Legal Statement

The purpose of this presentation is to guide ICA programs and provide members information to make independent business decisions.

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**Antitrust Guidelines for Copper Industry
Trade Association Meetings**

The following guidelines with respect to compliance with antitrust laws of the United States, Japan and European Community[1] are intended to govern the conduct of participants in copper industry trade association meetings, both at the meeting itself and in informal discussions before or after the formal meeting.

Price: Competitors should not discuss future prices (including terms of sale) of their products. There is no blanket prohibition against the mention of or reference to current or past prices but limits must be observed. Such references or mentions should occur only when necessary in connection with the development of association programs. For example, reference to a particular price level in comparing the cost of a copper product to a competing product is permitted. Whenever possible, such references should be discussed in advance with legal counsel.

Competitive Information: Competitors should not discuss the market share of a particular copper producer or copper fabricator's products. Furthermore, nothing should be said at a meeting which could be interpreted as suggesting prearranged market shares for such products or producer production levels. The overall market share of copper products may be discussed with regard to competition with non-copper products and general market acceptance.

New Products: Competitors should not encourage or discourage the introduction of a new product by another competitor or reveal a particular copper company's plans to change the production rate of an existing product or to introduce a new product. No company should disclose to another company whether it is in a position to make or market a new product. New products may be discussed in a technical manner or from the standpoints of competition with non-copper products and general market acceptance. In addition, proposed methods for and results of field and laboratory testing can be considered.

The Role of Legal Counsel: Legal counsel attends association meetings to advise association staff and other meeting attendees regarding the antitrust laws and to see that none of the matters discussed or materials distributed raise even the appearance of antitrust improprieties. During the course of a meeting, if counsel believes that the discussion is turning to a sensitive or inappropriate subject, counsel will express that belief and request that the attendees return the discussion to a less sensitive area.

A paper entitled 'Copper Industry Trade Associations and Antritrust Laws' is available upon request.

10/92, 5/93, 10/10

1. Other foreign competition laws apply to International Copper Association, Ltd. (ICA)'s activities worldwide.

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Copper in Electric Motors and Generators

Krisztina Kalman-Schueler, DMM Advisory Group
on behalf of MetalsPlus

October 2018

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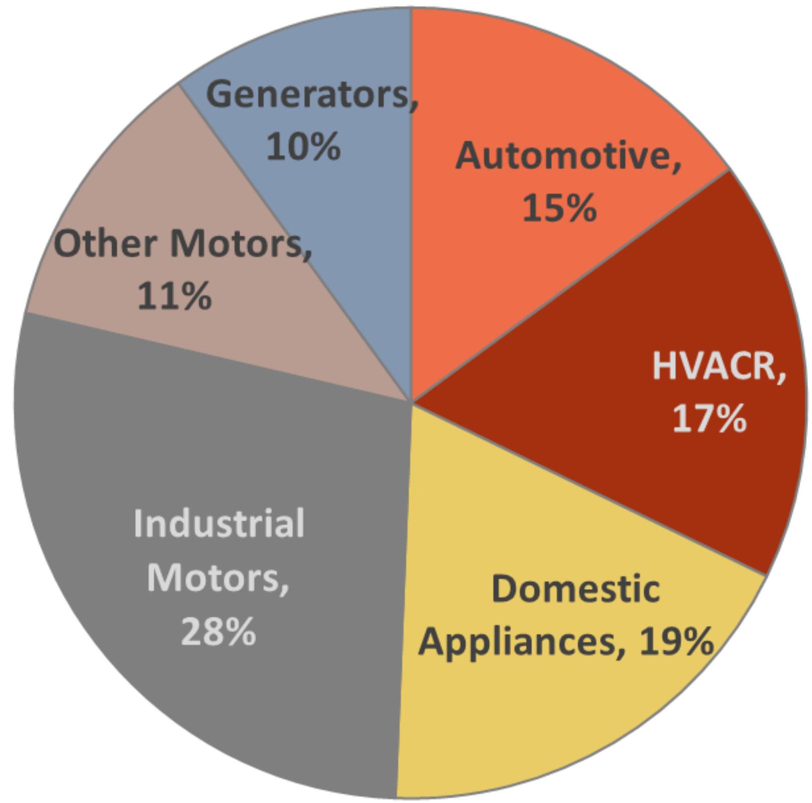
Motors & Generators Market in 2017

Copper use

	Kt Cu
Automotive	318
HVACR	369
Domestic Appliance	393
Industrial Motors	598
Other Motors	242
Generators	213



Total = 2.13 Million Tonnes

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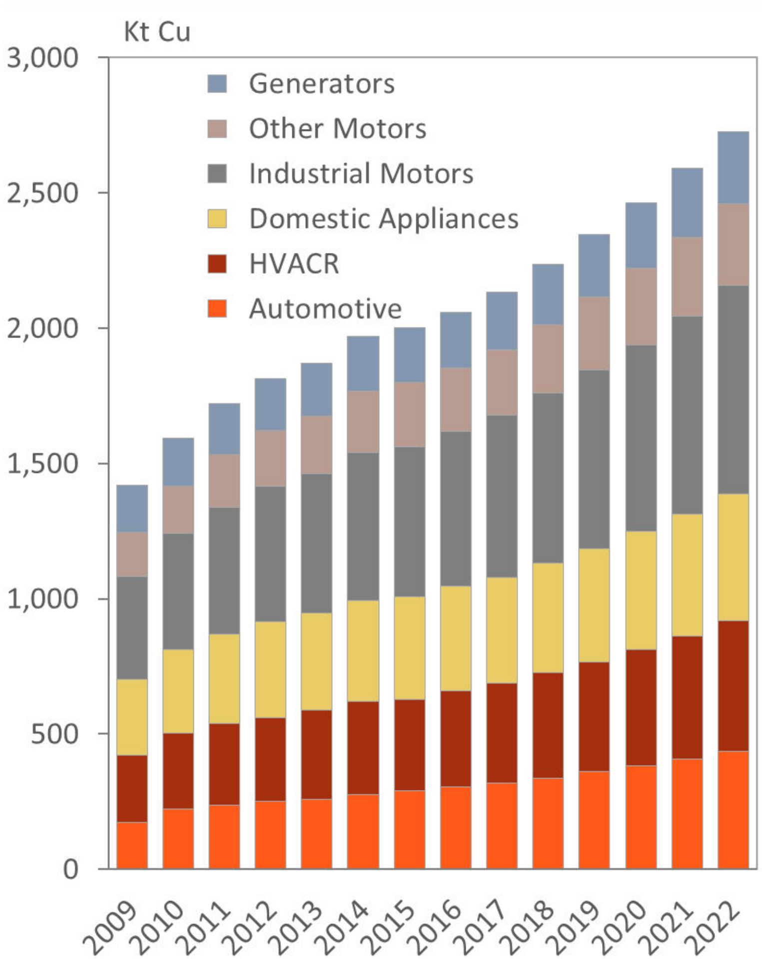
Motors & Generators Market in 2011-2022

