

ANTITRUST GUIDELINES

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 Community¹ 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 Antitrust 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.

LEGAL STATEMENT

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

ENERGY EFFICIENCY

MARCH 2020

WHAT IS THE THREE PERCENT CLUB?

The Three Percent Club is a collaboration of governments and supporting organizations that commit to working together to put the world on a path to three percent annual efficiency improvement.



STUDY OVERVIEW

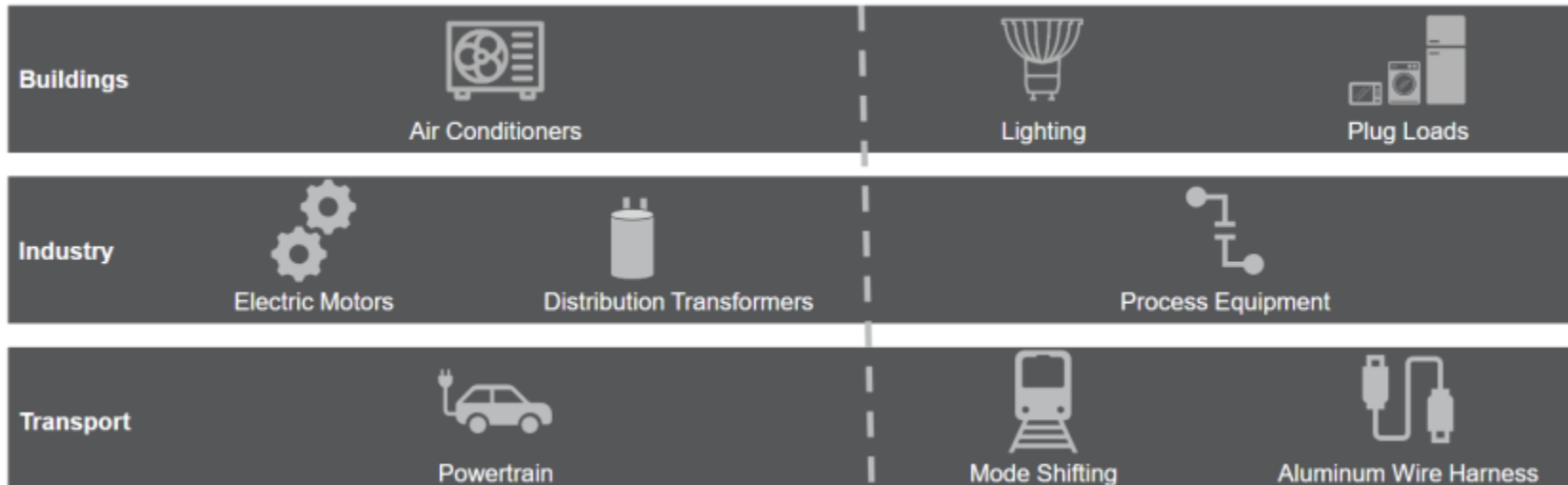
Goal: Understand the impact of buildings, industry, and transport on energy consumption and the impact of reducing energy consumption by 3% annually on copper demand.

Energy Consumption

- Benchmark global energy consumption for relevant building, transport, and industry end-use applications
- Analyze requirements to meet 3% annual reduction in energy
- Create 2 energy consumption forecasts: base scenario and 3% annual reduction in energy consumption (efficiency scenario)

