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Steel Demand Beyond 2030

Forecast Scenarios

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accenture strategy

Strategy | Digital | Technology | Operations

Introduction

Introduction

The long range forecast model was developed to assess the potential impact of key forecast drivers and disruption forces on global steel demand to 2035

Forecast Drivers

- Per capita GDP
- Fixed Asset Investment intensity
- Manufacturing intensity
- Urbanization rate
- Population growth rate

Applied to

88 Countries / 6 Groups

- Mature: high manufacturing intensity
- Mature: low manufacturing intensity
- Emerging: high manufacturing intensity
- Emerging: low manufacturing intensity
- China
- India

Baseline Projection

Disruption Forces
(tested incremental and radical disruption)

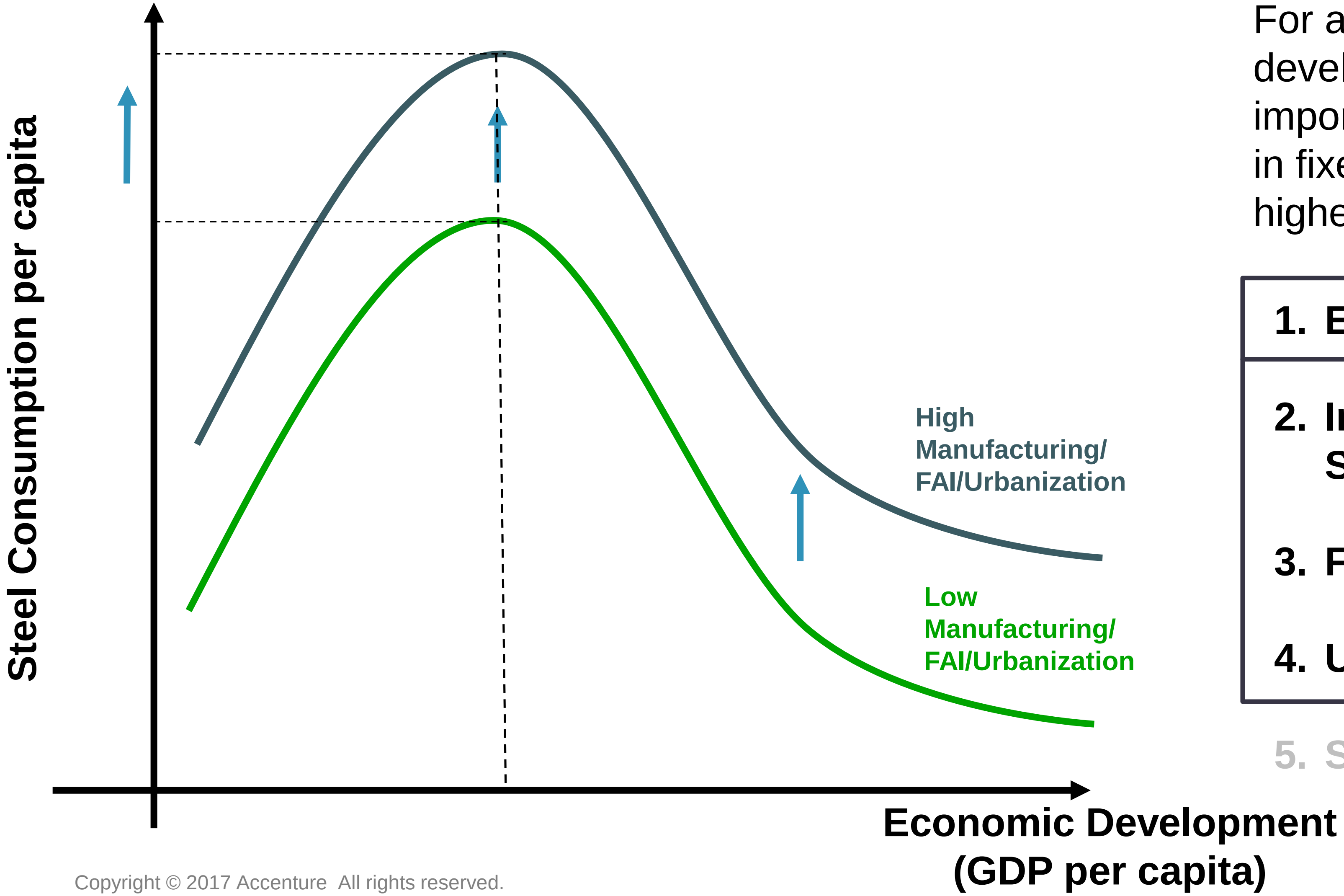
- Application of digital technologies by customers, suppliers, other material producers
- Circular economy and changing consumer preferences
  - Reduced end product demand
  - Longer end-product life including re-use and re-manufacturing
  - Accelerated reduction in steel intensity due to material and process substitution

Scenarios

- Steel production and raw material
- Tested for impact of increase in EAF production share in China and ROW

Forecast Drivers on Steel Demand

As countries develop, their steel consumption per capita increases to a peak point then per capita consumption starts declining -- finally plateauing

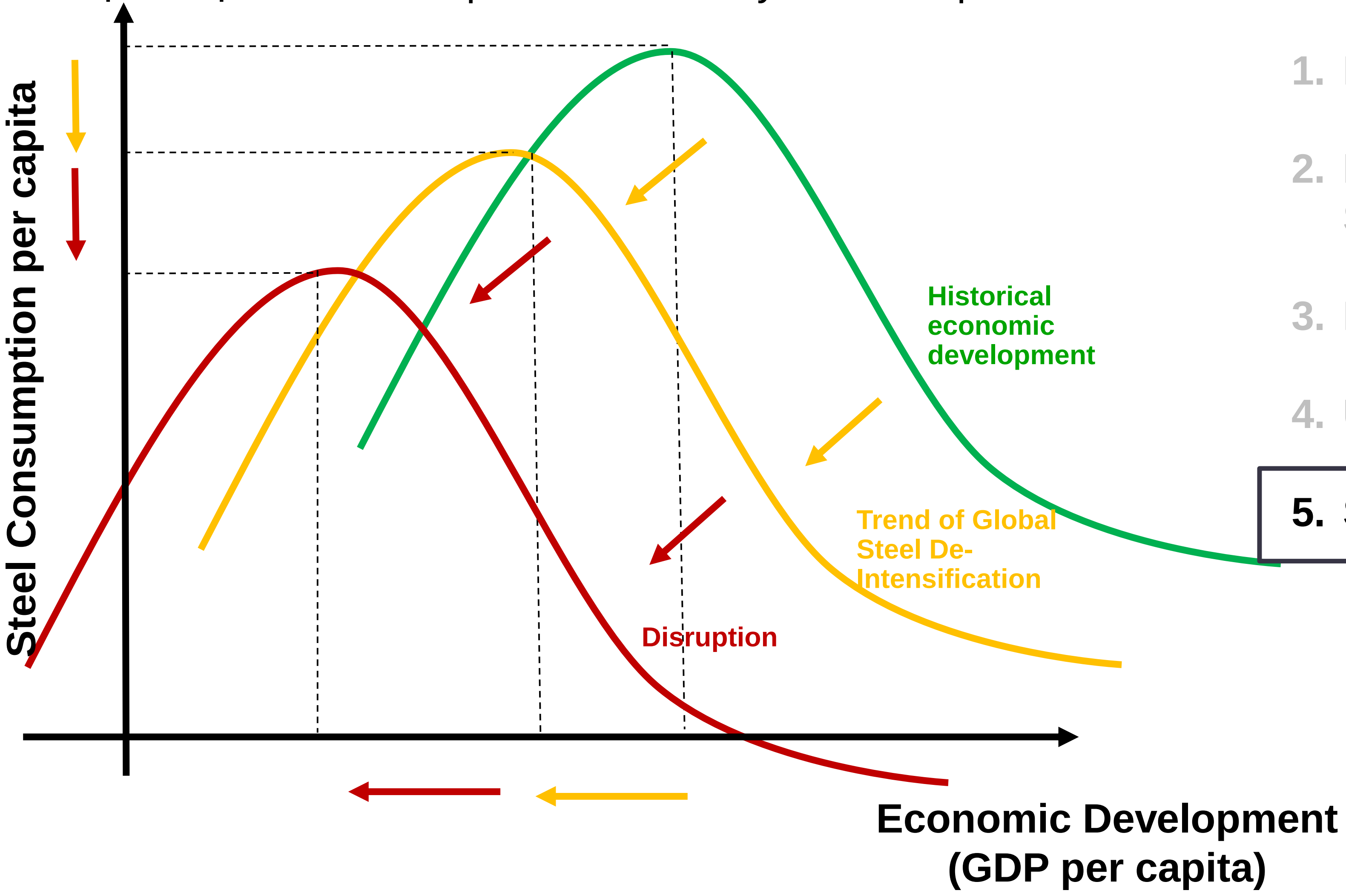


For a given level of economic development -- the higher the importance of manufacturing, investment in fixed assets and urbanization, the higher the consumption of steel