Copper use



MARKET SUMMARY

	2011	2017	2022	*% CAGR 11-17*	*% CAGR 17-22*
ALL COPPER USE (kt)	**1,722**	**2,134**	**2,728**	***3.6%***	***5.0%***

BY END MARKET

	2011	2017	2022	11-17	17-22
Automotive	237	318	434	*5.0%*	*6.4%*
HVACR	302	369	484	*3.4%*	*5.6%*
Domestic Appliances	329	393	469	*3.0%*	*3.6%*
Industrial Motors	471	598	771	*4.1%*	*5.2%*
Other Motors	193	242	302	*3.9%*	*4.5%*
Generators	190	213	267	*2.0%*	*4.6%*

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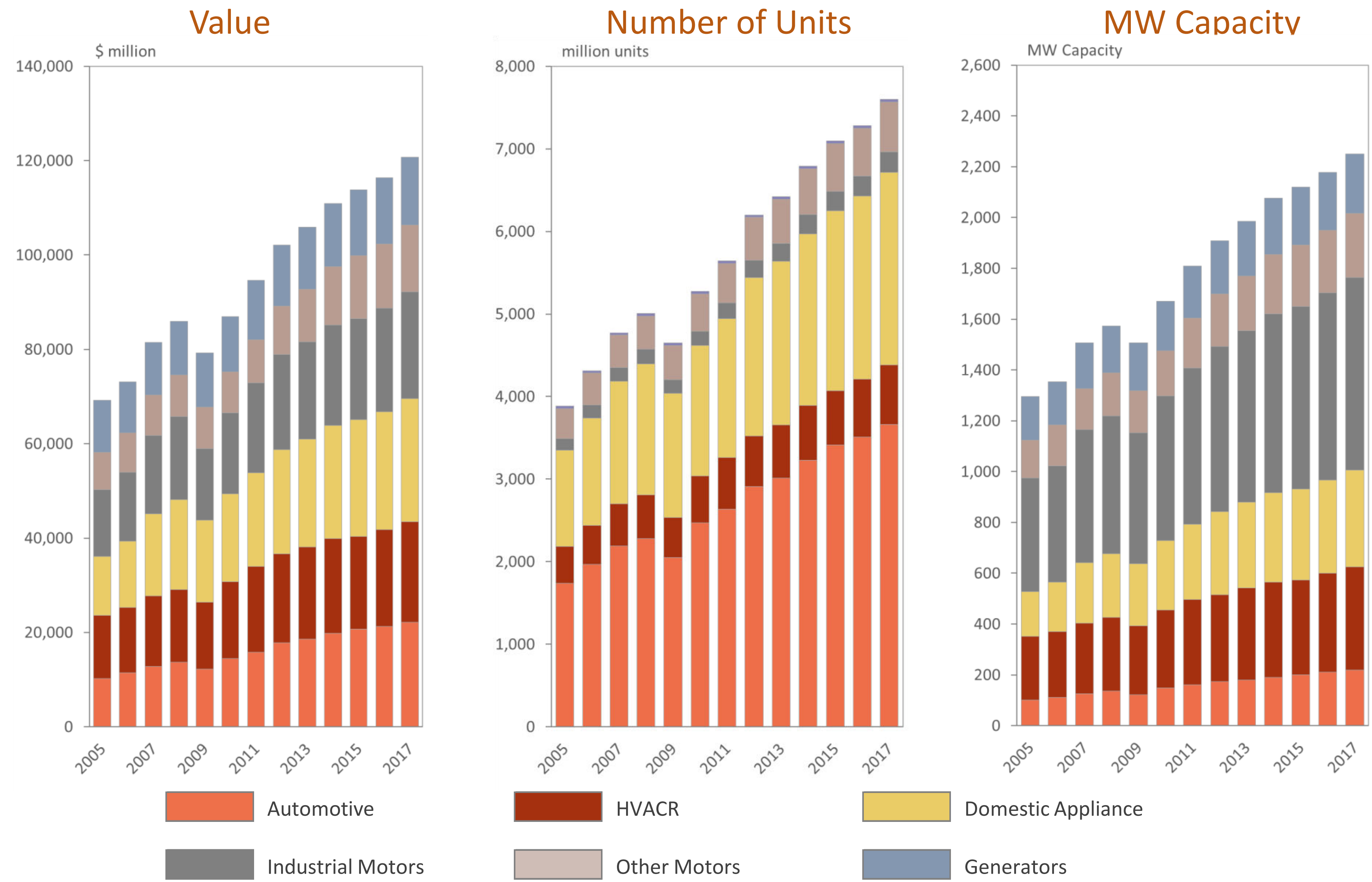
Application Shares by Alternative Measures