Copper Demand

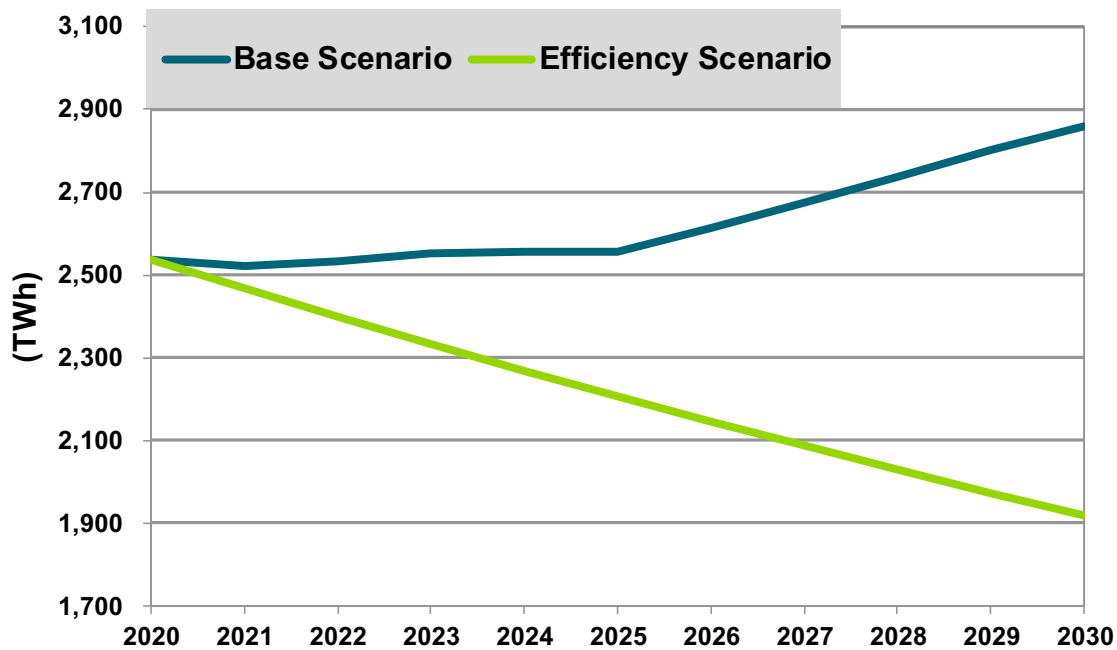
- Establish copper content of relevant building, transport, and industry end-use applications
- Evaluate impact of energy efficiency on demand
- Create 2 demand forecasts: base scenario and 3% annual reduction in energy consumption (efficiency scenario)



