CAEF
The European Foundry Association

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14. INTERNATIONALE GIESSEREI-FACHMESSE MIT TECHNICAL FORUM

Forecast 2025 for the global Foundry Industry

Düsseldorf, June 2019

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IKB
Deutsche Industriebank

Agenda

1	Macroeconomic Environment	3
2	Forecast 2025 for the Global Foundry Industry	14
3	Future Challenges for the worldwide Casting Industry	22
4	Appendix	25

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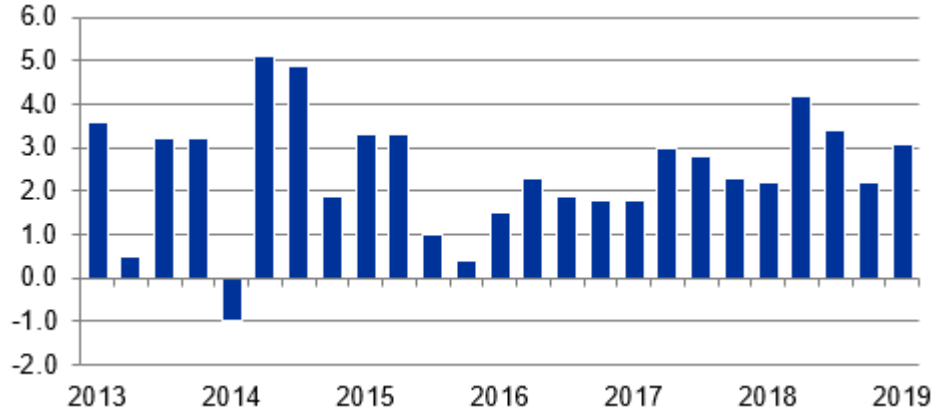
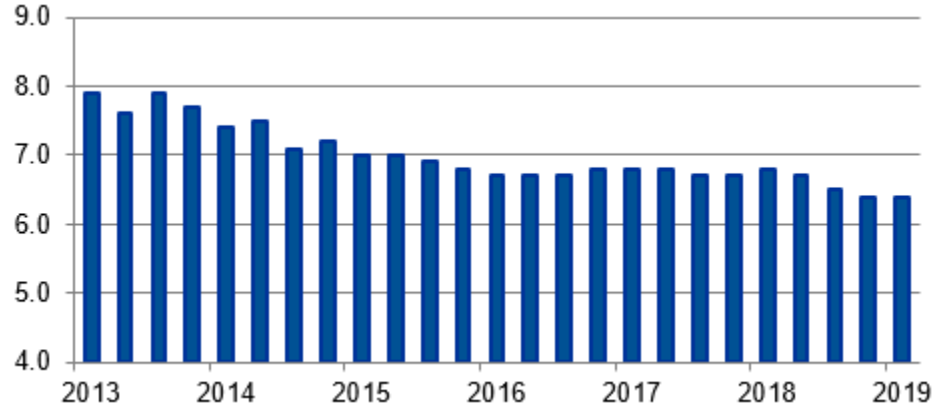
1	Macroeconomic Environment	3
2	Forecast 2025 for the Global Foundry Industry	14
3	Future Challenges for the worldwide Casting Industry	22
4	Appendix	25

Lower Growth Rates

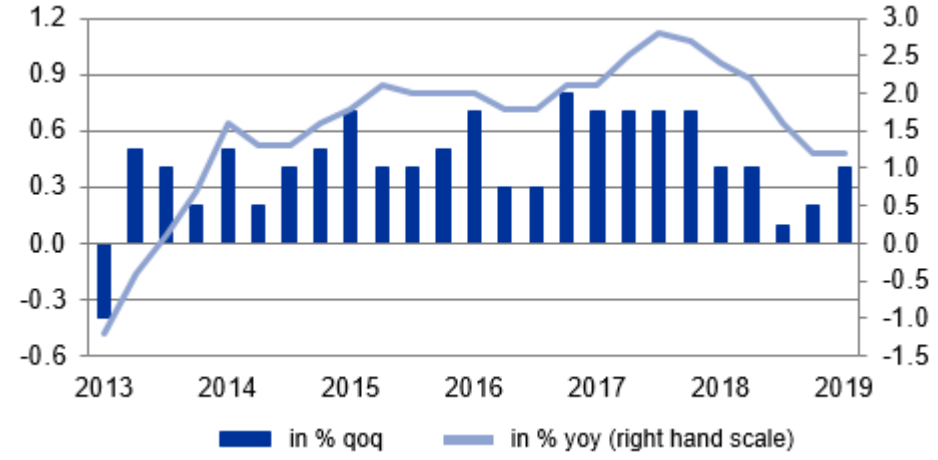
US Real GDP; qoq; in%



China Real GDP; yoy; in %



Euro Zone Real GDP; qoq; in %



In Detail

- The **US-GDP grew by 3.1 % (qoq)** during the **first quarter of 2019**. In total, the economic development was **very strong.** Therefore, IKB forecasts a **growth rate of 2.6 % in 2019**
- **China‘s economy** had a **strong start** into the current year. The **GDP grew by 6.4 % yoy**. The consensus **forecast** had expected a **lower growth** in relation to the last quarter. We expect an average **growth** of the **industrial production** between **5 and 6 %** in the current year
- Eurostat confirms for the euro zone a **GDP growth of 0.4 % qoq** for the first quarter of 2019: A **significant improvement** in relation to the previous quarter. IKB **forecasts** for the euro zone a **GDP growth of 1.2 %** in 2019

Sources: Bloomberg

Crude Oil: Geopolitical Disturbances

Brent Blend; US-$/Barrel[1)]

Active Oil Rigs USA[2)]

High Realibility of Supply

- In **2018** a strong rise of the **worldwide demand** for crude oil was seen: On average the demand rose by 1.4 mbd (million barrel per day) to 98.75 mbd
- For **2019**, we expect another rise in the global crude oil demand of 1.15 mbd **to nearly 100 mbd**
- In addition to a higher oil production in **Non-OPEC countries** an **OPEC production of 35.4 mbd will be necessary**. Around 4.8 mbd will come from the **OPEC NGL grades**
- As a result an OPEC production of around 30.5 mbd is necessary in the current year. This equals the OPEC monthly production in the **first quarter of 2019. But in April and May 2019** the monthly production of the OPEC was below this level
- We have seen a **rise in geopolitical disturbances,** e.g. the war in **Yemen**, the war in **Syria** and the political instability in **Venezuela**. But the highest risk in our point of view is the conflict after the cancellation of the **nuclear agreement with Iran by President Trump**
- The number of **active oil rigs** in the United States of America equal 788, significantly below the peak
- Therefore, we forecast a **crude oil price** fluctuating between **60 and 70 US-$ per barrel Brent** for the next three months of 2019. **WTI** will be around 8 US-Dollars per barrel below the Brent price

Sources: 1) Bloomberg 2) Baker Hughes North America Rotary Rig Count

Higher Geopolitical Risks

Crisis in the Middle East

- The main **geopolitical risks** are the wars in **Yemen** and **Syria,** the political instability in **Venezuela** and the cancellation of the **nuclear agreement with the Iran including strong sanctions**
- We see **no process of democratization in Saudi-Arabia**
- **Iran's threat** to close the **Strait of Hormuz –** an important part of the **crude oil exports from the Gulf region** is passed through the Strait of Hormuz – could induce an explosion
- The **attacks on several oil tankers** lead to a **rise in insecurity** in the region

Brexit: Is it time to say "Good bye"?