Copper use closer to Value than other measures



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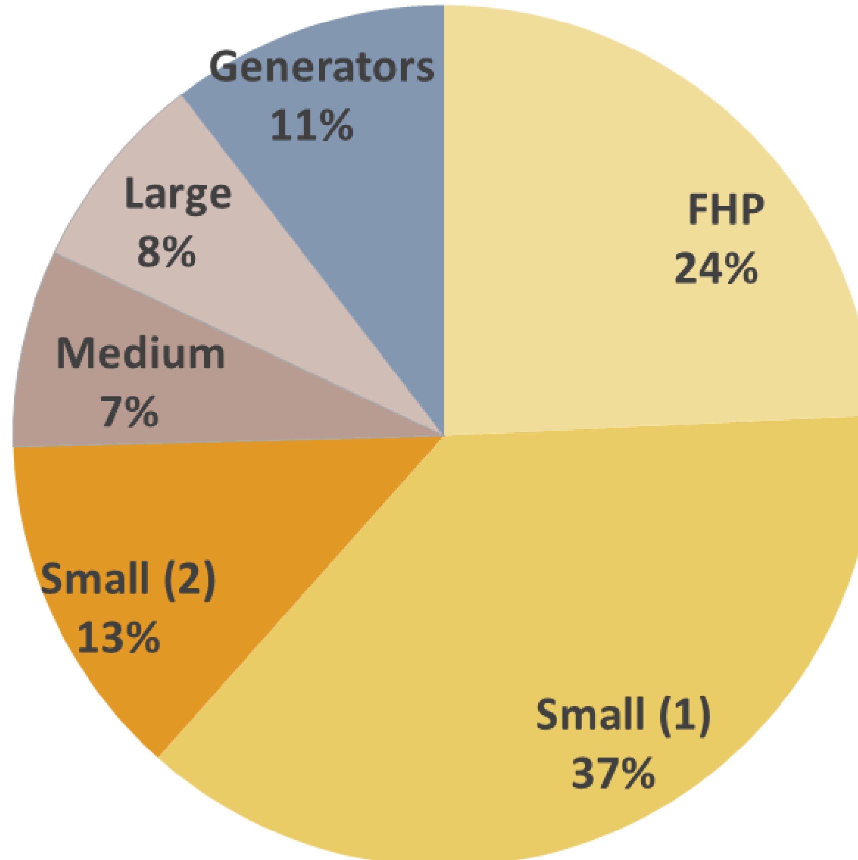
A Closer Look at Capacity

Over 60% of the market in Motors under 37.5 kW

	MW
FHP Motors	546
Motor 0.75 - 37.5 kW	840
Motor 37.5 - 200 kW	294
Motor 200 - 375 kW	166
Motor over 375 kW	170
Generators	235



Total MW = 2,251

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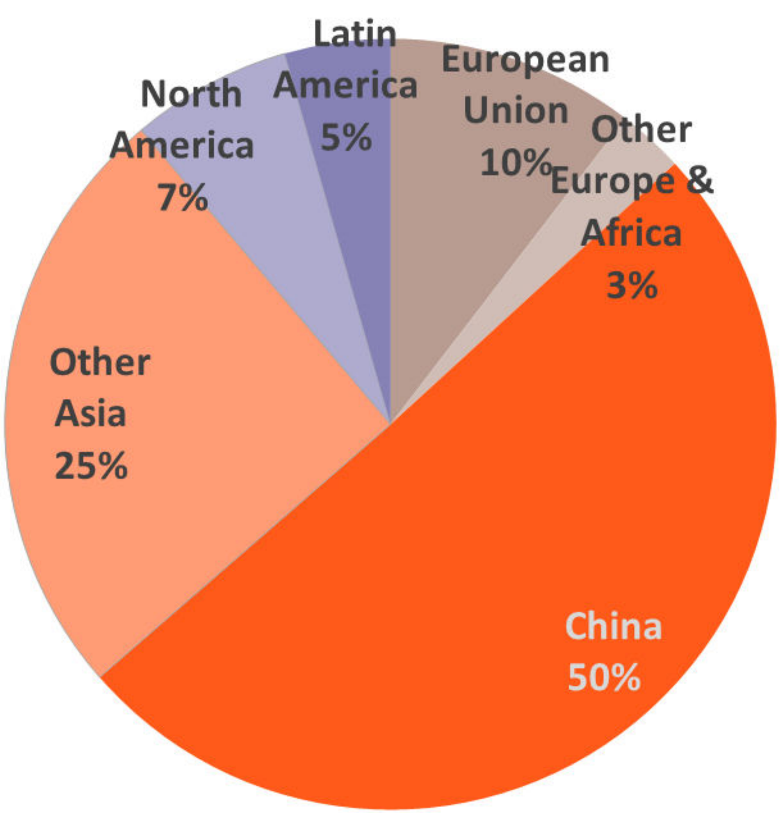
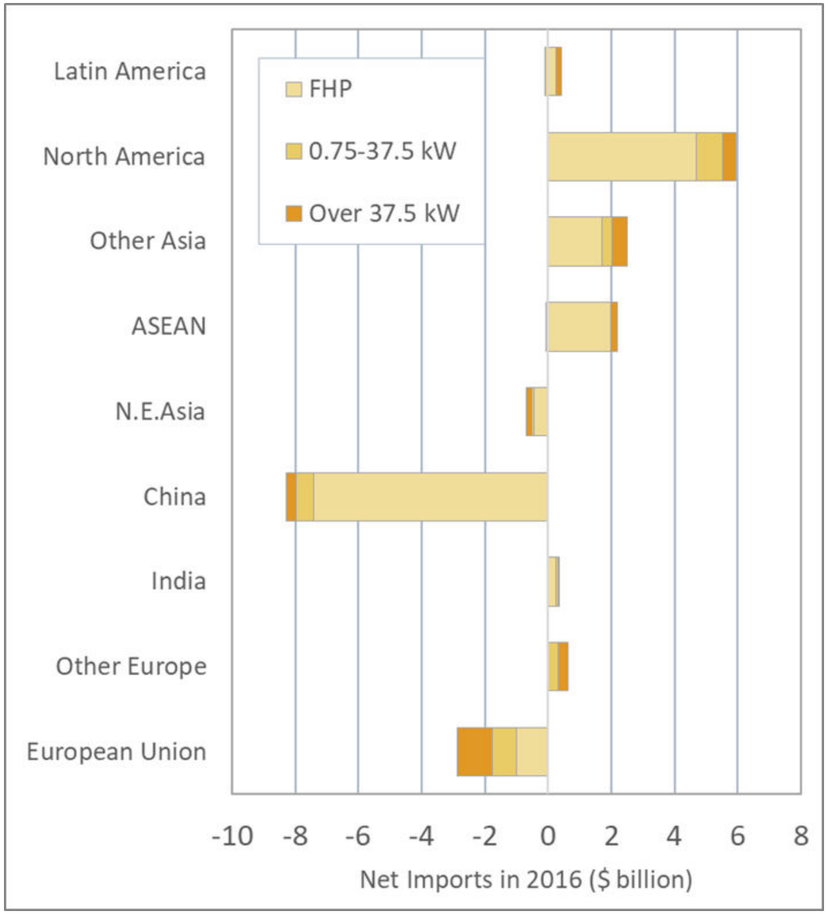
Regional Shares of Copper Use

