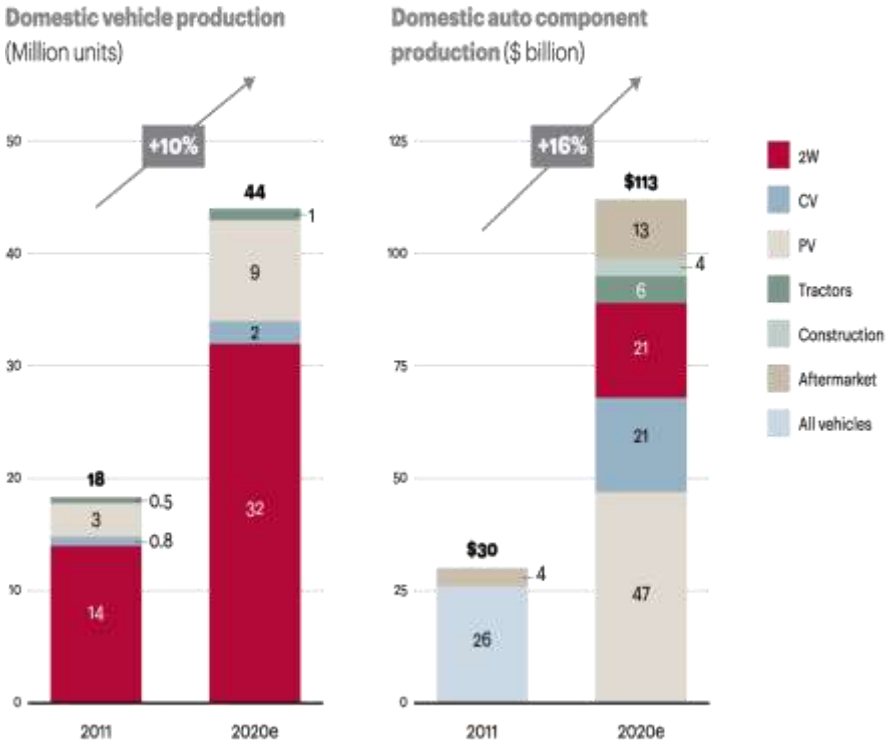
Summary

- Indian Auto Industry will be a major engine to the India growth story
- Growth of automotive industry along with successful implementation of BSIV emission norms will lead to overall growth in demand of AdBlue
- Growth is expected Q2 FY 16-17 onwards considering BSIII inventory liquidation in Q1
- Installation of multi locational AdBlue Blending Plants for optimising costs and better servicing of customers
- Small packs for retail and Drums and mini bulk dispensers for fleet – major role till 2020.
- Post 2020, Dispensing Pumps at Fuel Retail Outlets will be required.

Figure 1

Auto component sales will increase almost fourfold by 2020



Notes: 2W is two-wheeler vehicles; CV is commercial vehicles; PV is passenger vehicles. Due to rounding figures may not add up exactly to total.

Source: A.T. Kearney analysis

The pioneer of AdBlue manufacturing in India

VELVEX AdBlue® by NPL | KRUSE AUTOMOTIVE

NPL BlueSky Automotive

Technical JV between Nandan Petrochem and KRUSE Automotive GmbH, Germany

Established in 2011

Technical Collaboration with KRUSE Automotive GmbH, Germany

VDA approved

Approved by major OEMs in India

Plant Equipped with German Technology

Thank You