- The **retirement of Prime Minister May** raises the **possibility** of a **hard Brexit**
- We could see a **rising uncertainty in the British sentiment indicators**, which have been **going down** since the summer of 2018
- For the **second quarter of 2019** a **decrease in the British GDP** is expected as a result of **anticipatory effects** of the **Brexit**
- A **hard Brexit** will induce a **reduction in economic growth** in the countries of the **EU**

Tweets and Trade Wars

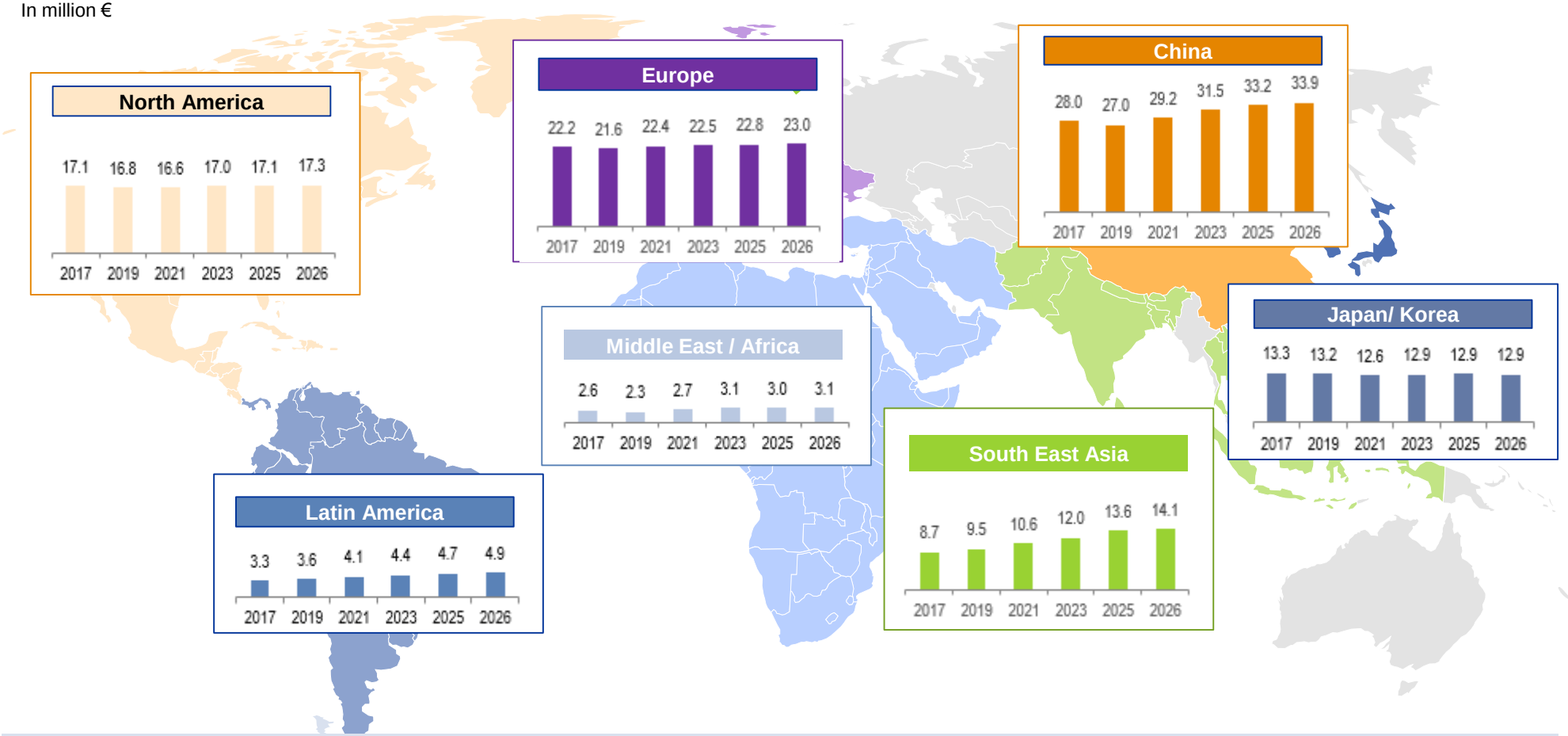
- For President Trump there are threats concerning tariffs on imports and other **sanctions,** an instrument to sharpen his **domestic political profile**
- Even very newly **closed agreements** (e.g. with **Mexico**) are **no longer reliable**
- The **conflict with China** has more and more **negative impacts on** the major **trading partners**
- Does it make sense to **close agreements** and **contracts with the US government**, if a quick **cancellation via tweets** is possible?

Tariffs on Automotive Imports

- Trump is **threatening to impose tariffs** on **imports** of **European light vehicles** as a possible reaction in the trade conflict. His main focus is on **deliveries from Germany**
- The EU proposal to **eliminate tariffs on light vehicles** was **rejected** by Trump as **insufficient**. Reason: **Europeans are used to buying** European cars, thus American OEM's do not have a real chance
- The **US-American car manufacturers** are in total **against tariffs** on car imports

Production of Light Vehicles

In million €

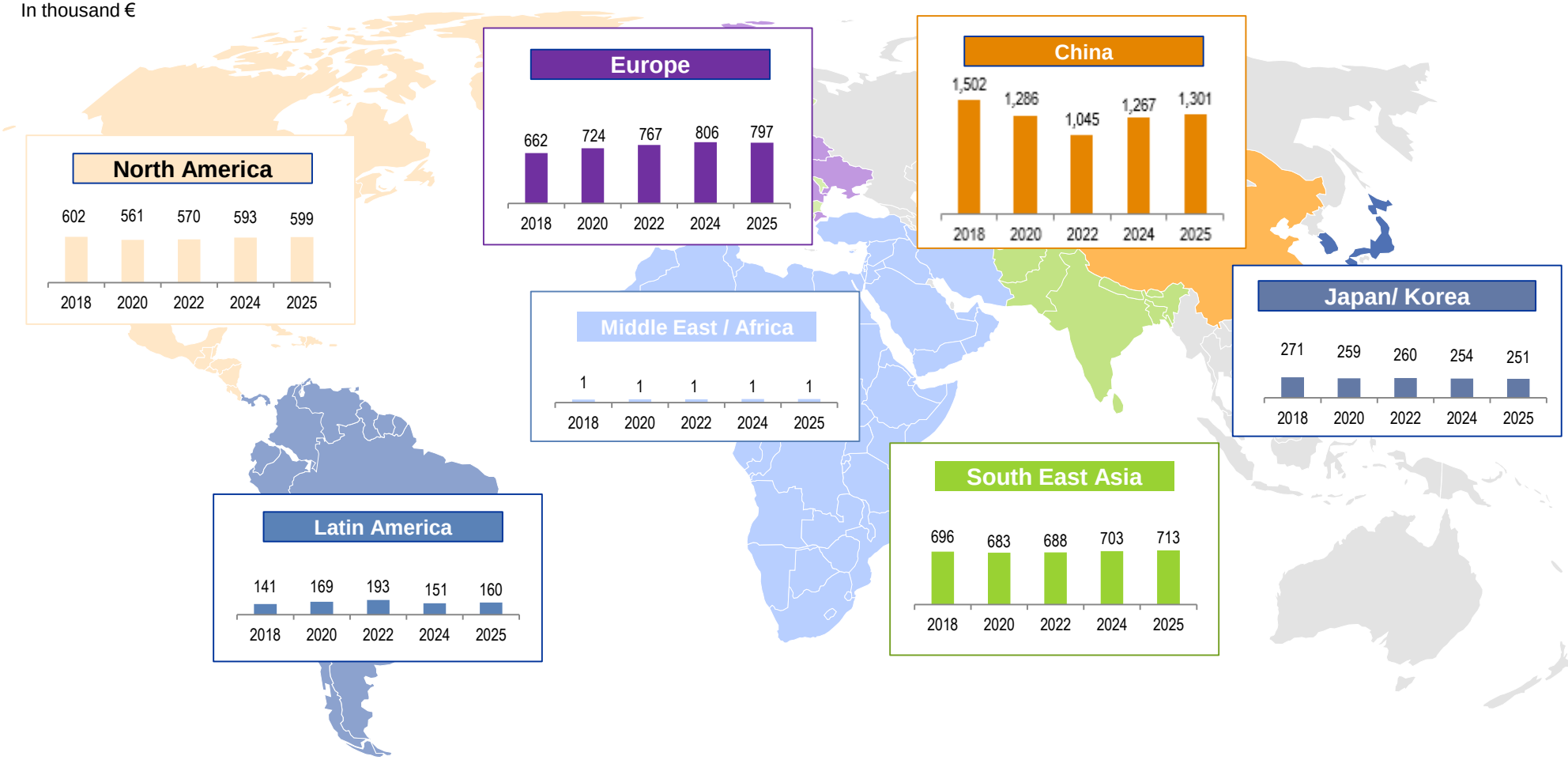


- **The European automotive industry recovers. The growth is stronger in the Eastern European countries**
- **Within the NAFTA we see a rising importance of Mexico: The new manufacturing plants of several global OEM‘s will not reduce their production volume as a result of “America First”**
- **Japan and Korea will lose production volume to new manufacturing plants in China**