China's Cu use boosted by copper in exported motors

Cu Shares of Motor & Generator Output 2017



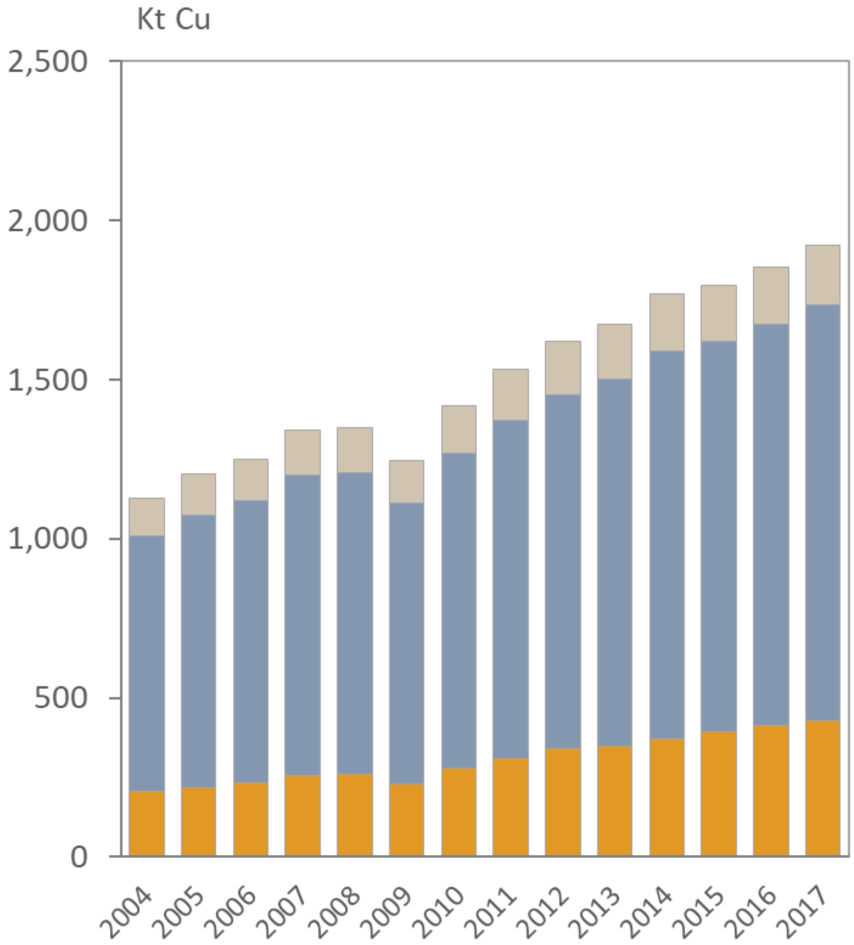
Net Import Value (Motors Only)



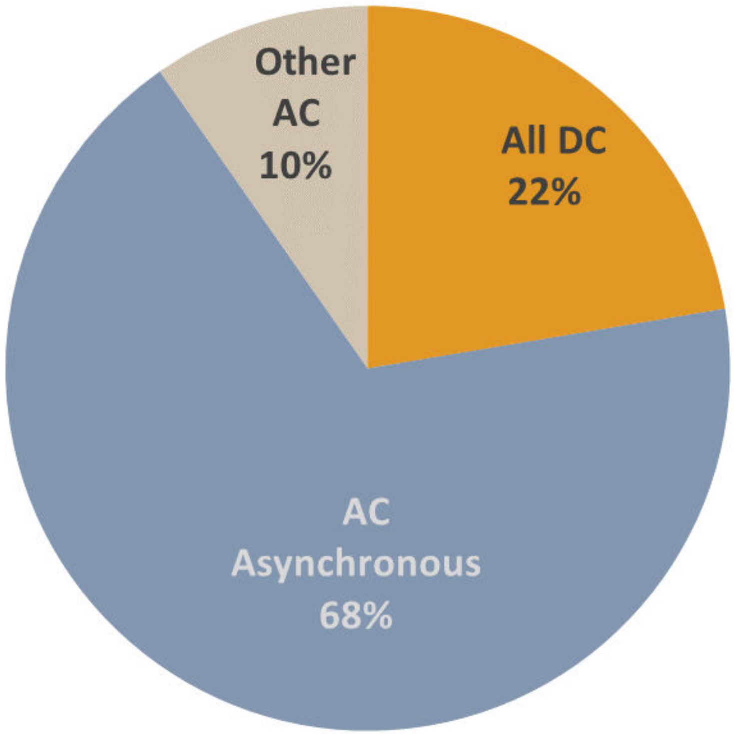
Cu Shares by Motor Type (kt Cu)