1. **Economic Development Level**
2. **Importance of Manufacturing Sector**
3. **Fixed Asset Investments**
4. **Urbanization**
5. **Steel De-Intensification Factors**

Shifting Peak Consumption of Steel per Capita

Technology advancements have driven steel consumption per capita in countries to peak at lower levels of GPD per capita and disruption factors may drive the peaks to even lower levels



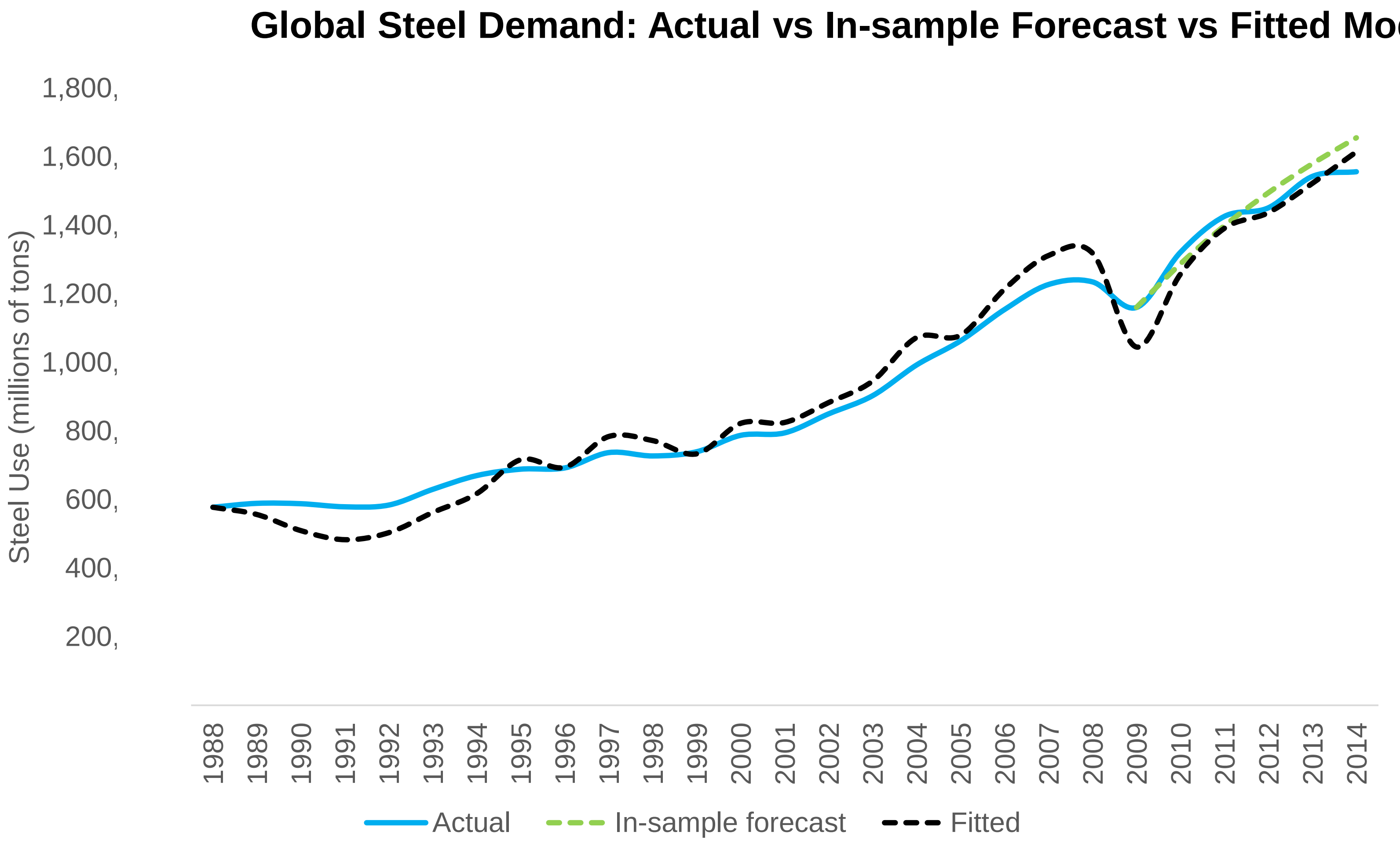
1. Economic Development Level
2. Importance of Manufacturing Sector
3. Fixed Asset Investments
4. Urbanization
5. **Steel De-Intensification Factors***

* Factors include material substitutions, quality improvement of materials and changing design

Historical Analysis

Testing the Model – Predicting the Trend

The econometric model that was developed indicates a very good fit at the global level



The Macro Layer - In-sample Forecast (2010-2014) & Fitted Values 1988-2014

The model has an R^2 of 0.97 at the global level

Testing the Model – Predicting the Peak

The closer to the 45 degree line the better the model explains the peak per capita