Source: IHS March 2019

Production of Medium & Heavy Vehicles

In thousand €

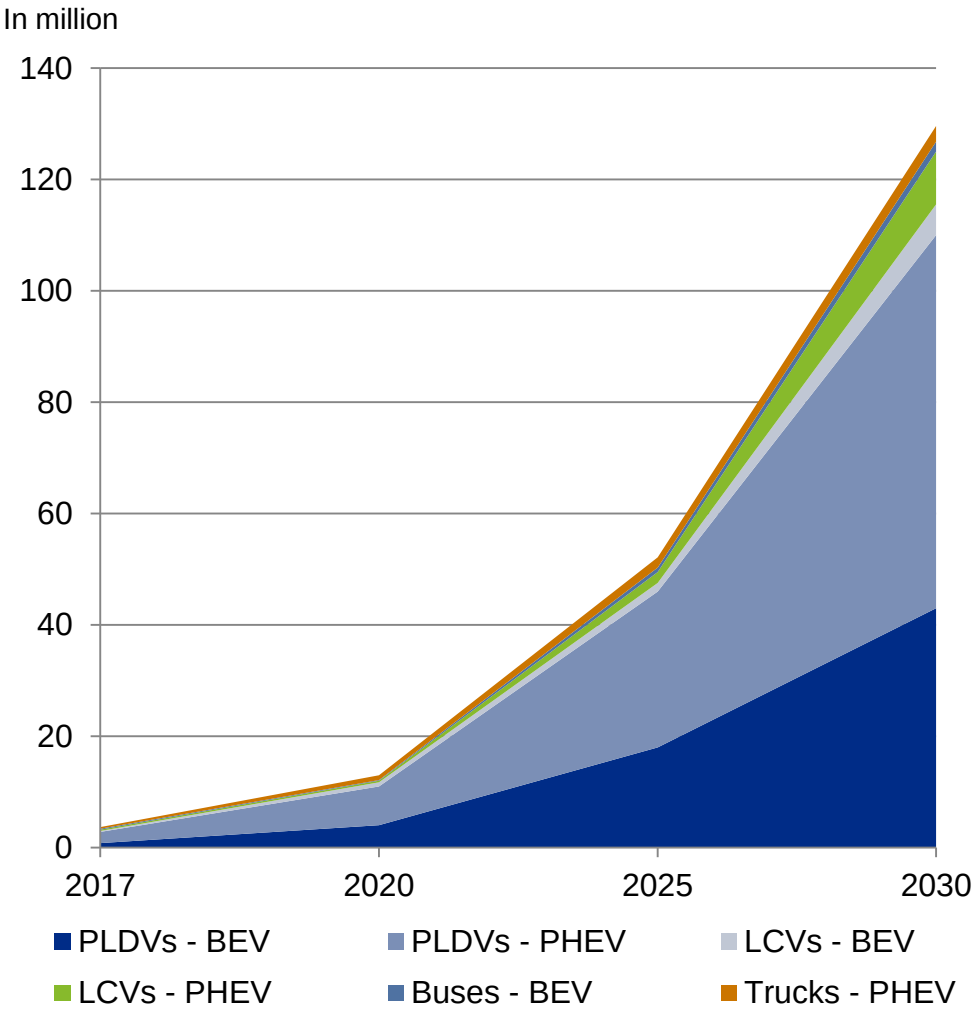


- **Stronger emission regulations in the European Union and the US induce a reduced fuel consumption**
- **This stimulates investments in a new generation of trucks and commercial vehicles**

Source: IHS January 2019

Global Electrical Vehicle Stock with strong Growth

Outlook to 2030



In Detail

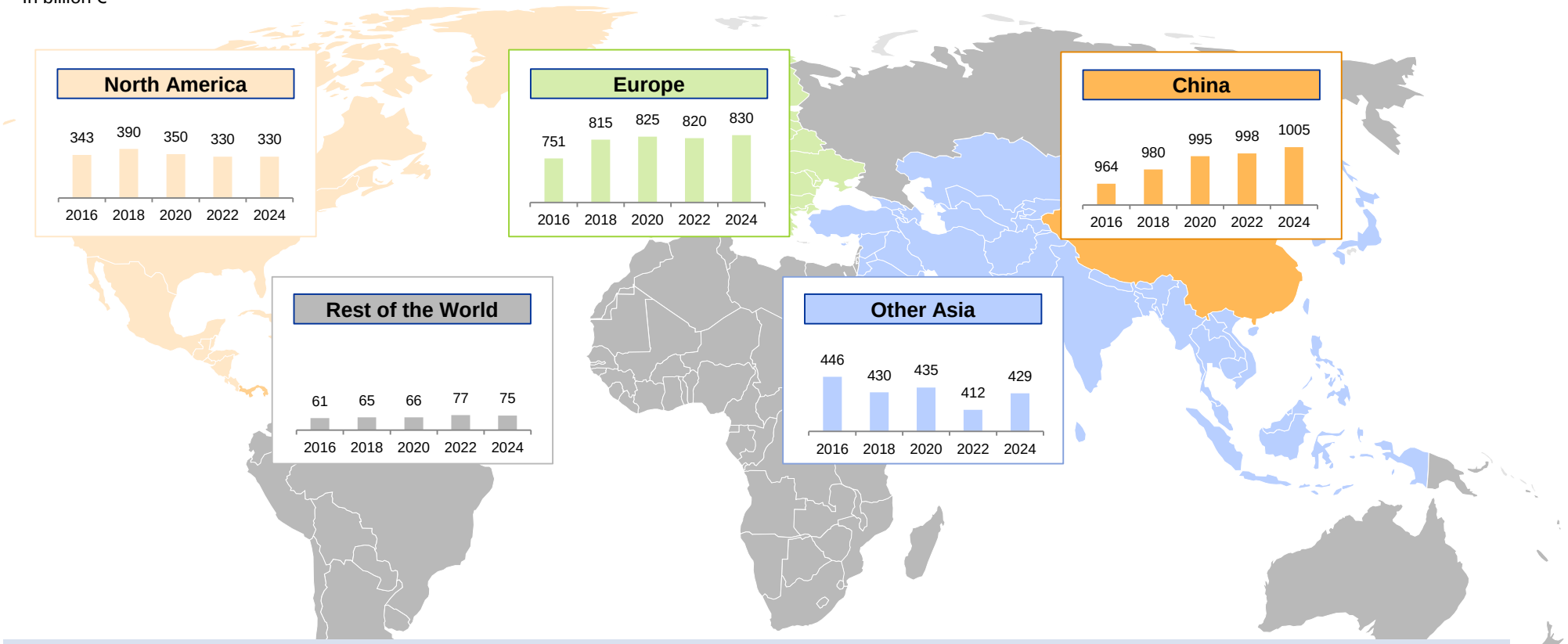
- The following **forecast** is **the basic scenario** of the **International Energy Agency** (IEA). The scenario is based on the **announced policies** and **measures** that **governments** all over the world put in place
- In **2020**, the global stock will **rise to 13 million vehicles** from 3.7 million in 2017
- **Between 2020** and **2030** the total **stock** of vehicles will **nearly tenfold** to around **130 million** in this scenario
- The **increase** will **result** primarily from the **private passenger light vehicles** market
- In the **commercial sector** we see – with the exception of buses – only a very **slight rise**

1) PLDV = Passanager light duty vehicle; LCV = light commerical vehicle; BEV = battery eletric vehicle; PHEV = plug-in hybrid electric vehicle