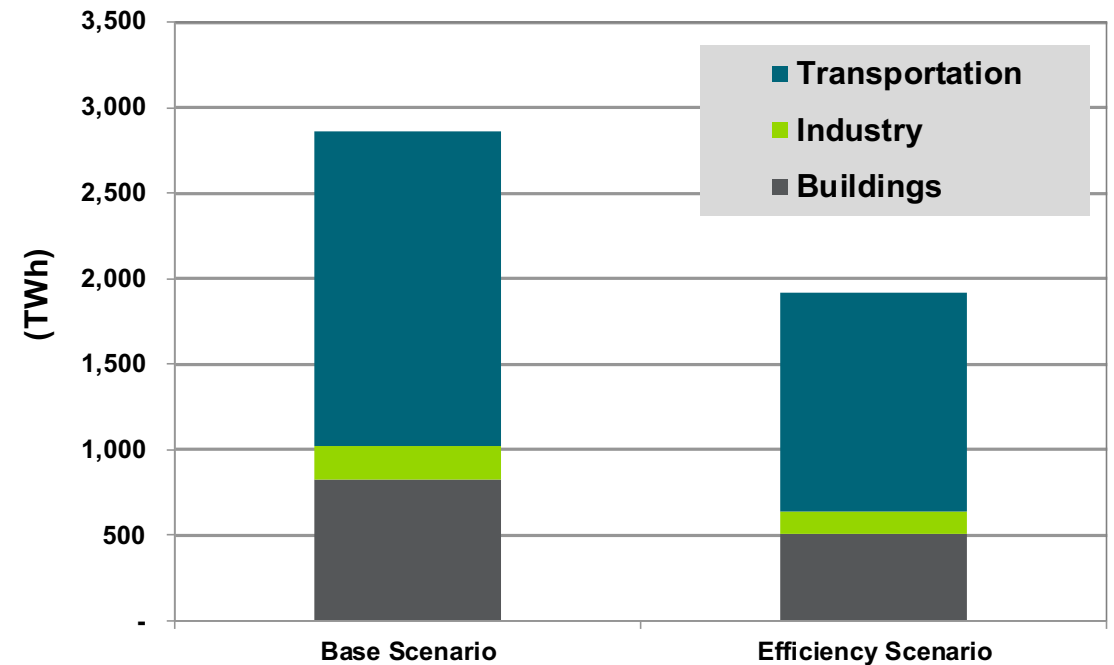
ENERGY CONSUMPTION IN THE SCENARIOS

Under the base scenario we expect energy consumption to grow 13% between 2020 and 2030. In the efficiency scenario, energy consumption declines 24% between 2020 and 2030.