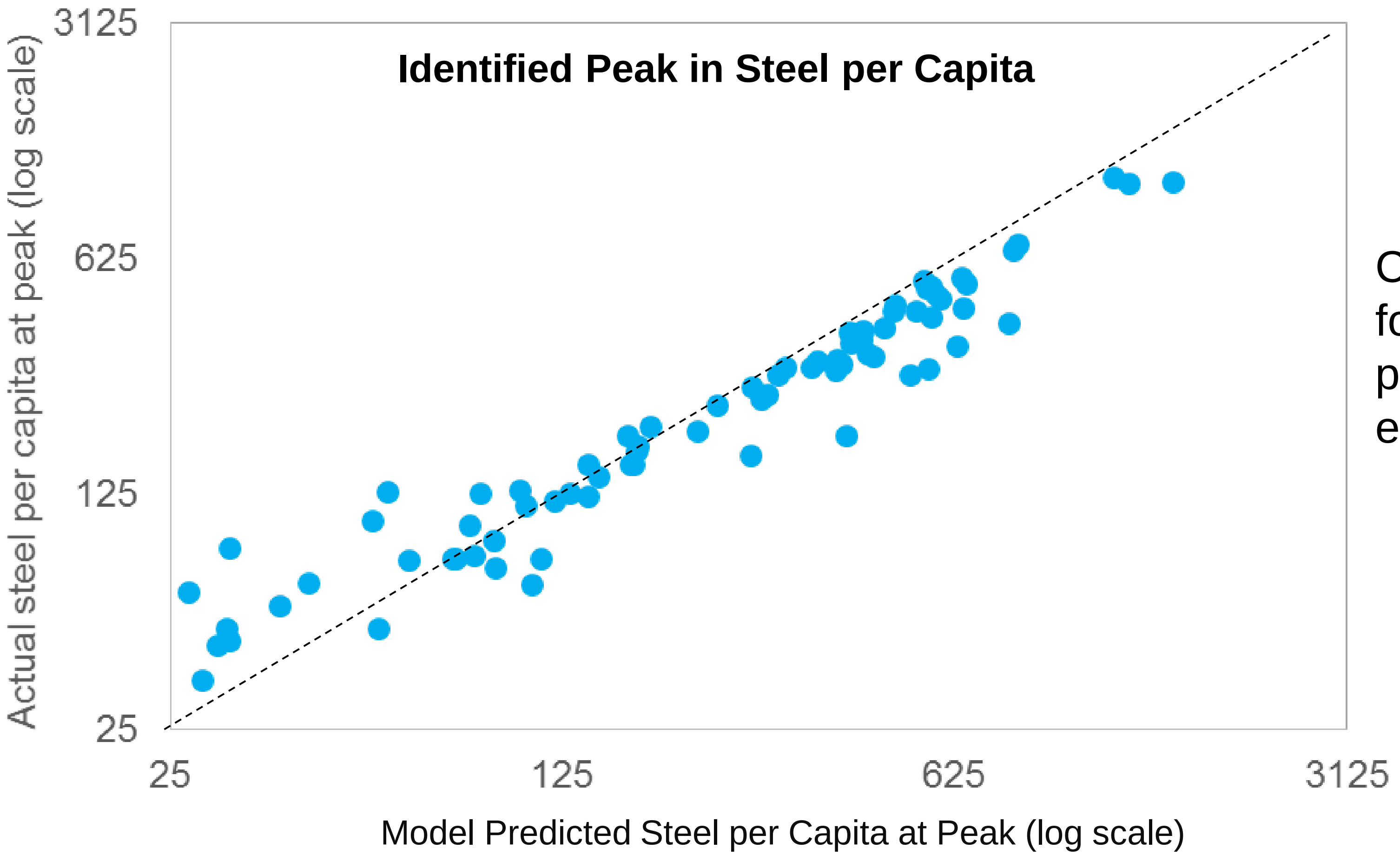
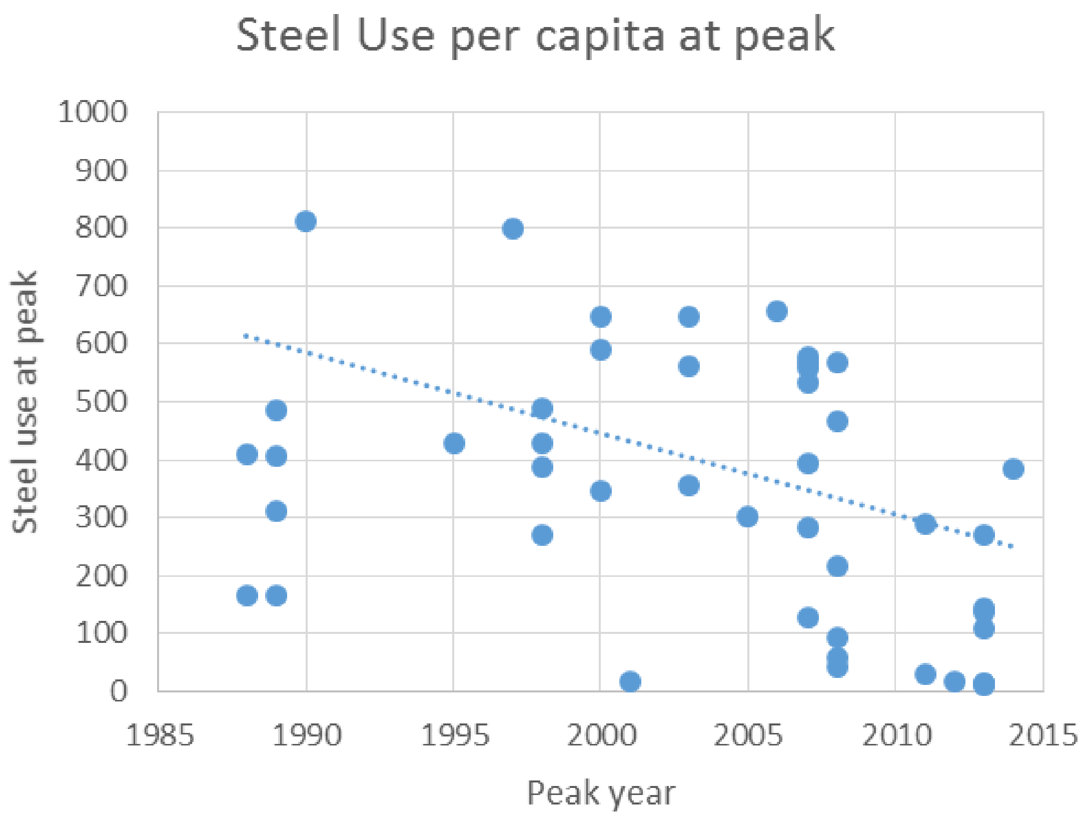
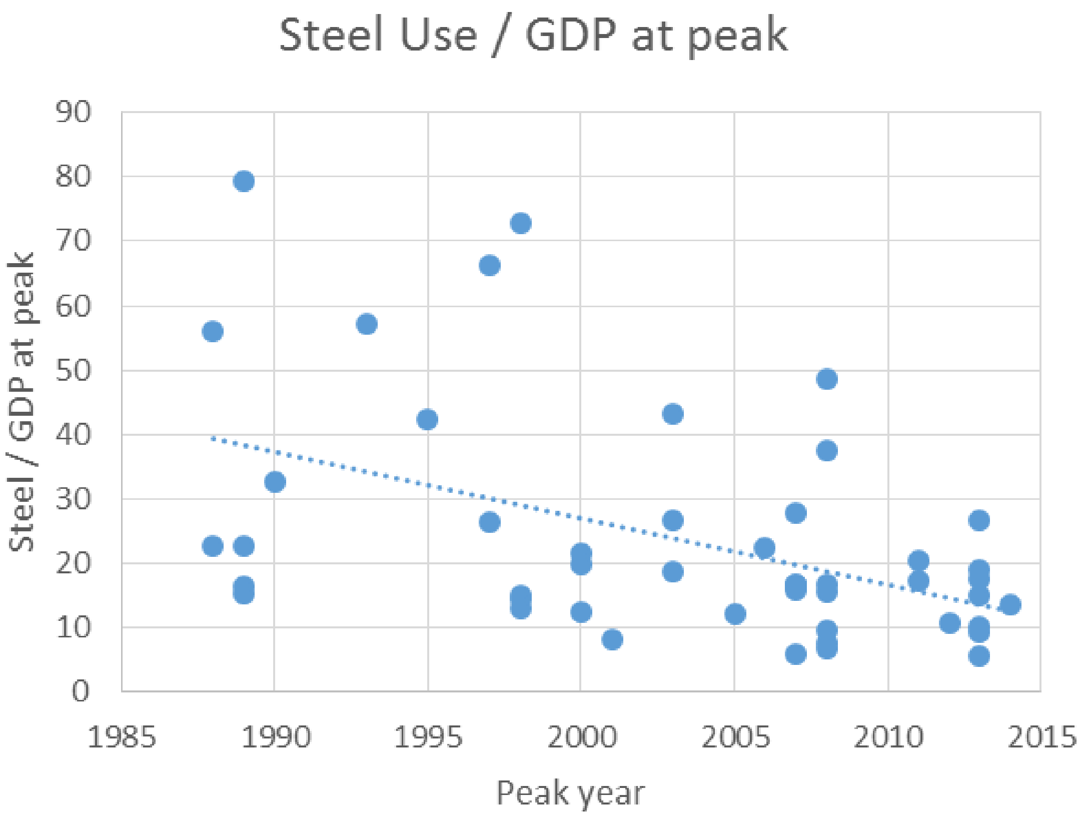


Chart shows data only for those countries that peaked in 2015 or earlier (N = 38)

Historical Trend of Peak Per Capita Steel

Over time countries have tended to reach peak steel intensity at lower levels





Disruption Forces

Disruption Factors and Consumption Sectors

The impact of disruption factors were estimated and applied to six major consumption sectors

Disruption Factors

- ❑ Reduction in demand for sector's product
- ❑ Increase in useful life
- ❑ Change in steel intensity

Consumption Sectors

1. Automotive
2. Capital Equipment and Machinery
3. Residential Construction
4. Commercial Construction
5. Consumer & Durable Goods
6. Infrastructure