AC Asynchronous (induction motors) dominant

Shares 2004-2017



Shares in 2017

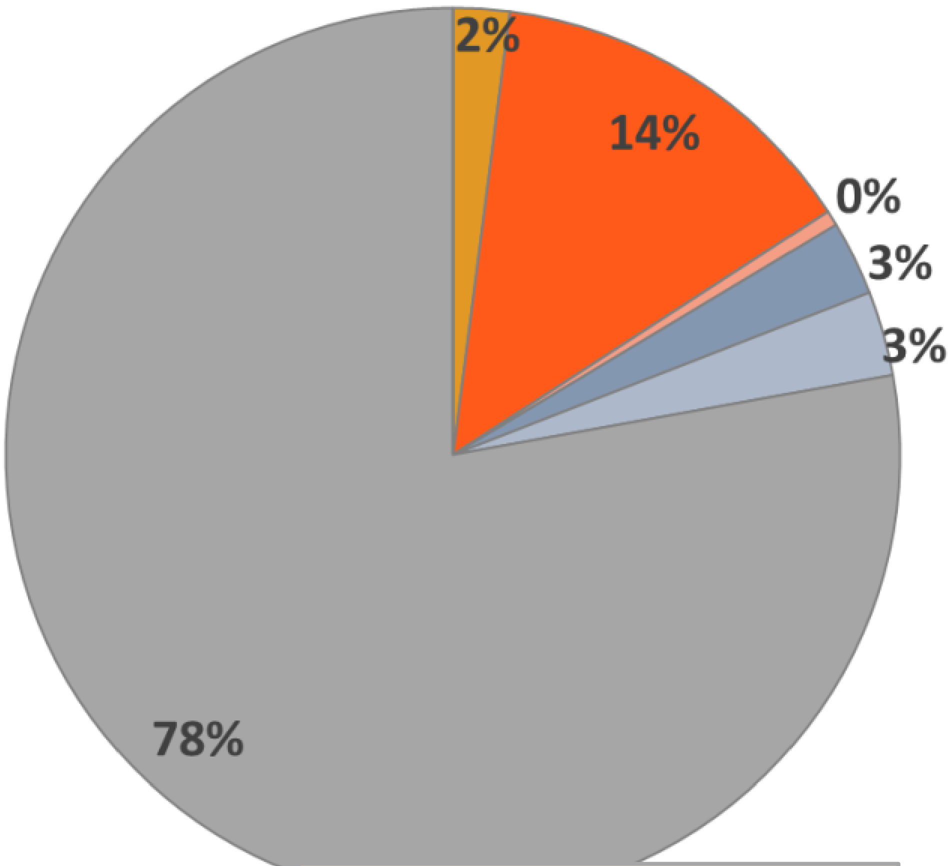


Note: Generators excluded from these figures

Electrical Materials in Motors & Generators (2017)

Aluminium winding wire competes directly with Cu; other materials influence Cu through changed design parameters

	kt
Cu Winding Wire	2,052
Other Copper	82
Al Winding Wire	400
Cast Rotor Aluminium	455
Permanent Magnets	291
Electrical Steel	11,509