Energy Consumption from Shipments By Scenario, World Markets: 2020- 2030

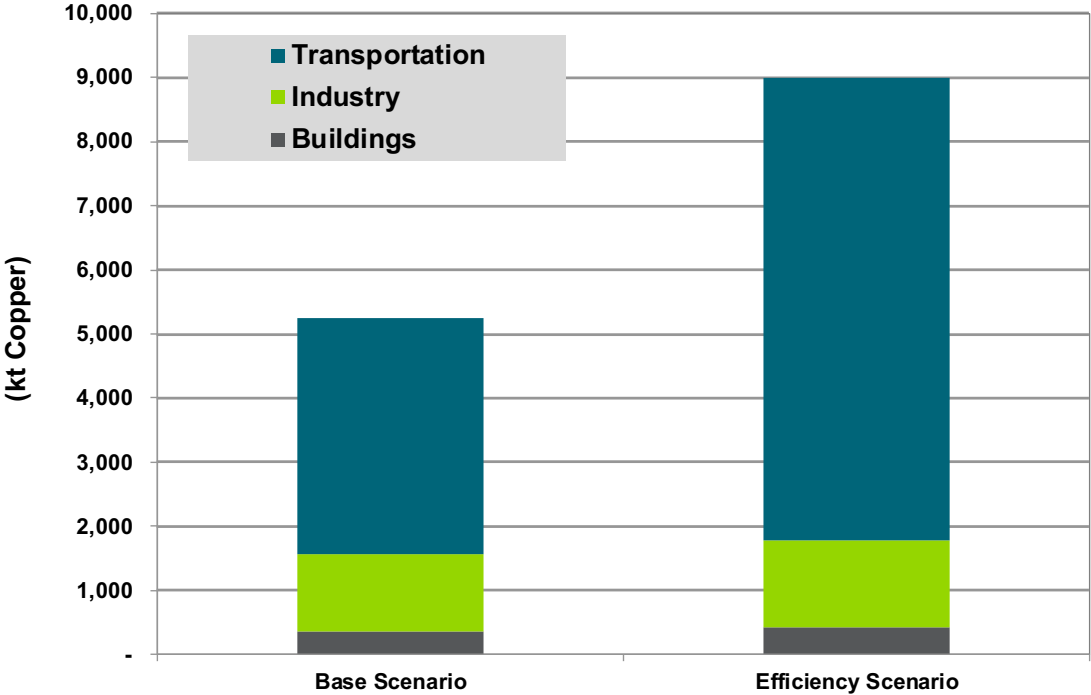


By Segment and Scenario, World Markets: 2030

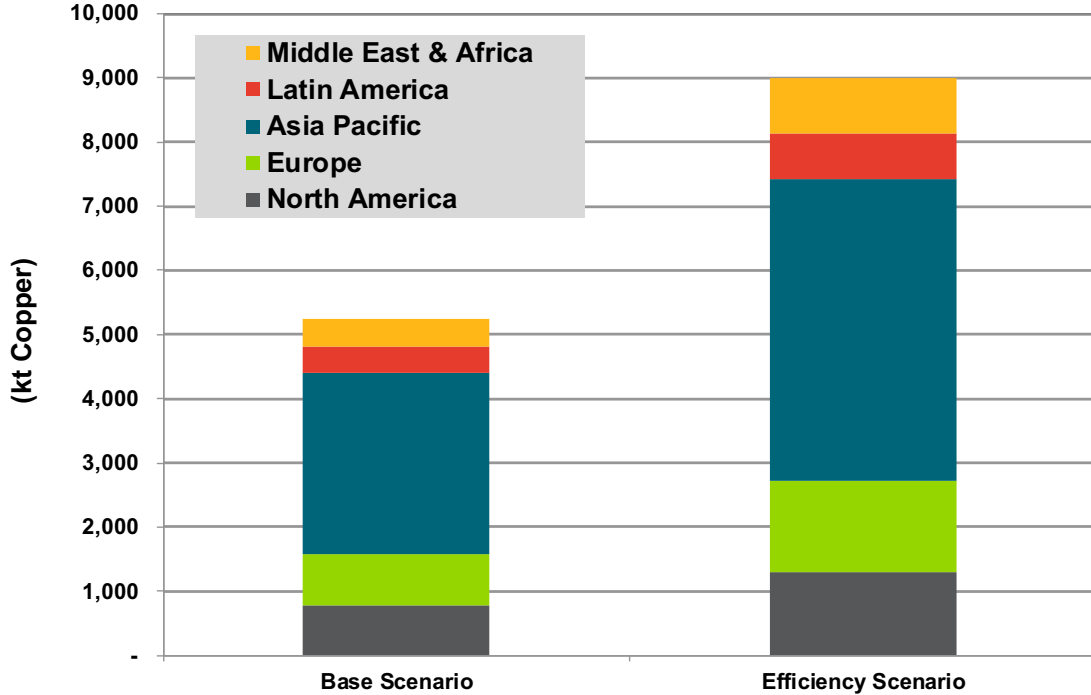


2030 DEMAND – BASE AND EFFICIENCY SCENARIOS

Demand by Segment and Scenario, World Markets: 2030



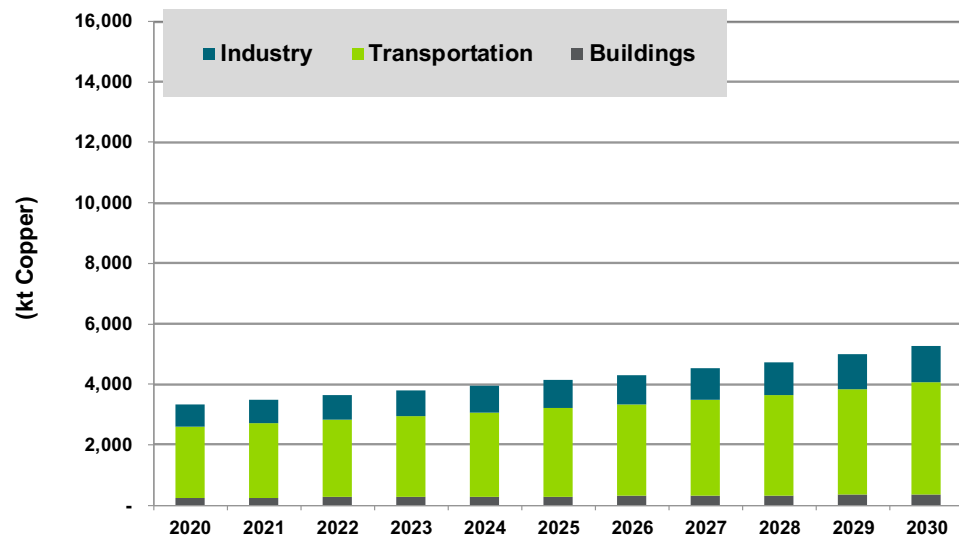
Demand by Region and Scenario, World Markets: 2030