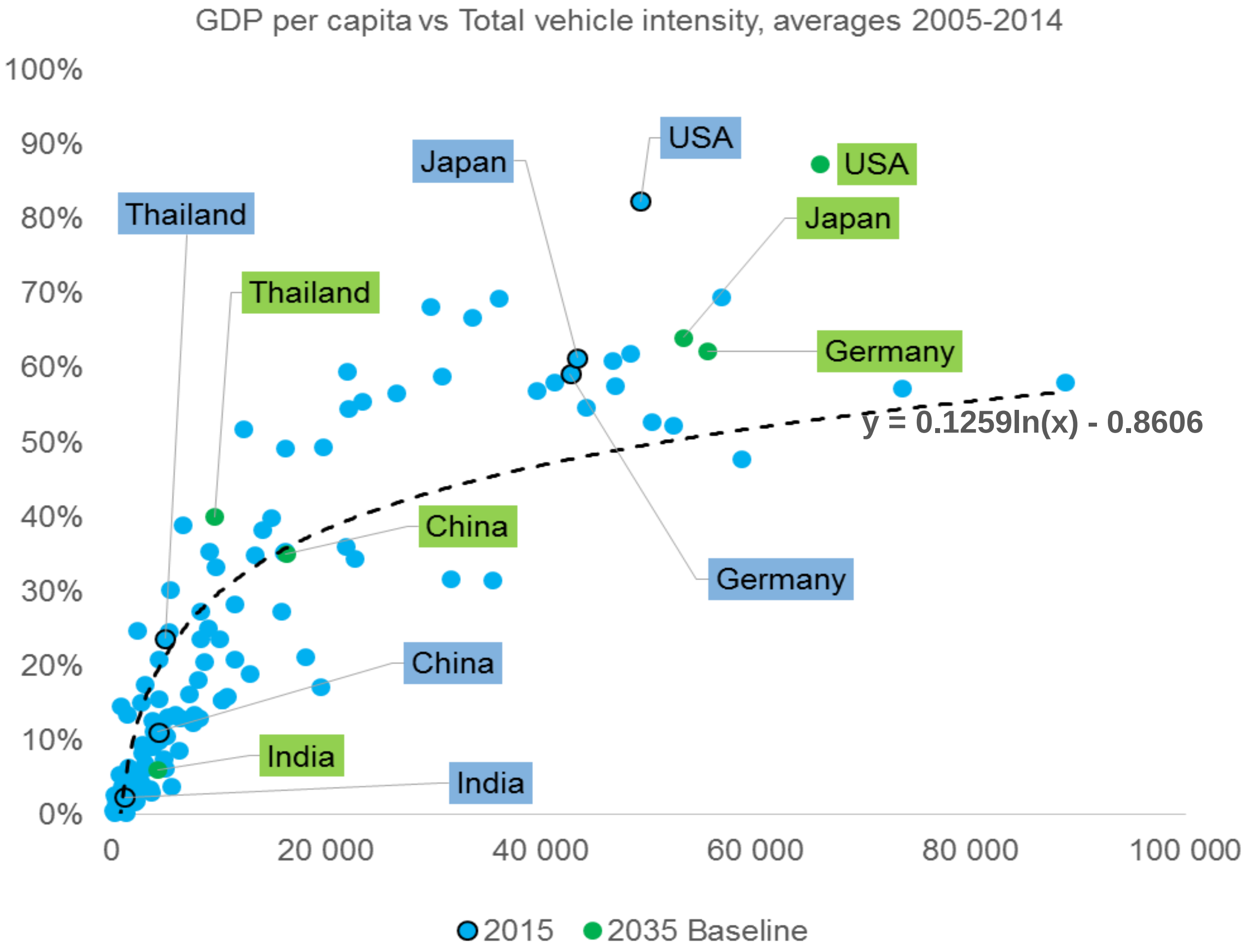
Detail - Automotive

Using automotive as an example specific disruption factors were estimated and applied to the baseline estimate of steel demand

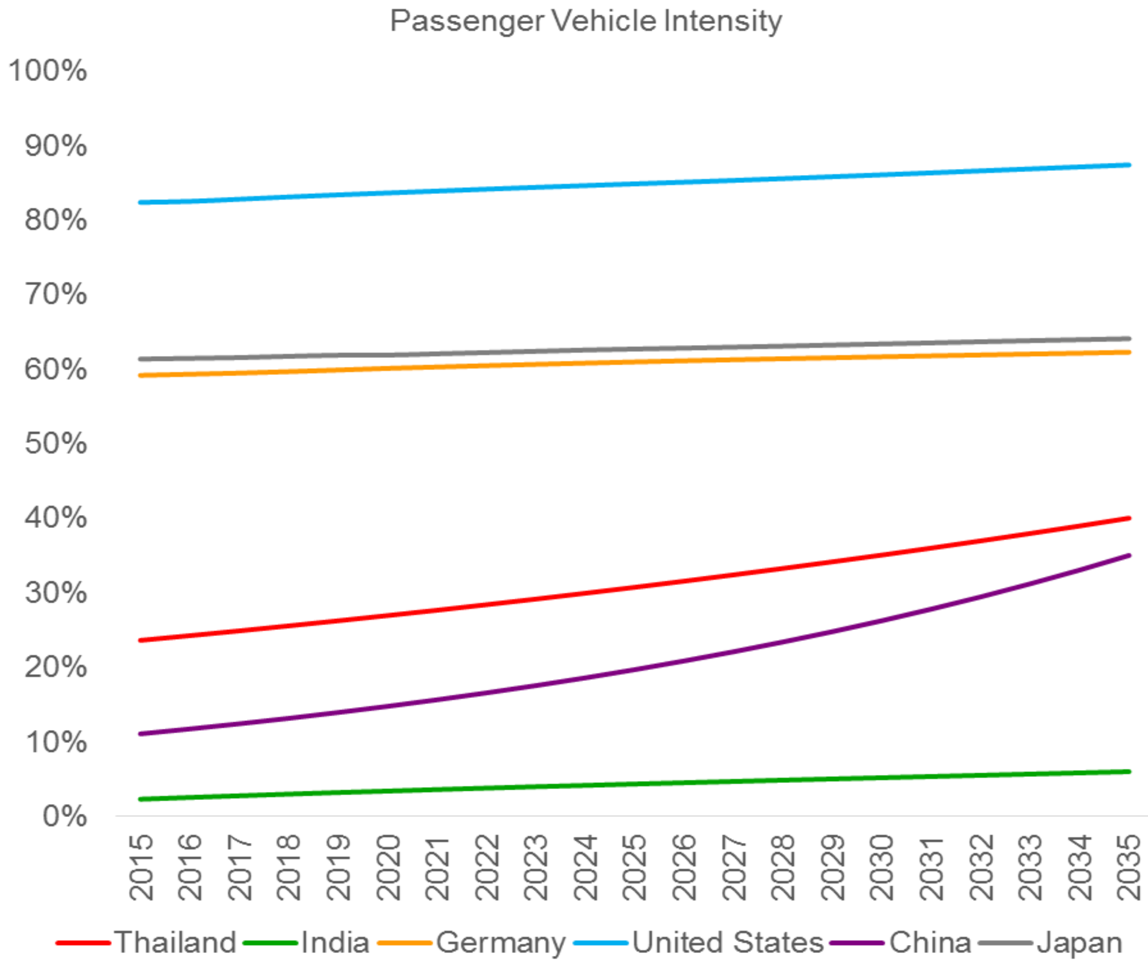
Sector's Baseline Steel Demand	Auto Specific Disruption Factors
+/-	
Reduction In Demand for Sector's Product	Sharing, transportation-as-service and consumer preference will decrease per capita passenger vehicle intensity (fewer vehicles per capita)
+/-	
Increase In Useful Life	Longer-lasting / reusable vehicle structural and exterior components as a result of better design and materials will reduce annual demand for new vehicles
+/-	
Change in Steel Intensity	Continued vehicle light weighting for both steel (same surface area – less mass) and impact of substitutes

Total vehicle intensity - pre-disruption forecasts

Vehicles per capita were estimated based on historical ratios and projections of economic development



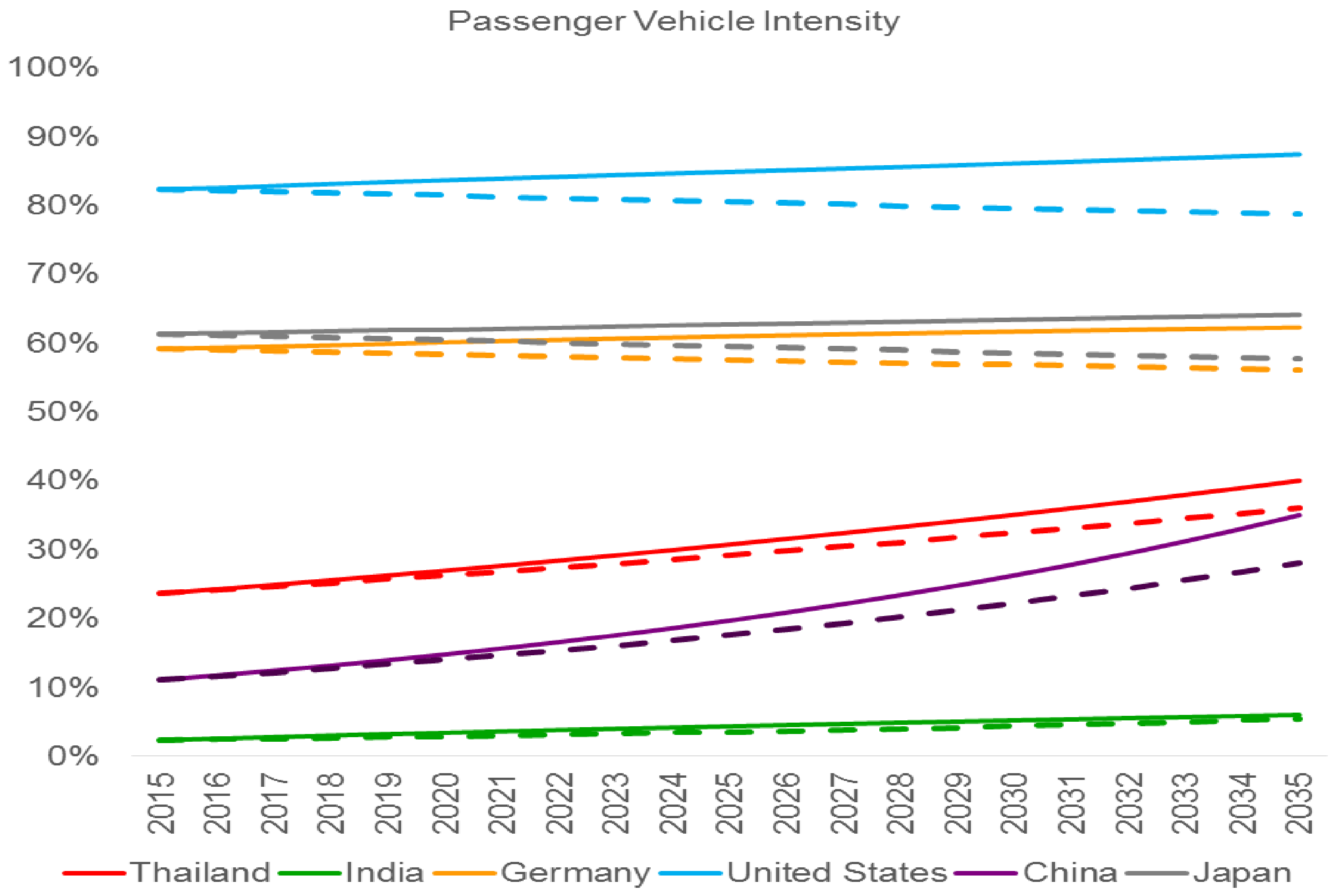
Note: Based on 120 countries. R^2 = 0.84
Source: Accenture Research, Oxford Economics, OICA, 2016