All Material = 14.86 Mt
Excluding Steel = 3.29 Mt

Note: Aluminium figures in kt equivalent, all others as actual kt

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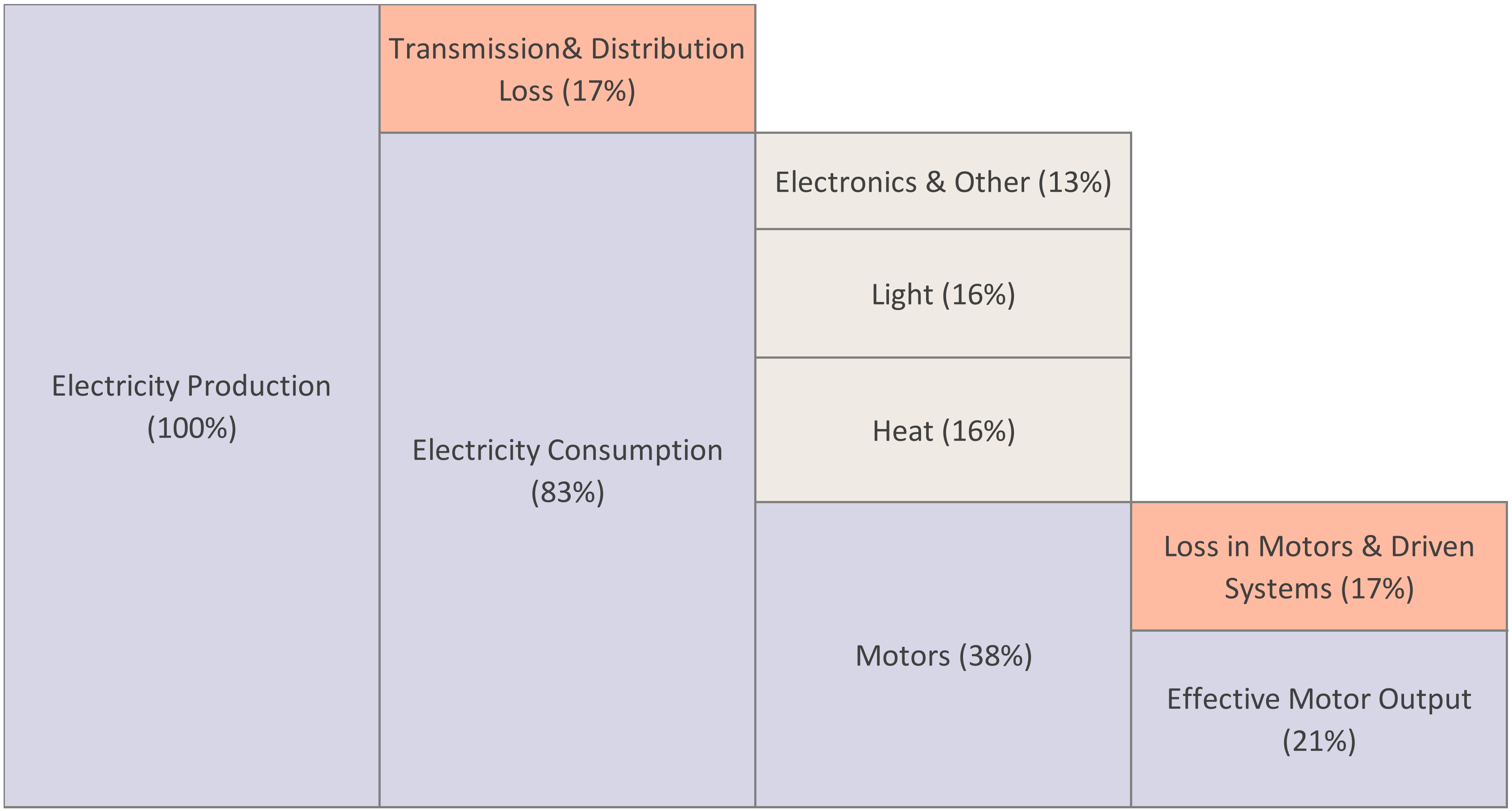
Need to Lower Carbon Footprint Drives Motor Design

Typically, lowering loss means higher copper use

Motor Electricity Use and Loss in the Electricity Market Context



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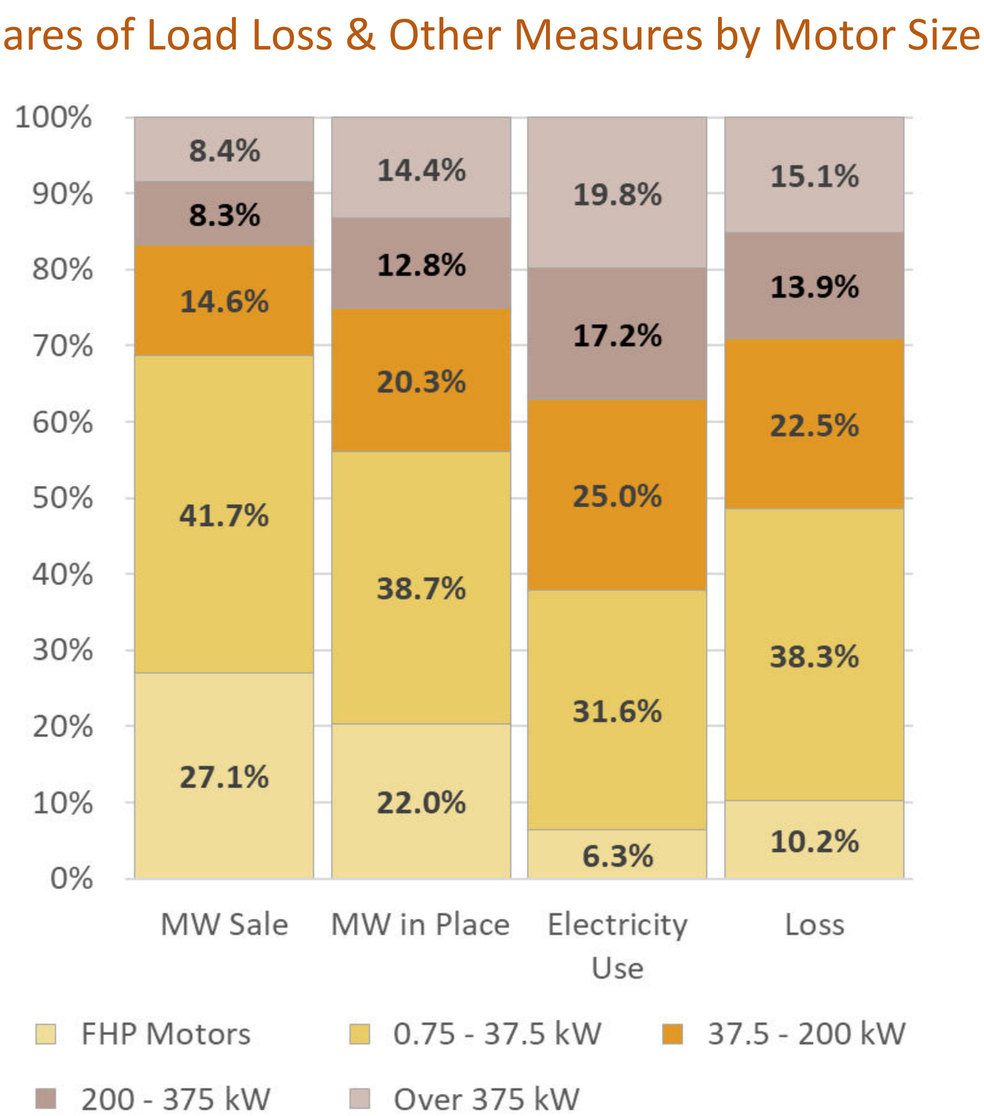
Load Loss by Motor Size