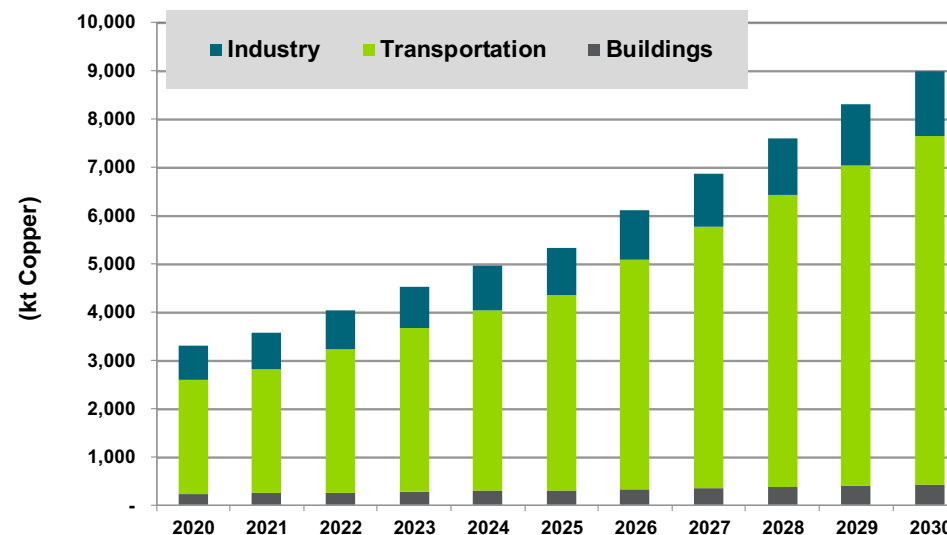
DEMAND IN EFFICIENCY SCENARIO

- The cumulative increase in demand associated with the efficiency scenario in comparison to the base scenario is 17,672 Kt over ten years.
- The largest opportunity for demand gains comes from increased energy efficiency in the transportation sector, driven by the growth in electric vehicles and plug-in hybrids.
- Current policy around the world is significantly behind required levels to support the efficiency scenario. The transportation sector is currently more likely to achieve the efficiency scenario among all sectors analyzed due to transportation electrification policy in countries such as India, Denmark, and others.

Demand by Segment, Base Scenario: 2020 – 2030



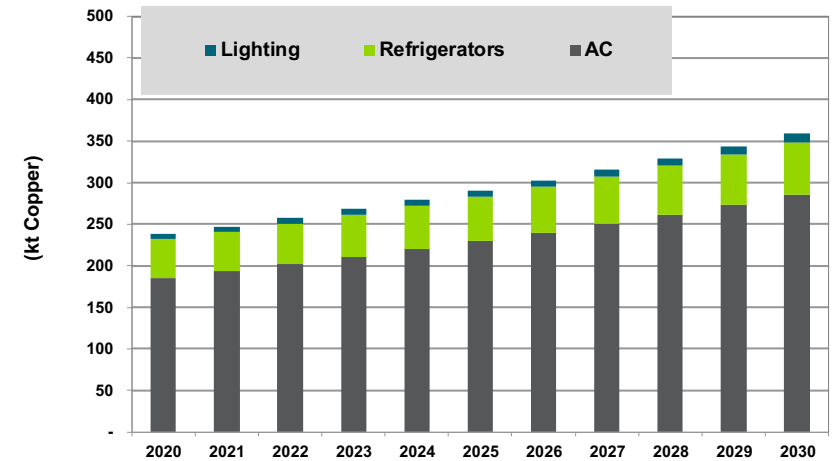
Demand by Segment, Efficiency Scenario: 2020 – 2030