Note: Use growth rates form fitted model to project forecasts from actual historical data.
Source: Accenture Research, Oxford Economics, OICA, 2016

Total vehicle intensity - post-disruption forecasts (incremental scenario)

The impact of the disruption factors shifted the estimated vehicle intensity estimates



Solid line is baseline vehicle intensity – dotted line represents vehicle intensity after disruptors

Note: Use growth rates form fitted model to project forecasts from actual historical data.
Source: Accenture Research, Oxford Economics, OICA, 2016

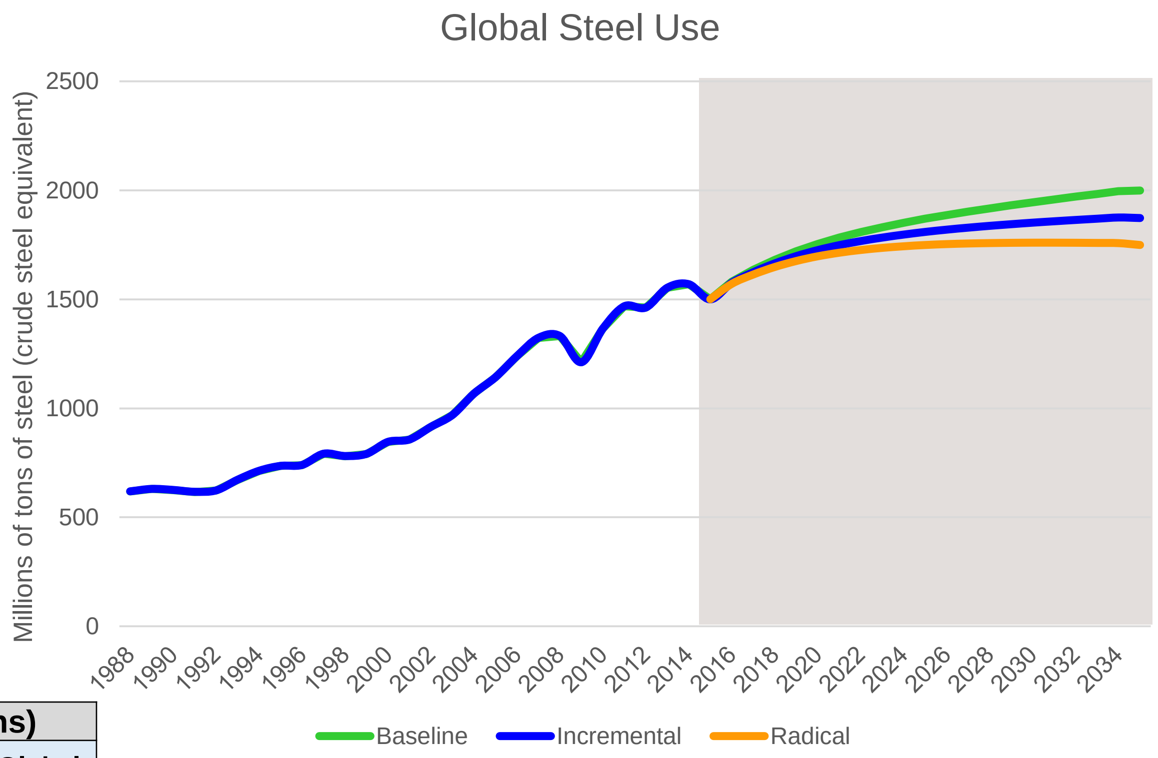
Global Steel Demand Forecast

Baseline Global Demand Forecast Under Disruption - Overall

In the baseline forecast, global steel demand grows by **1.4%** per annum to reach around **2.0** billion tons by 2035

However after applying the estimates of the impact of disruptors the projection is that global steel demand will grows by **1.1%** per annum to reach **1.87** billion tons by 2035

In the Radical scenario, global steel demand grows by **0.4%** per annum to reach **1.75** billion tonnes by 2035, which is **12.5%** below the baseline forecast of 2.0 billion tonnes



Summary Table: Apparent steel use (Crude steel equivalent, millions of tons)

		EME/HM	EME/LM	DEV/HM	DEV/LM	China	India	Global
Baseline	2015	44	315	113	276	672	80	**1,500**
	2035							**2,000**
	CAGR 2015-2035							**1.4%**
Incremental	2015	44	315	113	276	672	80	**1,500**
	2035	77	638	116	269	537	237	**1,873**
	CAGR 2015-2035	2.9%	3.6%	0.1%	-0.1%	-1.1%	5.6%	**1.1%**
Radical	2015	44	315	113	276	672	80	**1,500**
	2035	71	593	104	248	504	228	**1,749**
	CAGR 2015-2035	2.4%	3.2%	-0.4%	-0.5%	-1.4%	5.4%	**0.8%**

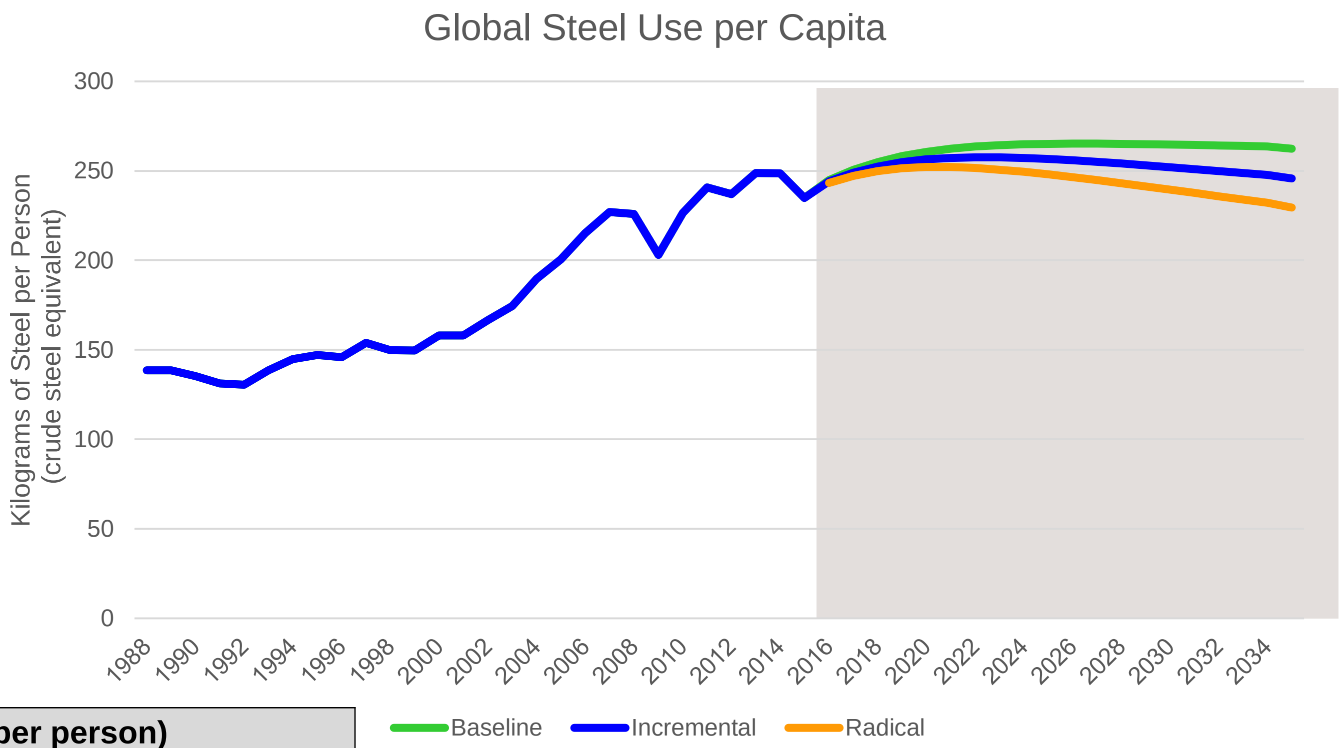
EME/HM: Emerging/High Manu
EME/LM: Emerging/Low Manu
DEV/HM: Developed/High Manu
DEV/LM: Developed/Low Manu