Source: International Energy Agency ; Picture credit: Lynk & Co 01

Mechanical Engineering: Slight Recovery in Europe, Growth in Asia

In billion €

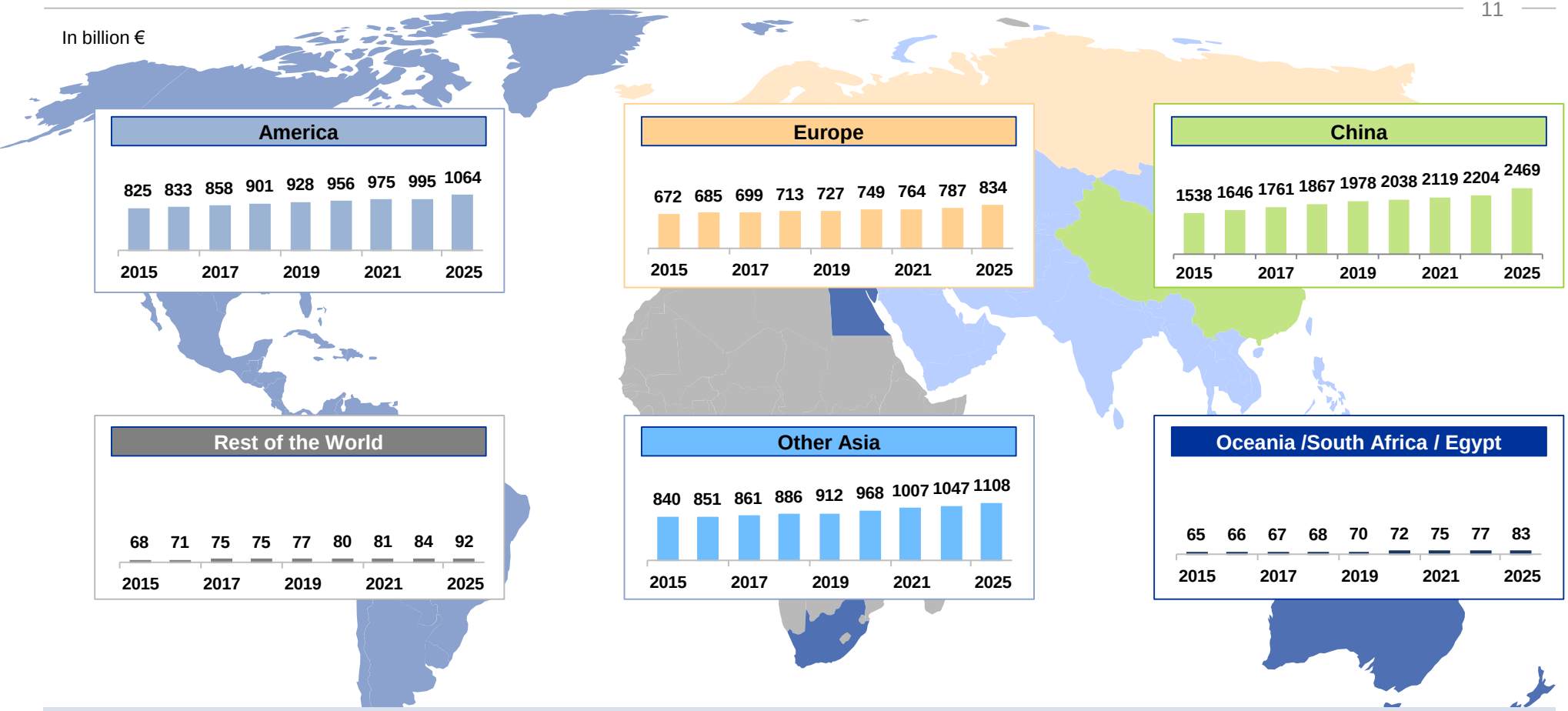


- **Globally, we expect further increases in demand for mechanical engineering products**
- **Sales in China will show a further growth within the next years. Chinese sales will be higher than the combined sales of the rest of Asia and North America**
- **In Europe, Germany and Italy will gain market share compared to other western European states**
- **In the mechanical engineering industry there is a movement towards lightweight construction (robotics, machine tools, etc.)**

Sources: VDMA, IKB estimates

World Market for Electric Products and Electronics

In billion €

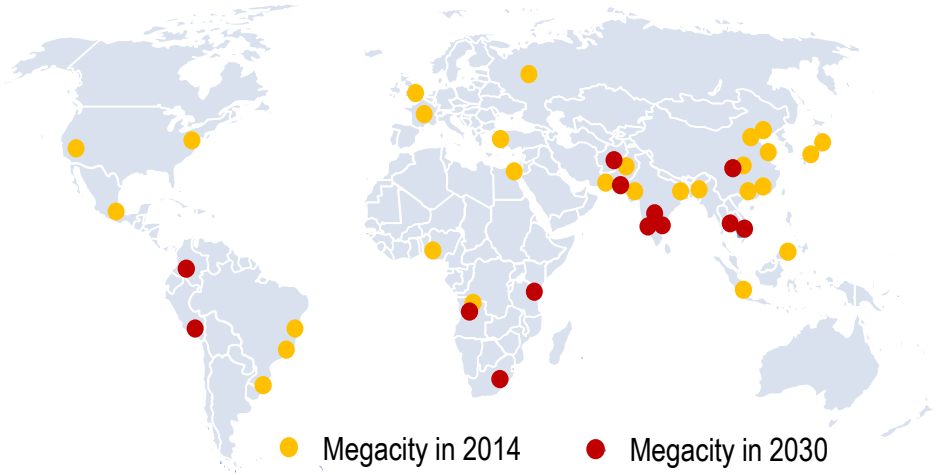


- **The global market for electric products and electronics was estimated with around €4,500 billions in 2016. By 2025 we see a production volume of above 5,600 bn. Euros**
- **During the next years a stable growth is expected. The growth rate in China will fluctuate between 5 and 7 per cent after double-digit rates in previous years**
- **We expect an increasing production in all major sub-segments of the market**

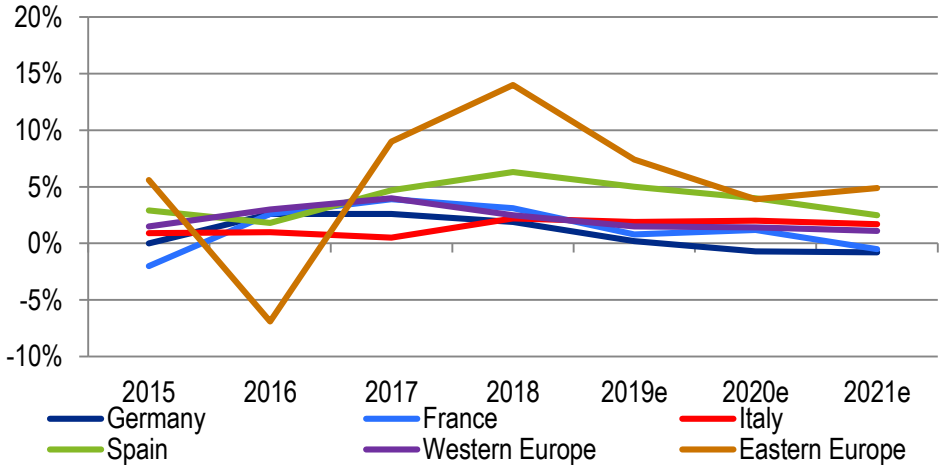
Sources: ZVEI, IKB forecast

Construction Sector: Further Growth Prospects

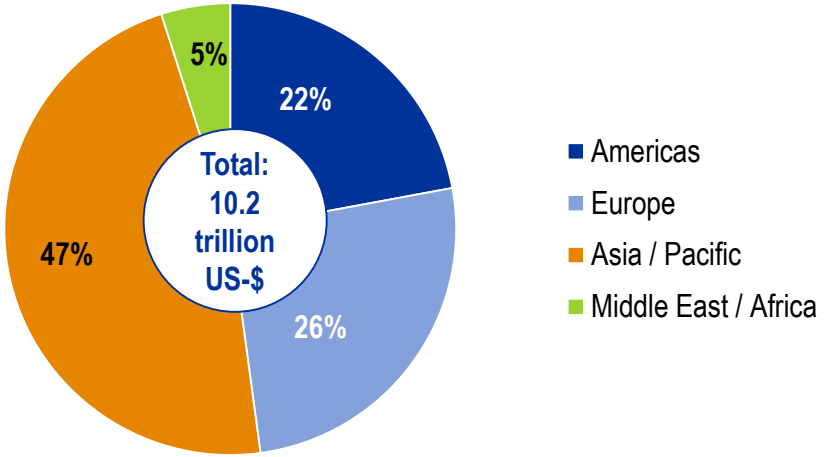
Urbanization and Development of Megacities[1)]



Recovery of the European Construction Sector



Forecast Global Construction Sector



In Detail

- The **global construction industry** will be on a **stable growth path** during the next five years. We do not only expect a strong **urbanization process in the emerging markets**. By 2030 several new „**megacities**“ will have been developed
- Between 2017 and 2021 the **global construction output** will grow at an average of 2.8 % a year to more than 10 trillion US-$
- **China, the US, Japan, India and Germany** will account for more than half of the global construction output in 2021
- Therefore we forecast a **rising demand for construction-related casting products** in the major markets. Mainly iron cast will profit from this development