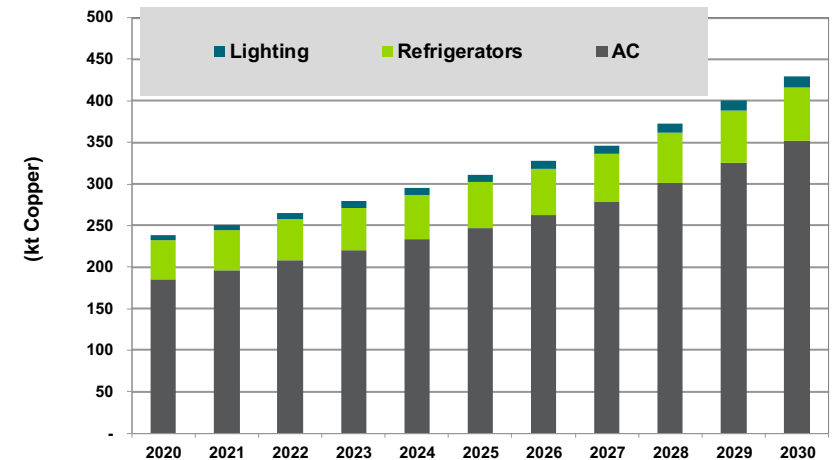
BUILDINGS SUMMARY

- AC contributes most to demand in residential buildings under both the base and efficiency scenarios.
 - Intensity of use grows per AC unit in the efficiency scenario due to higher energy efficiency requirements and an expected associated increase in indoor heat exchangers that utilize copper coils.
- Lighting material demand is expected to see fastest growth among the three technologies at an 8.2% CAGR due to LED copper content.
 - Adoption of LEDs is growing fast due to affordability, ease of replacement, and quick ROI.
 - LED bulbs are estimated to contain more than ~200 times copper as incandescent lamps.
- Refrigerators are a relatively less significant contributor.
 - Manufacturers are utilizing non-copper strategies to increase refrigerator efficiency, such as envelope improvements and variable speed drives.

Demand From Buildings by Technology, Base Scenario: 2020 – 2030



Demand From Buildings by Technology, Efficiency Scenario: 2020 – 2030



ROLE OF MINIMUM ENERGY PERFORMANCE STANDARDS (MEPS)

More stringent efficiency standards are required to incentivize AC shipments at energy consumption levels required for the 3% scenario.

- The technology exists in the market but is not widely adopted.
- According to IEA, an average efficiency of an AC unit installed globally in 2018 was 4 SEER.
- Most efficient units can reach efficiencies of 26 SEER. AC controls play a big role in optimizing AC performance at these levels.

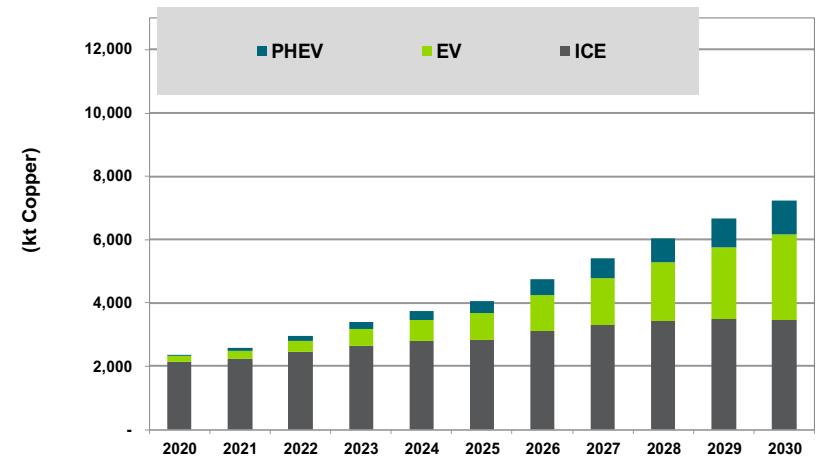
European demand increases most between the base and the efficiency scenario on a percentage basis, due to MEPS and policy incentivizing purchase of efficient units. European demand is estimated to grow at a 7.7% CAGR in the efficiency scenario.