Focus of load loss, and legislation, 0.75-375 kW



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Minimum Energy Performance Standards (MEPS)

IE3 now firmly on the agenda, IE4 standard defined

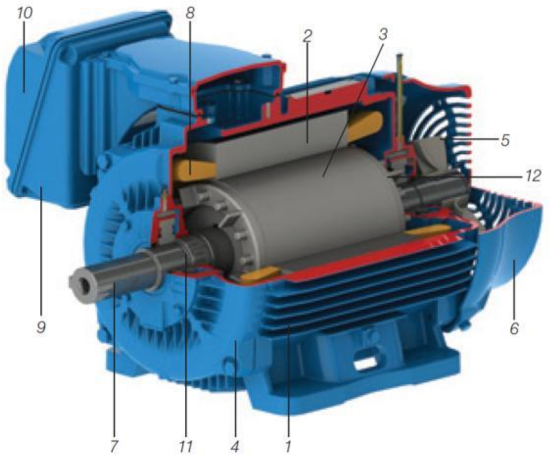
Select Milestones in Mandatory MEPs Development

1997	US & Canada pass rules for IE2 minimum
2004-06	Early adopters of minimum standards include Mexico, Australia & Korea
2008	China brings in IE1 minimum
2010	USA brings in IE3 ruling (implementation 2016)
2011	EU implements IE2 minimum, replacing voluntary system
2012	China IE2 minimum, with stated plans to implement IE3
2014	EU IE2 with VFD, IE3 without, and forward plan to bring in IE3 for all motors, scope 0.12- 1,000 kW
2015	Japan implements Top Runner IE3 0.75-375 kW
2017	India first mandatory rule: IE2 for industrial motors

Options for Improving Efficiency (1)

Enhance current design, or re-design

1) Optimise Existing Designs



2) Variable Frequency Drives (VFDs)

3) Rare Earth Permanent Magnet (REPM) Solutions

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Options for Improving Efficiency (2)

Solutions not relying on rare earths

4) Non PM Solutions: Synchronous Reluctance (SynRM) Motors

5) Non PM Solutions: Switched Reluctance (SRM) Motors

6) Non PM Solutions: Copper Rotor Motor

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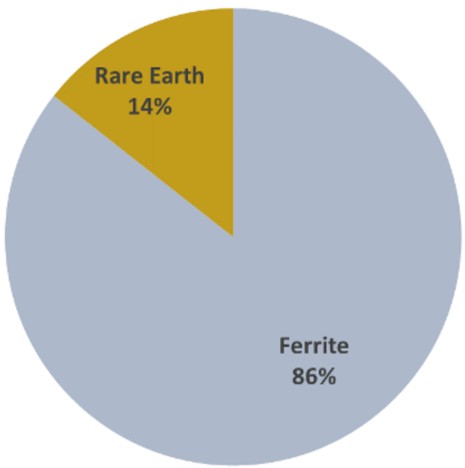
Why Limit Rare Earth Exposure?

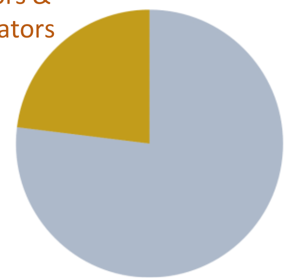
Pricing, and critical rare earth supply issues