1) Megacity: > 10 mill. inhabitants
Sources: Euroconstruct, UNEP, CIC

Challenges in major Customer Industries

Challenge Automotive Industry

- For 2019 we forecast a small **dip** in the global **automotive production**. This is the result e.g. of:
  the impact of **trade conflicts**
  the secondary effects of the **diesel crisis problems with new testing methods** in Europe
- The **Brexit** has a negative impact in Europe
- **In the middle and long run the trend towards E-Mobility has a negative impact on foundries. The light-weight construction reduces the part weights and the change in the power train has impacts on the supply chain**

Challenge Digitalization

- The digital transformation **will strengthen existing supply chains.** Customers with digital requirements for casting products will have a look on geographical proximity
- The development in **lightweight construction** in the automotive **industry could only be realized together with foundries**
- **Medium-sized foundries will be successful if they are able to strengthen their own USP between niche players and commodity producers**

Challenge Emerging Markets

- We forecast **new capacities for foundries** mainly in the emerging markets, e.g. **India, Brazil and Mexico**
- We see a rising importance of **Eastern Europe.** Especially countries with new or **extended automotive production**, e.g. **Slovakia, Poland or Romania**
- **In the long run countries like Indonesia or Vietnam have an increased potential for casting production**

Challenge Climate Protection

- We expect rising energy costs in Europe. Therefore**, high needs for investments into energy efficiency** are necessary in Europe
- The **regulation on emission reductions** will increase during the next years
- **As a result a loss of competitiveness mainly for medium-sized foundries is possible**

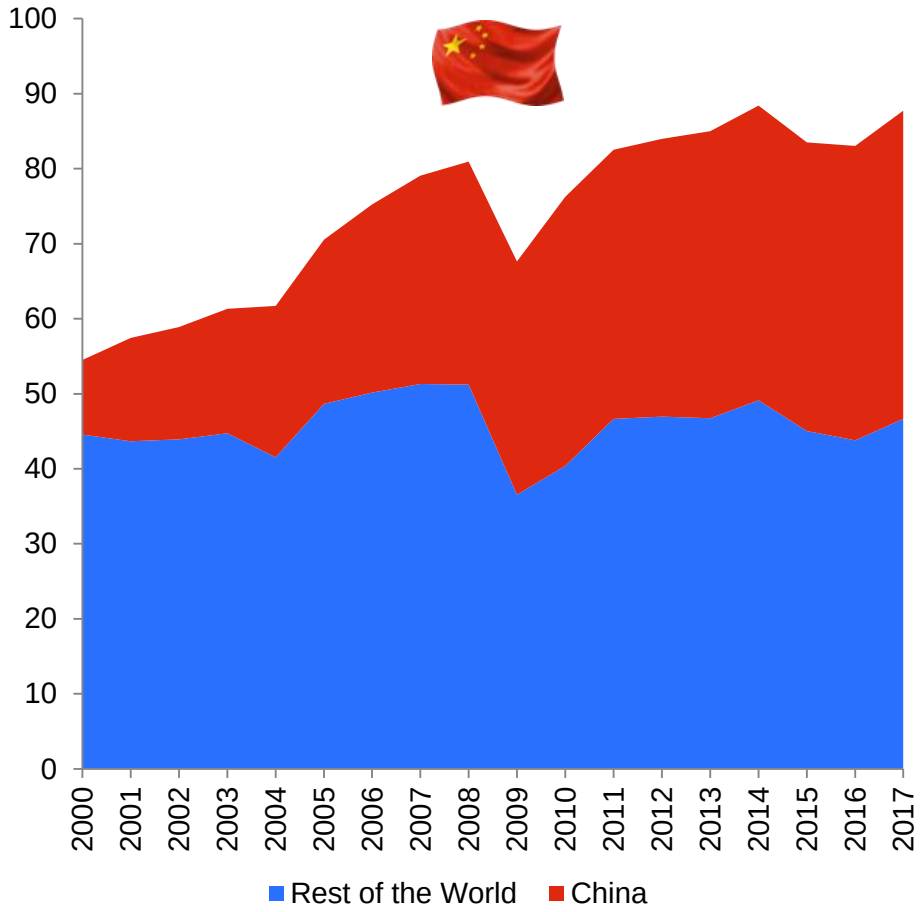
Agenda

1	Macroeconomic Environment	3
2	Forecast 2025 for the Global Foundry Industry	14
3	Future Challenges for the worldwide Casting Industry	22
4	Appendix	25

Cast Iron: Growth only in China?

Cast Iron Production from 2000 to 2017

in mill. tons



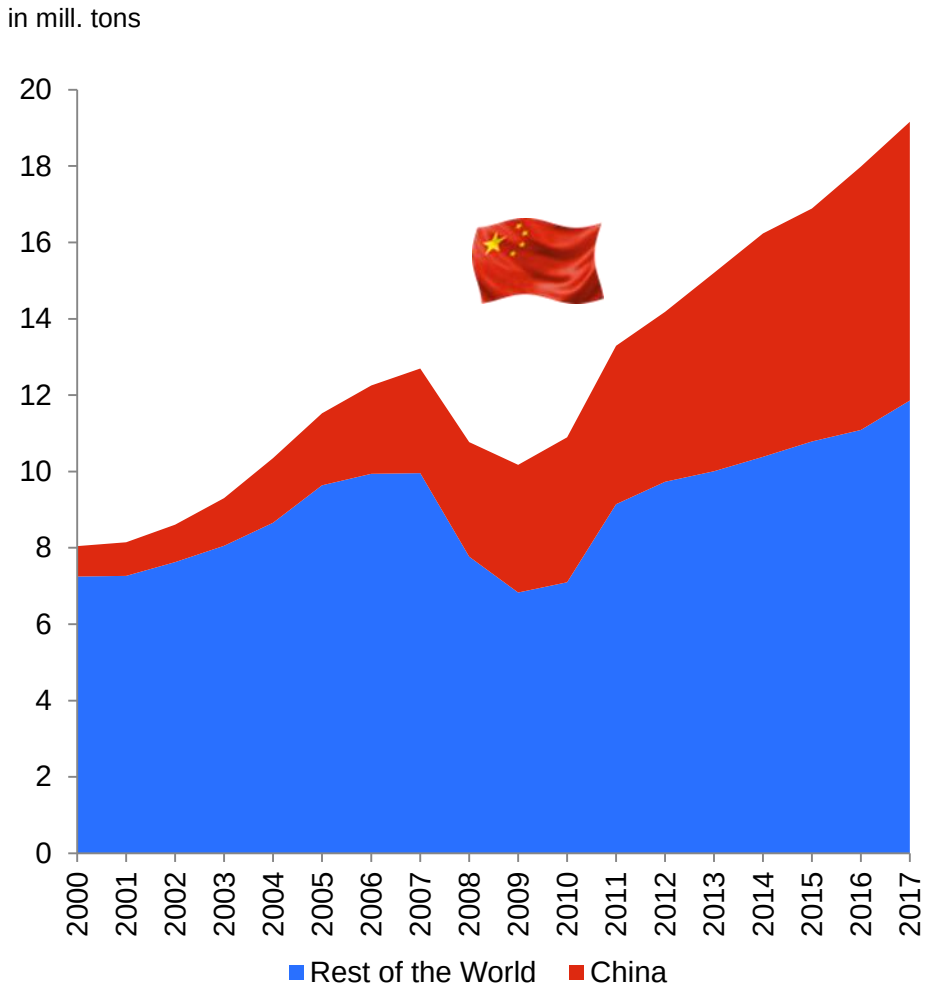
In Detail

- **The global iron cast production rose** from 54.5 million metric tons in the year 2000 to over **85 million tons** in **2017**
- In 2000, **China** produced around 9.9 million tons of iron cast products in total. **Until 2017**, the country **expanded** its **foundry production** output to around **41 million tons**
- During the same time, the cast iron production in the **rest of the world stabilized**
- While some of the **leading producers** in the **western world** (e.g. USA, Japan, France, Italy) as well as **Russia lost market shares**, the production in some **emerging markets** (e.g. India, Brazil, Turkey) **expanded**
- Between **2000 and 2017** the **output of grey iron cast** rose by around **40 %** while the production **volume** of **ductile iron cast doubled worldwide** to around **27 million tons**. The **steel cast** production grew by **65%**
- **China** showed a **similar trend**: While **grey cast** nearly **quadrupled**, the output of **ductile iron cast sextupled** and the **steel cast** output became **three times** higher