- However, even in the EU additional policy action is required to incentivize purchases at efficiency levels required for the 3% scenario.

TRANSPORTATION SUMMARY – LIGHT DUTY VEHICLES

- Growth in shipments of electric vehicles (EVs), as well as plug-in hybrids is driving increasing demand in both the base and efficiency scenarios.
 - Demand is growing at a CAGR of 4.6% in the base scenario and 11.8% in the efficiency scenario.
 - EV vehicles contain ~4 times as much copper as ICE vehicles.
- Energy consumption reduction gains are primarily achieved through a decrease in Internal Combusting Engine (ICE) vehicle shipments and growth in EVs. However, more efficient ICE vehicles also contribute to an overall energy consumption reduction in the efficiency scenario.
- Pressures to reduce vehicle weight are resulting in manufacturers exploring aluminum harness options for vehicles of all types. Additionally, pressures from mode shifting and the changing landscape of mobility are resulting in a decrease in light duty vehicle demand.

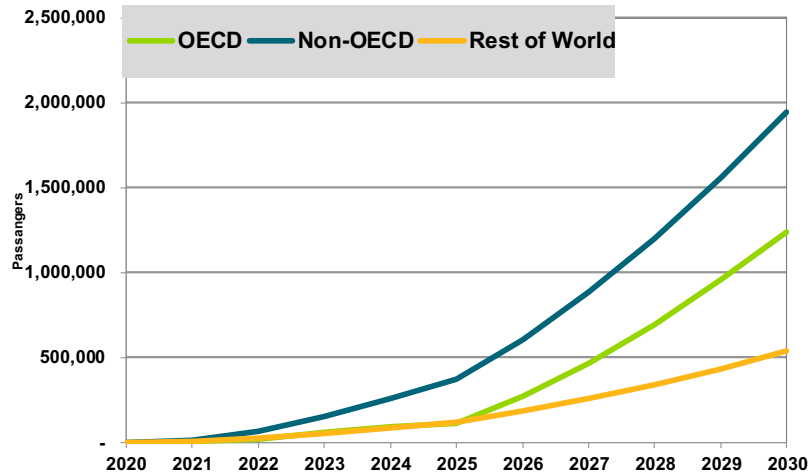
Demand From Light Duty Vehicles By Technology, Efficiency Scenario: 2020-2030