Baseline Global Demand Forecast Under Disruption – Per Capita

In the Baseline scenario, global steel per capita increases to 263 kg per person by 2035, but on a very flat curve

In the Incremental scenario, global steel per capita increase to 246 kg per person by 2035, but is on a downward trajectory

In the Radical scenario, global steel per capita decreases to 229 kg per person by 2035, which is 33 kg per person lower than the baseline forecast of 263 kg per person



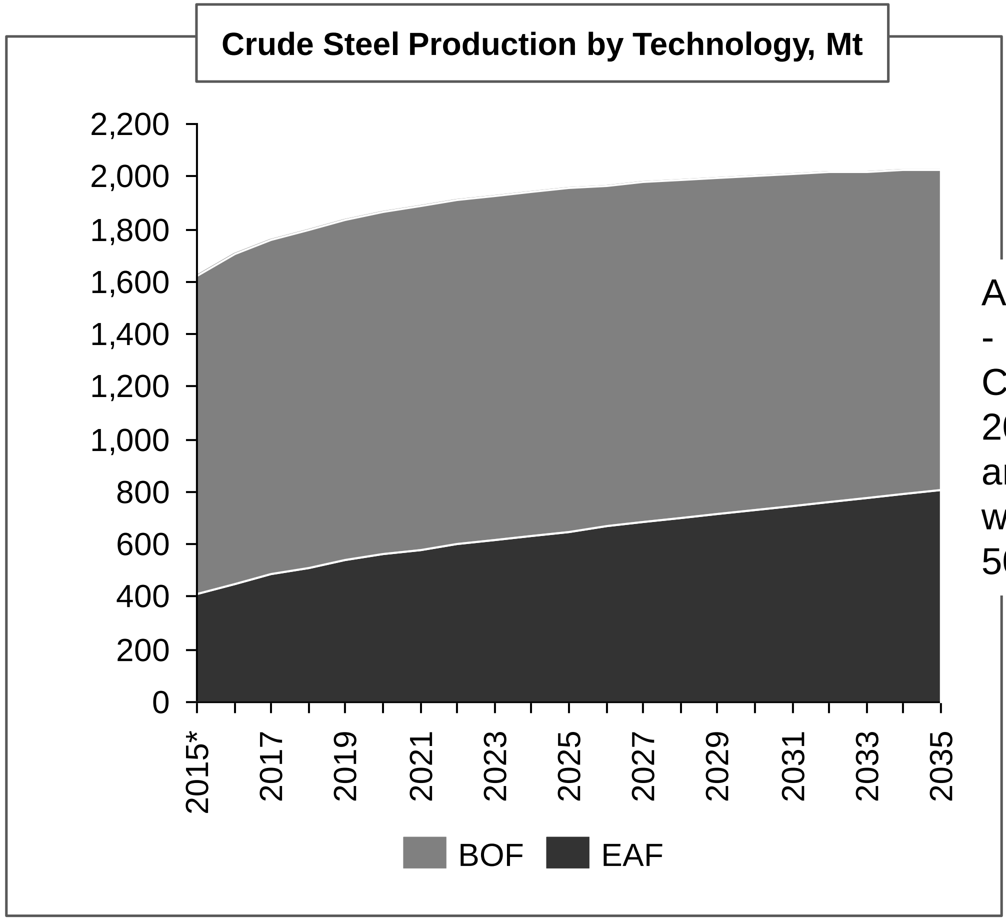
Summary Table: Steel use per capita (kilograms per person)								
		EME/HM	EME/LM	DEV/HM	DEV/LM	China	India	**Global**
Baseline	2015	173	204	703	321	497	61	**235**
	2035							**263**
	CAGR 2015-2035							**0.6%**
Incremental	2015	173	204	703	321	497	61	**235**
	2035	260	226	704	289	388	150	**246**
	CAGR 2015-2035	2.1%	0.5%	0.0%	-0.5%	-1.2%	4.6%	**0.2%**
Radical	2015	173	204	703	321	497	61	**235**
	2035	239	208	636	267	365	145	**229**
	CAGR 2015-2035	1.7%	0.1%	-0.5%	-0.9%	-1.5%	4.4%	**-0.1%**

EME/HM: Emerging/High Manu
EME/LM: Emerging/Low Manu
DEV/HM: Developed/High Manu
DEV/LM: Developed/Low Manu

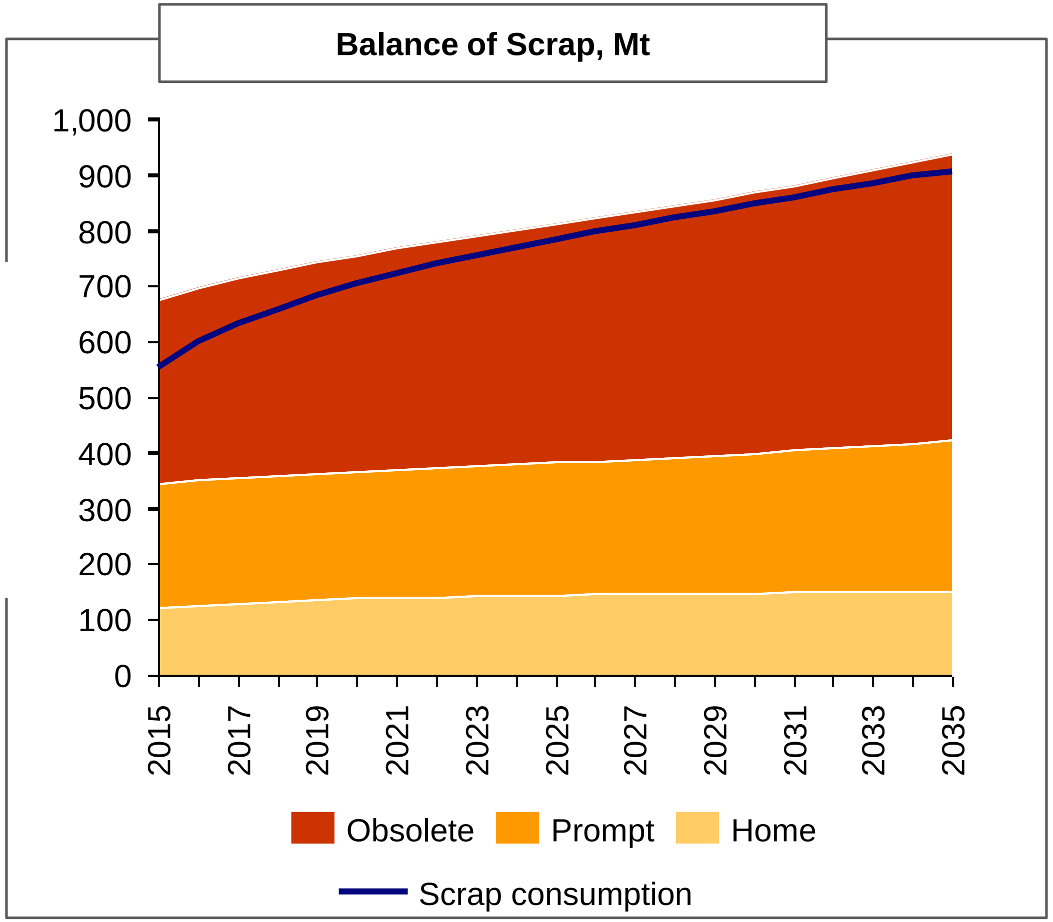
Steel Production & Raw Material Scenarios