Type of Permanent Magnet

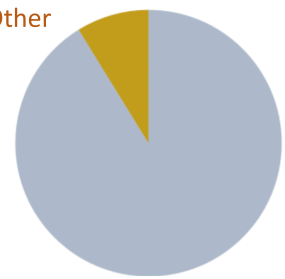
All



Motors & Generators

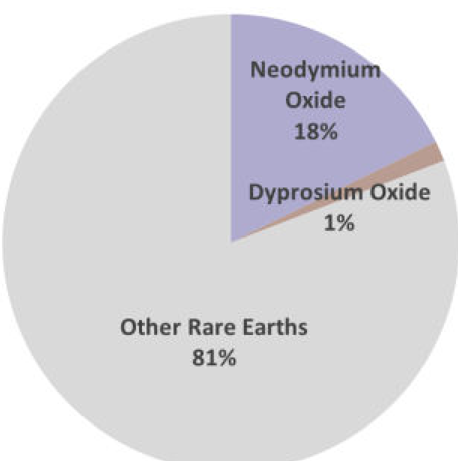


Other

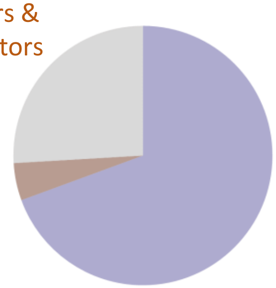


Critical Rare Earths

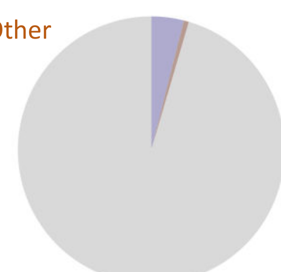
All



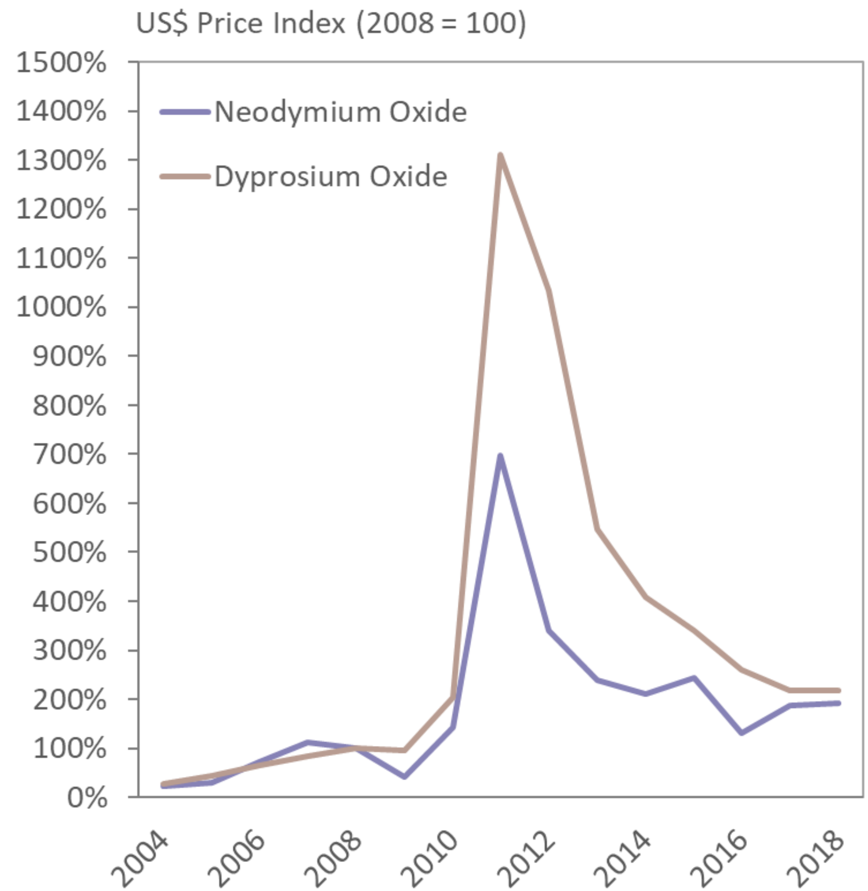
Motors & Generators



Other



Nd and Dy Price Index



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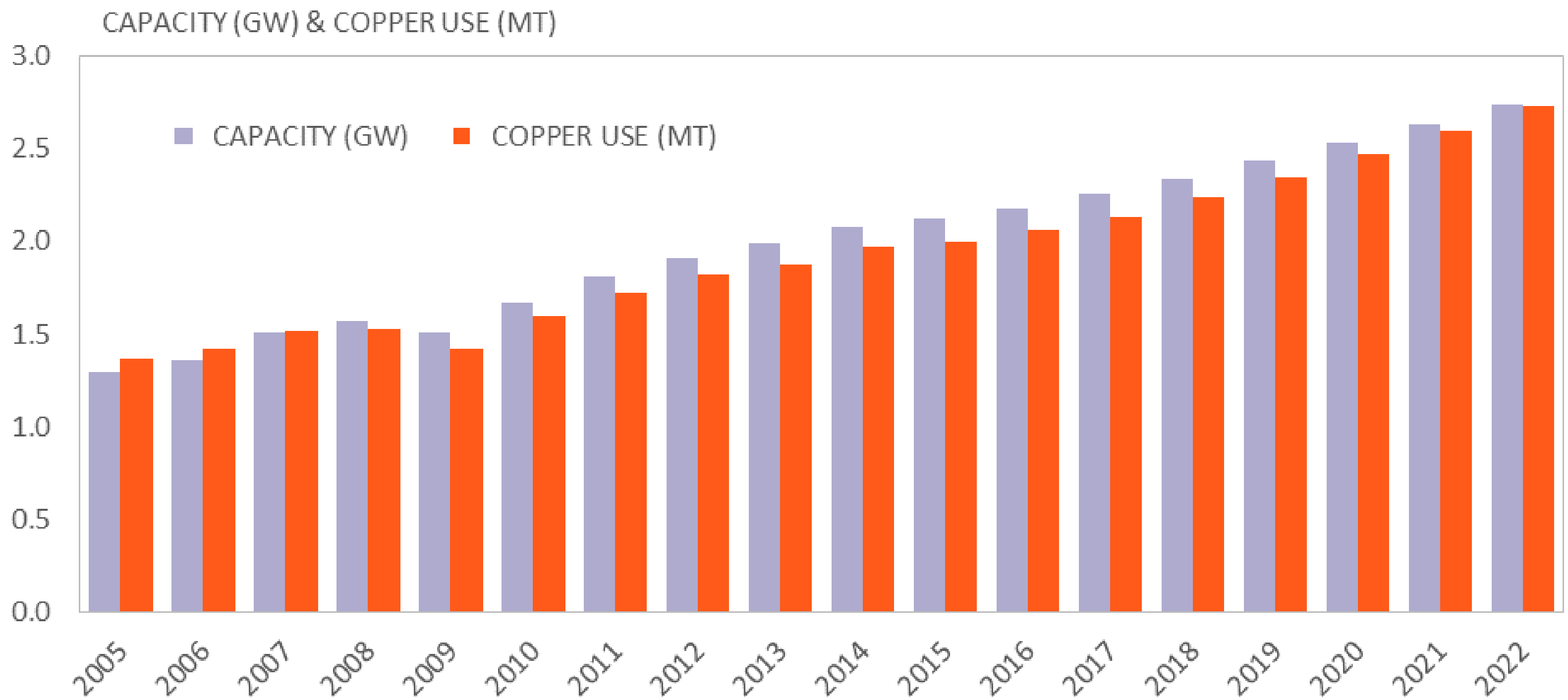
Net Impact on Copper Going Forward

Intensity of use now rising, in a fast-growing market



	2005	2011	2017	2022	*% CAGR 05-11*	*11-17*	*17-22*
CAPACITY (GW)	1.30	1.81	2.25	2.73	*5.7%*	*3.7%*	*4.0%*
MARKET VALUE ($ BN)	69	95	121	149	*5.4%*	*4.1%*	*4.3%*
UNITS (BN)	3.9	5.6	7.6	9.3	*6.4%*	*5.1%*	*4.1%*
COPPER USE (MT)	1.36	1.72	2.13	2.73	*4.0%*	*3.6%*	*5.0%*