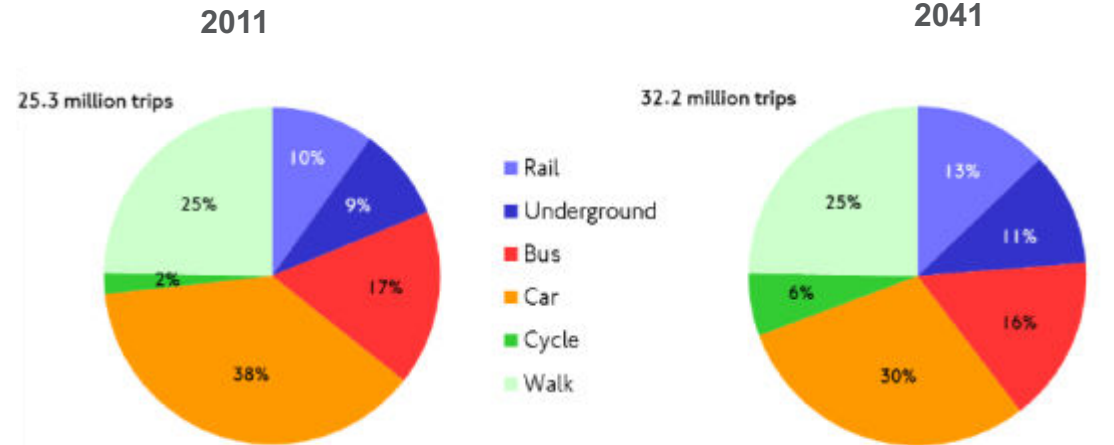
MODE SHIFTING

- Ride sharing, public transit, remote work and other alternatives to car usages are emerging as strong competitors to individual or family light duty vehicles in parts of the world. Mode shifting is expected to decrease overall light duty vehicle shipments.
- While mode shifting results in a decrease in demand associated with light duty vehicles, the decrease will likely be counterbalanced by gains in demand in other transportations sectors, such as rail and electric buses. Trips will be increasing, but underutilized rail and buses will be used first before investments are made.

Passengers Expected to Switch Away from Cars Between 2020 and 2030



Share of Transport by Mode – London Example

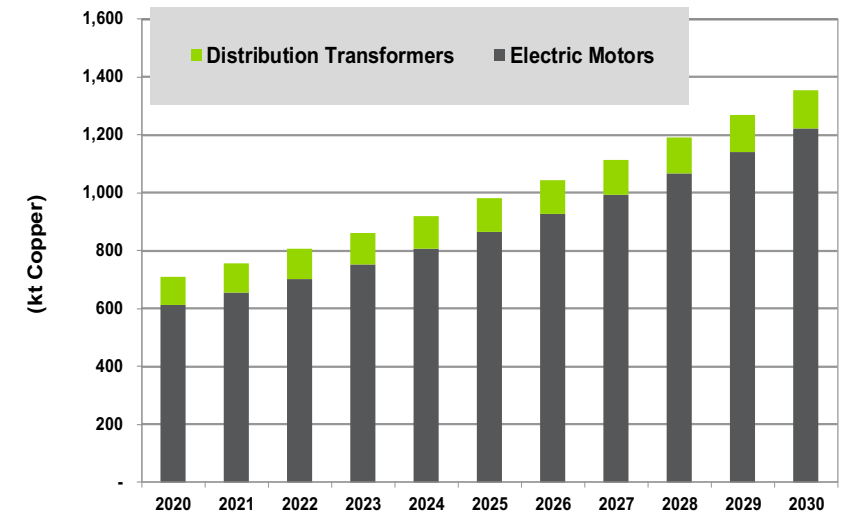


Source: TfL Planning, Strategic Analysis

INDUSTRY SUMMARY

- Electric motors contribute the most to demand in industry in both the base and efficiency scenarios due to the extensive use of copper in electrical motor components both in baseline and high efficiency models.
- Electric motors are used extensively and increasingly in the world's energy systems. Energy efficiency is of paramount importance which typically results in more copper use in the motor.
- Replacement of transformers with more efficient alternatives in the efficiency scenario results in growth in demand at a CAGR of 2.8%. In the base scenario, demand grows at a CAGR of 4.4%.
- Efficiency improvements are expected to primarily come from non-copper components, eroding the role of copper in the efficiency scenario.

Demand From Industry By Technology, Efficiency Scenario: 2020-2030



ROLE OF MEPS IN INDUSTRY

Countries Without Efficiency Programs for Distribution Transformers, 2017



Source: United for Efficiency

Similar to buildings, there is a large gap between current regulatory landscape and improvements required to achieve the efficiency scenario.

- For both electric motors and distribution transformers the regulatory landscape is patchy.
- The biggest divide is between developed and developing nations. The majority of countries in the world do not have MEPS for these two technologies.
- Countries that have MEPS in place for these technologies measure energy efficiency differently, resulting in a lack of consistency of definitions and standards.

There is an overall trend of more stringent regulation in the sector. However, it is not currently on the path towards the efficiency scenario.

2030 DEMAND – BASE AND EFFICIENCY SCENARIOS

Demand by Segment and Scenario, World Markets: 2030