Global Steel Production

The model was extended to consider different mixes of types of steel production to project the relative supply-demand balance of scrap – this is the scenario assuming EAF production increases to 40% of total – in this scenario scrap consumption would be below potential scrap supply



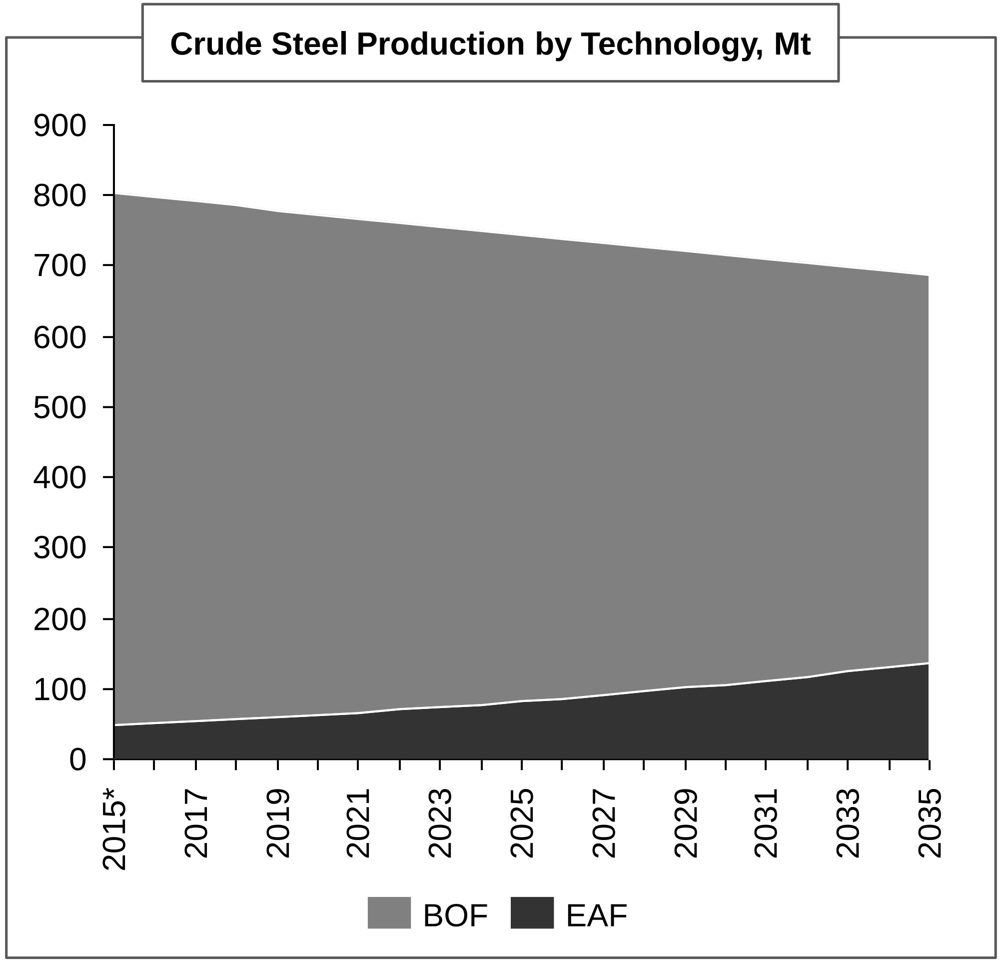
Assumption - In 2035 China at 20% EAF and rest of world at 50% EAF

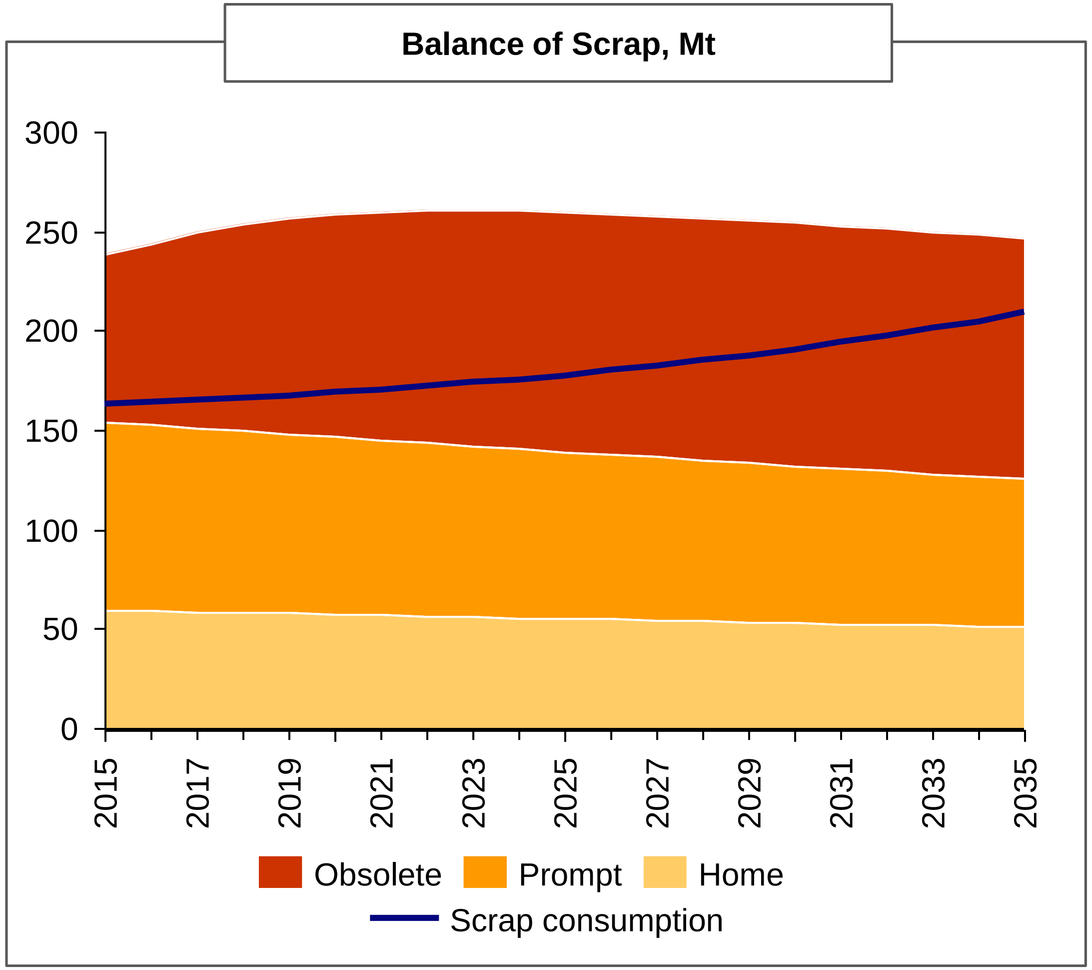


*Note: * factual data from WSA*
Sources: Modeling results

Steel Production in China

However the availability of scrap would not be evenly distributed with China having greater availability of scrap than projected consumption even with an assumption of 20% EAF share by 2035