Sources: CAEF, Modern Census, IKB Research

Aluminum Cast Production on a stable Growth Path

Cast Aluminium Production from 2000 to 2017



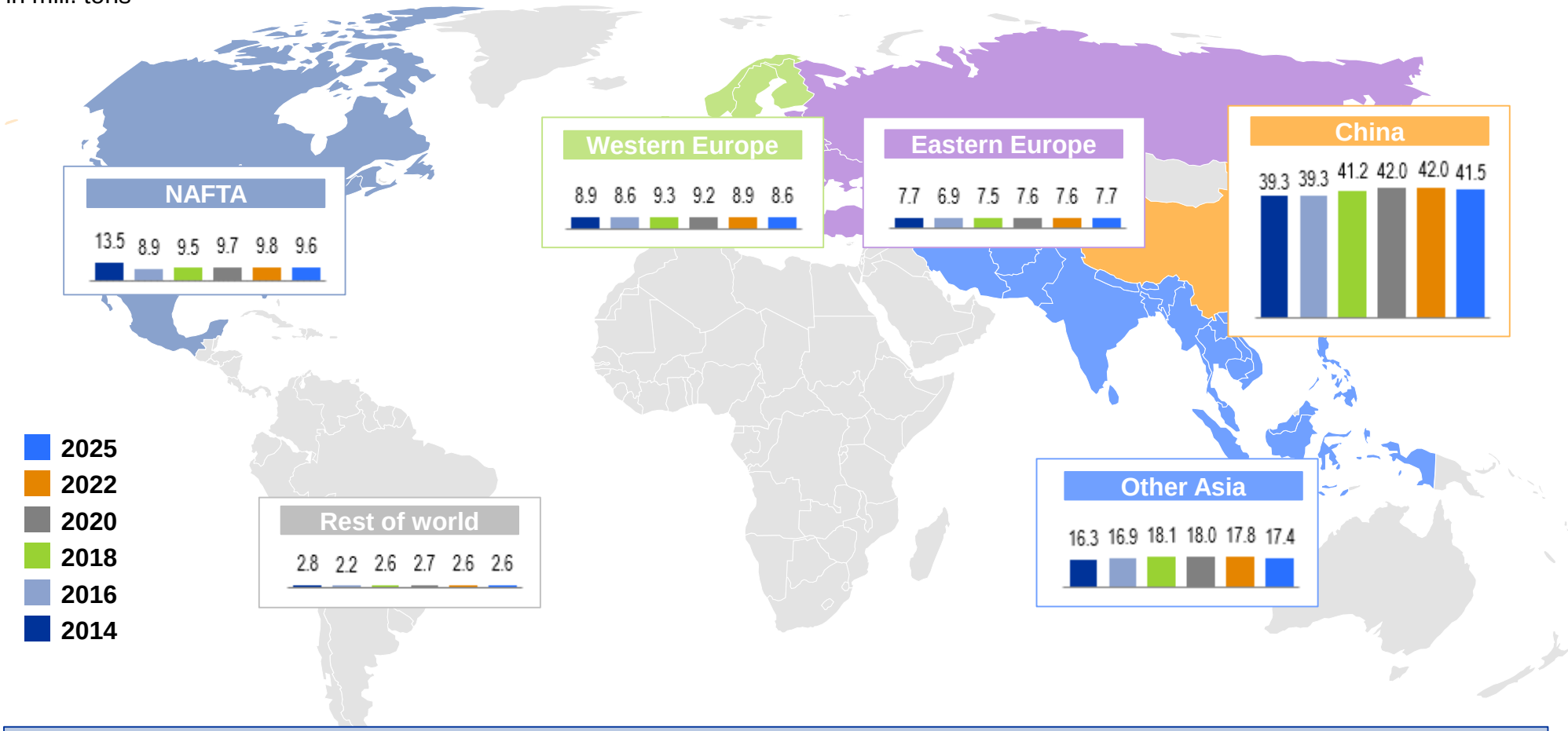
In Detail

- **The global aluminum foundry production rose** from **8 million metric tons** in the year 2000 to **19 million** tons in 2017
- **China's** aluminum cast output equaled **only 0.8 million tons in 2000**
- But in **the year 2017** the Chinese aluminum foundries manufactured a new all-time record with **7.3 million tons** of casting products: Within 17 years their aluminum foundry production **increased by a factor of over nine**
- In the **rest of the world** the aluminum cast output rose **from 7.2 million tons to over 12 million tons** in 2017
- While the **global growth of the iron cast production** mainly **resulted from an increase of the Chinese** production with a stable output level in the rest of the world, the **aluminum cast production rose in all major regions of the world**
- Between 2000 and the year 2017 the **production level stabilized in the USA, France and Russia**. During the same period **Japan and Italy** realized a **slight growth** of around 20 per cent, while the **German** output **grew by around 75 per cent**
- As a result of new plants for aluminum wheel rims the **Turkish foundry production expanded tenfold**, while the **Indian output sextupled**

Sources: CAEF, Modern Census, IKB Research

Global Production of Iron and Ductile Iron Cast stabilizes[1)]

in mill. tons



- Production in Western Europe will move sideways by 2025 with a slight decline from 2020 on
- Despite the partly re-industrialization of the US economy and temporary lower energy costs the foundry production in the NAFTA declined between 2014 and 2016. Development will level off from 2022 onwards
- China will dominate the world market but India will catch up. Japan and Korea will lose cast production to these countries

Sources: World Census, CAEF, IKB forecast; 1) Including Steel Cast

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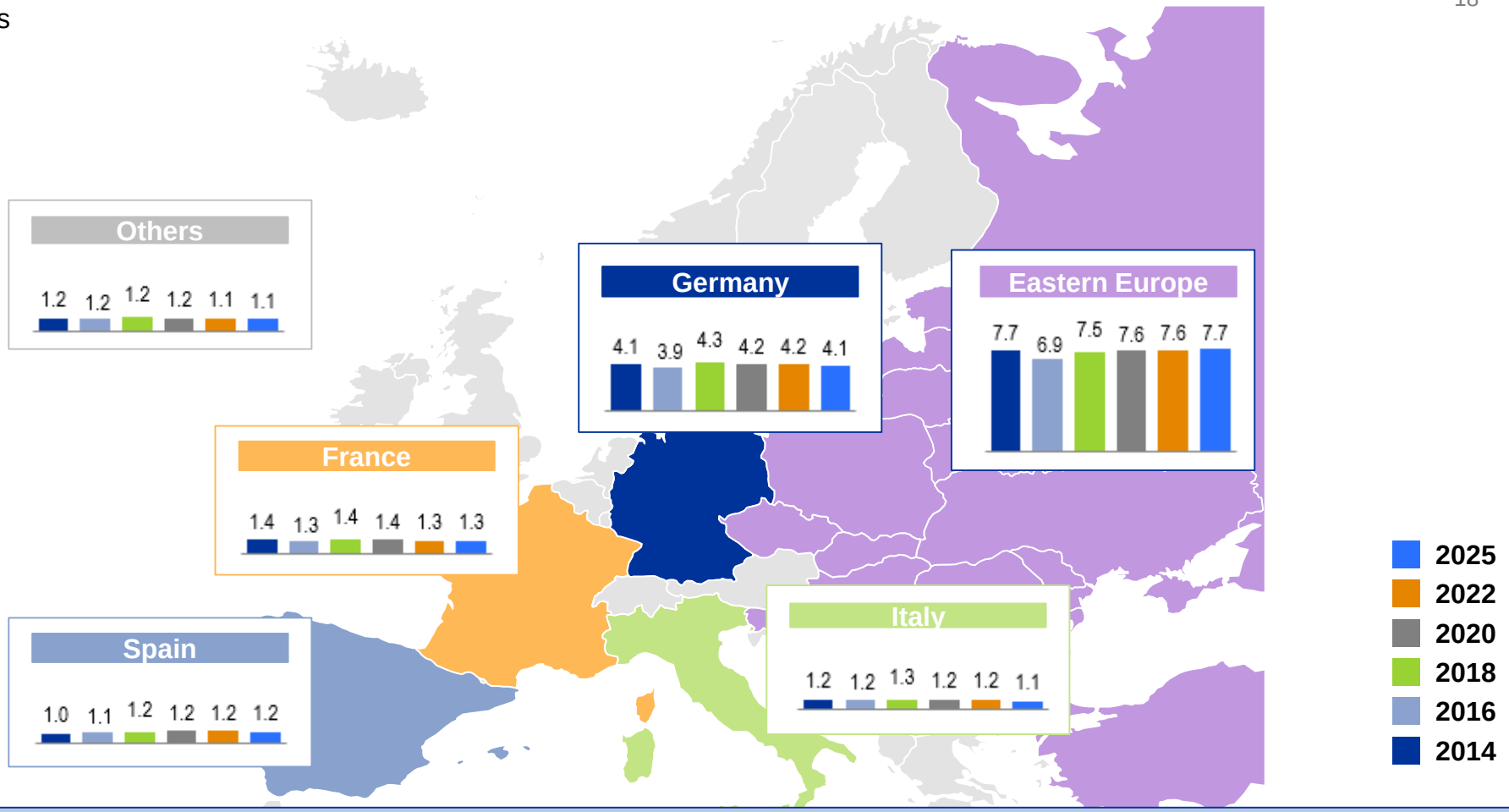
Iron Cast recovers in Eastern Europe[1)]

in mill. tons

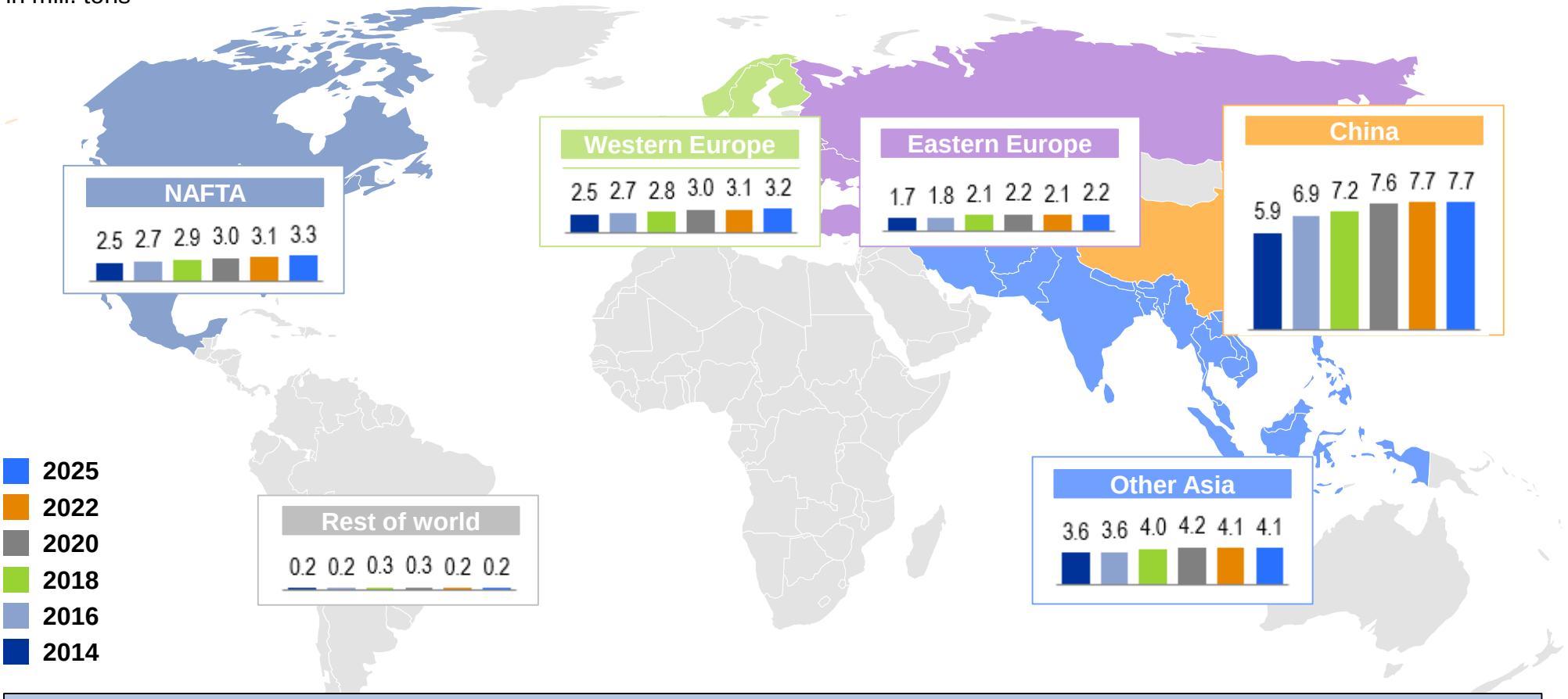


- In Eastern Europe a large part of growth will take place in Turkey but we also expect a recovery after sharp declines in Russia and Ukraine
- Western European production shows a tendency towards declining volumes. Spain could show stronger growth
- We see chances for Germany in case of a stronger recovery of mechanical engineering activities

Sources: World Census, CAEF, IKB forecast; 1) Including Steel Cast

Global Aluminum Cast Production will strengthen

in mill. tons

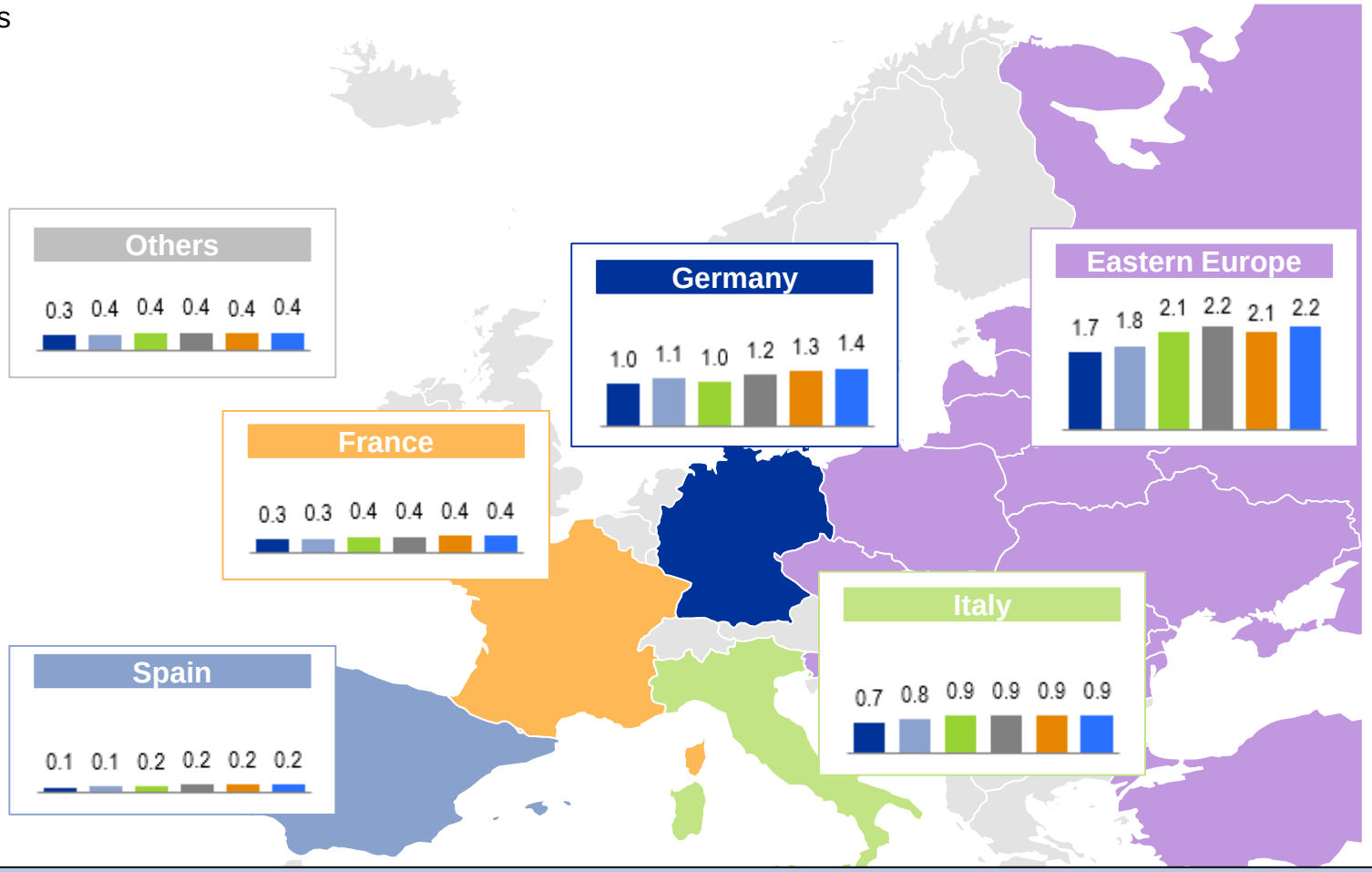


- The trend towards electrical vehicles and light-weight production induces a rising aluminum foundry production
- In addition to the higher production volume in Western Europe some of the leading foundry groups invest in Eastern Europe, too. We see a recovery in Russia and Ukraine and a catching-up process in Turkey
- The majority of growth in the NAFTA region will be fueled by investments of foreign OEMs and global foundry groups
- Korea and Japan will lose market shares to China