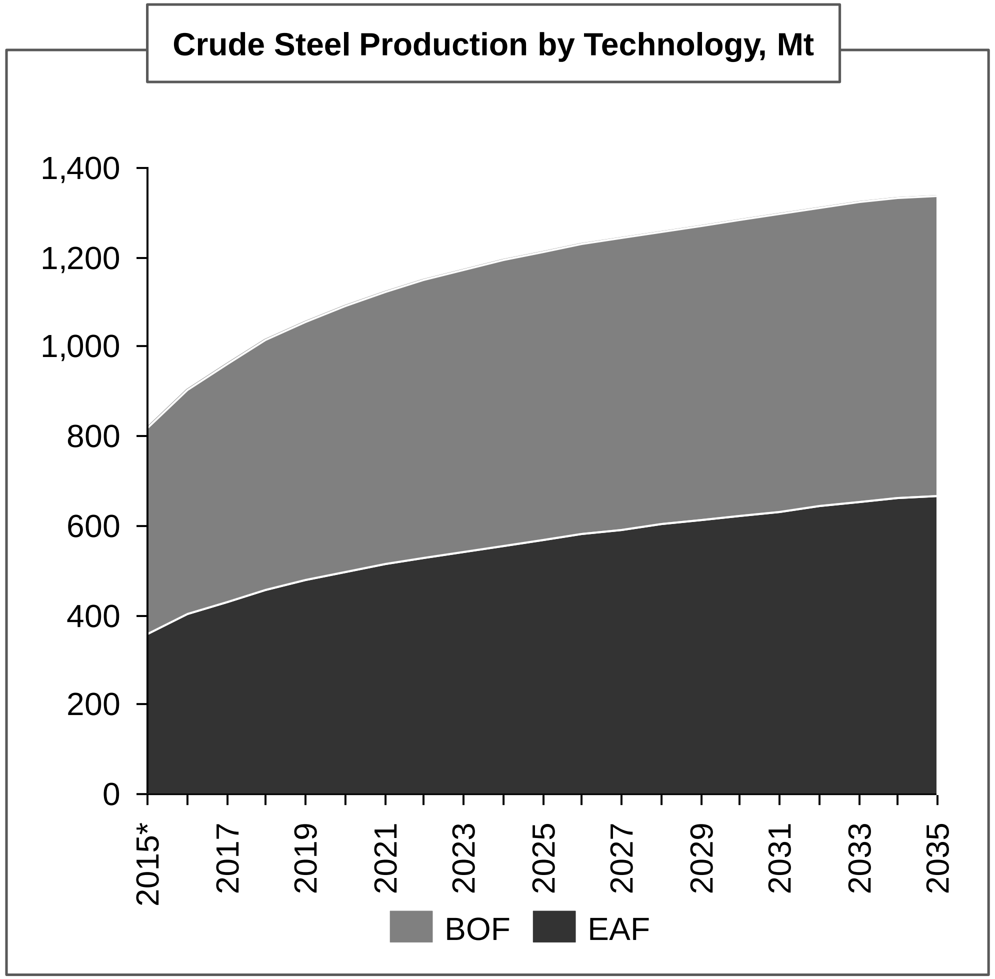


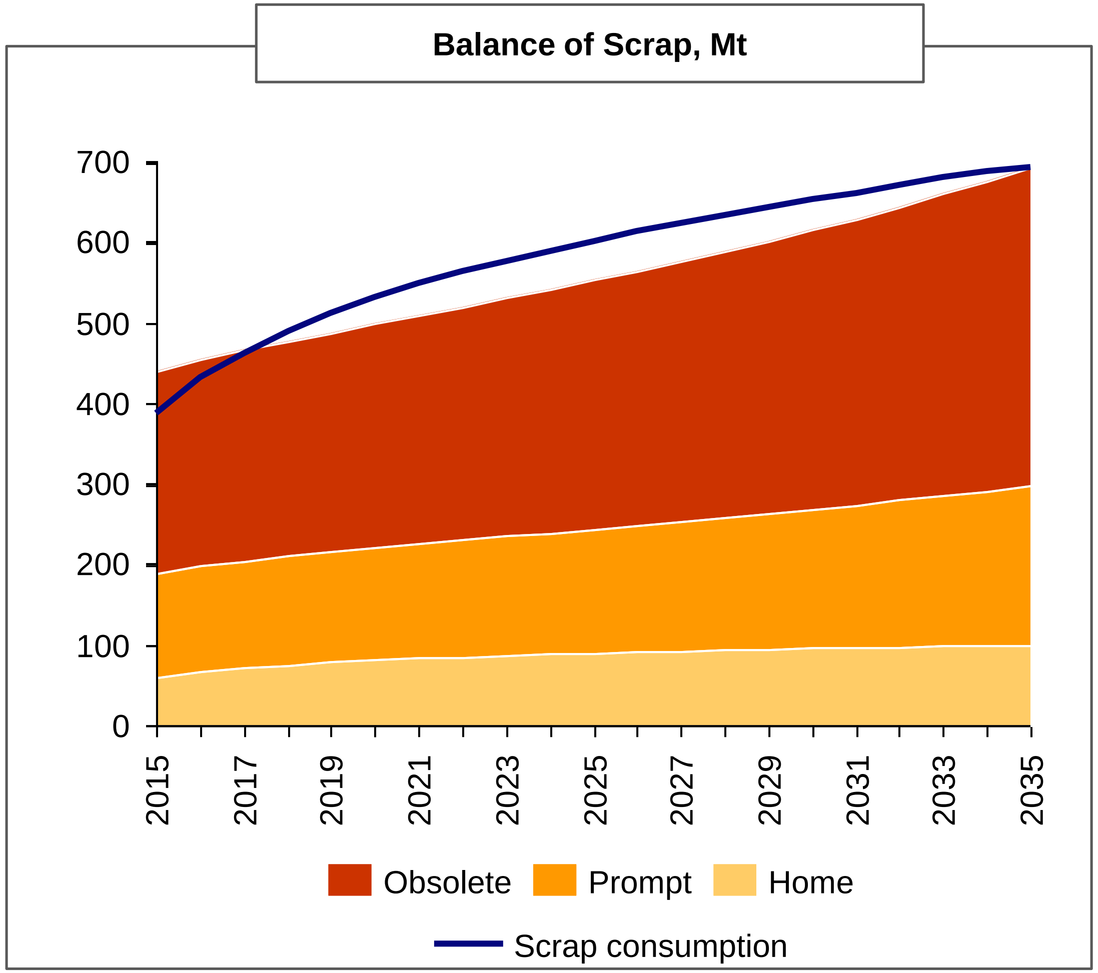


*Note: * factual data from WSA*
Sources: Modeling results

Steel Production in Rest of World

The rest of the world would have a scrap deficit with presumably China exporting scrap





*Note: * factual data from WSA*
Sources: Modeling results

Scenario Results: Global Indicators

Another interesting output of the scenario is that in the middle part of the next decade the world will hit peak iron ore consumption

Indicator (billions of tonnes)	2015	2020	2025	2030	2035	CAGR, %
Apparent steel use	1.50	1.73	1.81	1.85	1.87	1,1%
Crude steel production	1.62	1.86	1.95	2.00	2.02	1,1%
BOF	1.21	1.31	1.30	1.27	1.22	0,0%
EAF	0.41	0.56	0.65	0.73	0.81	3,5%
Demand for iron ore	**2.01**	**2.21**	**2.24**	**2.23**	**2.16**	**0,4%**
Balance of scrap	0.12	0.05	0.03	0.02	0.03	-6,2%
Demand for scrap	0.55	0.70	0.78	0.84	0.90	2,5%
Supply of scrap	0.68	0.76	0.81	0.87	0.94	1,6%
Home scrap	0.12	0.14	0.14	0.15	0.15	1,1%
Prompt scrap	0.22	0.23	0.24	0.25	0.27	1,0%
Obsolete scrap	0.33	0.39	0.43	0.47	0.52	2,2%

2035 (IV) - Net exports of finished steel in China is 100 Mt; BOF/EAF in China is 80/20; BOF/EAF in RoW - 50/50

Sources: Modeling results

Conclusion

Summary Findings

- An incremental disruption scenario reduced the growth rate for steel demand from about ***1.4% per annum to 1.1%***
  - ***1.87 billion tonnes in 2035*** a reduction of 130 million tonnes compared to the baseline projection of 2.0 billion
  - Global steel demand is not expected to peak in this period, but could peak by mid-century
  - Automotive and capital equipment markets are expected to experienced the largest % reductions

- Country group forecasts
  - Demand in ***mature economies*** will show ***zero to slightly negative growth*** rates over the period
  - Demand growth in ***emerging economies will be in the range 2.5% to 4***% - less robust than experienced by developing countries in the past
  - Demand in ***India*** is forecast to ***grow*** at around ***5.6% per annum*** to reach around 240 million tonnes
  - Demand in ***China*** is expected to ***decline at 1.1% per annum***

- Under a scenario of ***EAF share*** in China reaching 20% in 2035 (compared to 6 % today) and in the rest of the world to 50% (vs. 42% today)
  - There will likely be sufficient scrap available at the global level, with significant transfers from China for several years
  - Global demand for iron ore rises from 2 billion tons to ***a peak of around 2.24 billion tons in 2025,*** then starts to decline

Conclusion

- Any assumption that global steel consumption will significantly increase in the future appears to be flawed given potentially disruptive factors, including:
  - Circular economy driven by economics and environmental concerns
  - Digital technologies enabling reduced intensity of products
  - Materials science driving light weighting and substitution for steel
- Slower growth will impact the relative supply demand balance of raw materials which in turn will influence choices of technologies