Sources: World Census, CAEF, IKB forecast

European Aluminum Cast Production shows stronger Growth

in mill. tons

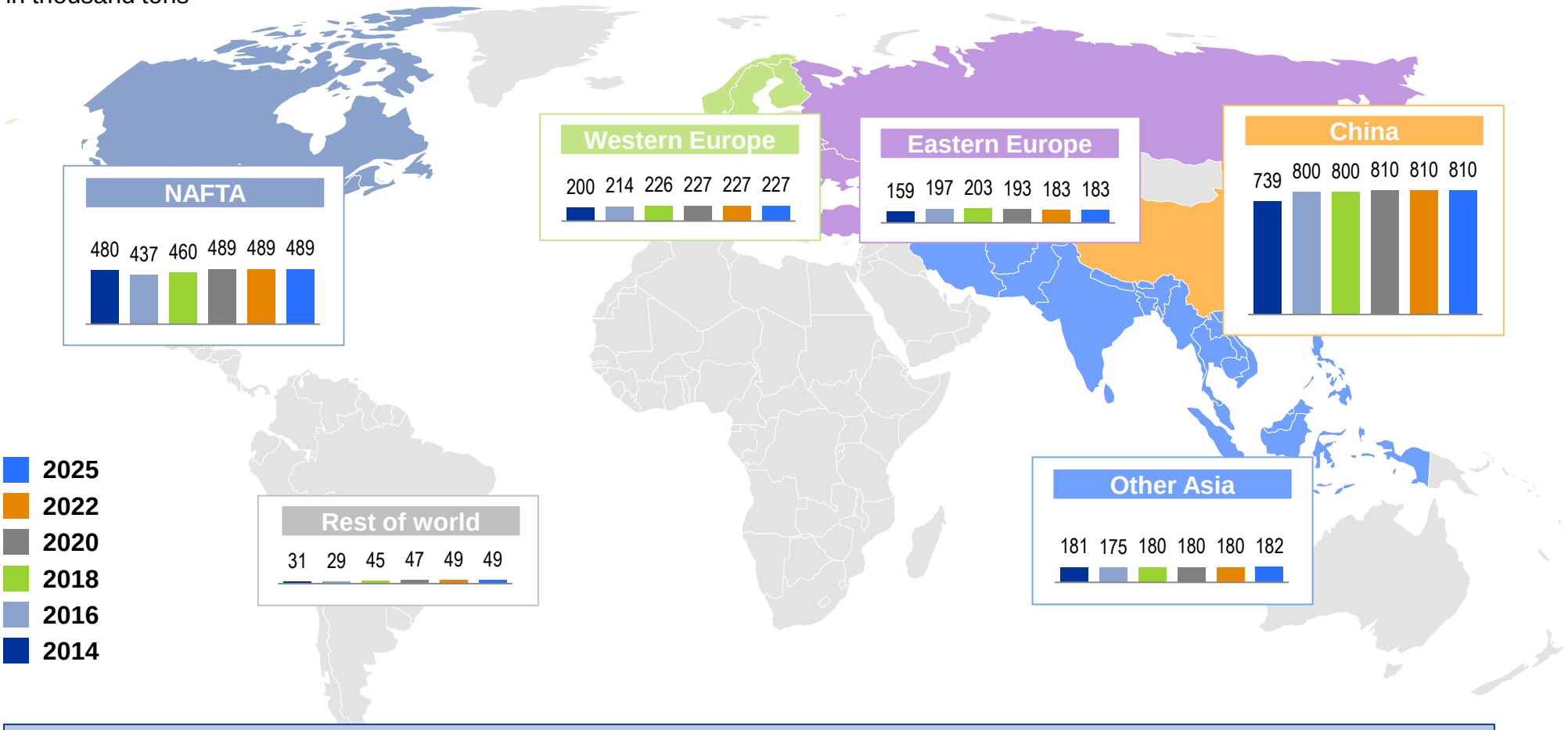


- For Eastern Europe we see a steady recovery within the next years (e.g. Russia, Ukraine)
- In the medium-term an expansion of aluminum rim production in Turkey as well as increased capacities in Slovakia, the Czech Republic and other countries will stimulate European production
- After a strong growth in the past years German aluminum foundries are expected to produce 1.2 million tons from 2018 on

Sources: World Census, CAEF, IKB forecast

Global Copper Casting Production with slight Increase

in thousand tons



- **The global copper die casting production increased by 11.7 % from 2010 to 2017**
- **By 2025 we expect global copper die casting production to rise to about 1.95 million tons**
- **While copper die casting production will slightly recover in Western Europe and Northern America, more than half of the global copper die casting production will take place in Asia**

Sources: World Census, CAEF, IKB forecast

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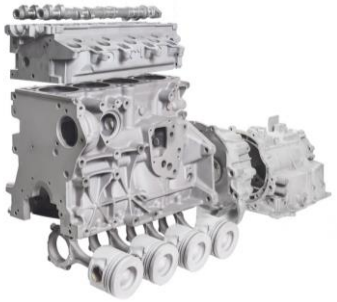
Agenda

1	Macroeconomic Environment	3
2	Forecast 2025 for the Global Foundry Industry	14
3	**Future Challenges for the worldwide Casting Industry**	**22**
4	Appendix	25

Consequences for the global Foundry Demand

1

- The trend towards **e-mobility** has tremendous consequences for the supply chain. Mainly the **suppliers** of **powertrain components** are negatively affected
- If we assume the weight of an average **engine block** of around **50 kg** and expect a **shift of 10 million light vehicles** from **combustion engine to e-battery-vehicles** …
- … this will result in a **reduction** of around **500,000 tons of iron cast**



2

- **Hybrid vehicles** are a better solution for foundries under the aspect of the necessary volume of casting production:
- They do **not only need a battery** but also **an engine block**
- The **average engine block** for an **e-vehicle is smaller** in relation to a traditional **combustion engine**, but the **battery** leads to a **higher total weight** of the car

3

- A **higher usage of copper** (autonomous driving) and **higher battery weight will** intensify the trend towards **light-weight production:**
- This will result either in a **reduction of the specific weight of a cast part** (as a result of a change in the geometry of the cast product) …
- … or in a **substitution** of iron cast **by aluminum cast**

Strategic challenges of foundries

Globalization		➢ Emerging markets will account for the majority of demand growth ➢ The automotive industry in particular demands local production outside of Europe ➢ Increased requirement of a global presence close to the customer will raise logistics costs
Technological challenges		➢ Preservation of technology leadership is of high importance, especially for the foundry industry ➢ Pressure on weight reduction will continue (e.g. in automotive and machine construction) ➢ The E-Mobility discussion will significantly change the supply chain, especially in powertrain
Retaining qualified personnel		➢ Many qualified employees will retire in the upcoming years (primarily in Western Europe) ➢ Competition for qualified personnel intensifies due to changing demographics ➢ Need for new employee retention programs (e.g. balance between work and family) and training
Investment requirements		➢ Trend towards delivery of completely processed castings will demand corresponding investment ➢ Increased complexity of metal alloy will also demand investment ➢ High costs of energy will have to be managed
Margin pressure		➢ International competition in vehicle construction will go up ➢ This limits the possibility of cost transfer to the end customer ➢ OEMs could pass on cost pressure to suppliers
Industry consolidation		➢ Continuation of industry consolidation is expected ➢ Main reasons are globalization pressure and increased investment requirements ➢ Many family businesses face problems in terms of company succession in our point of view

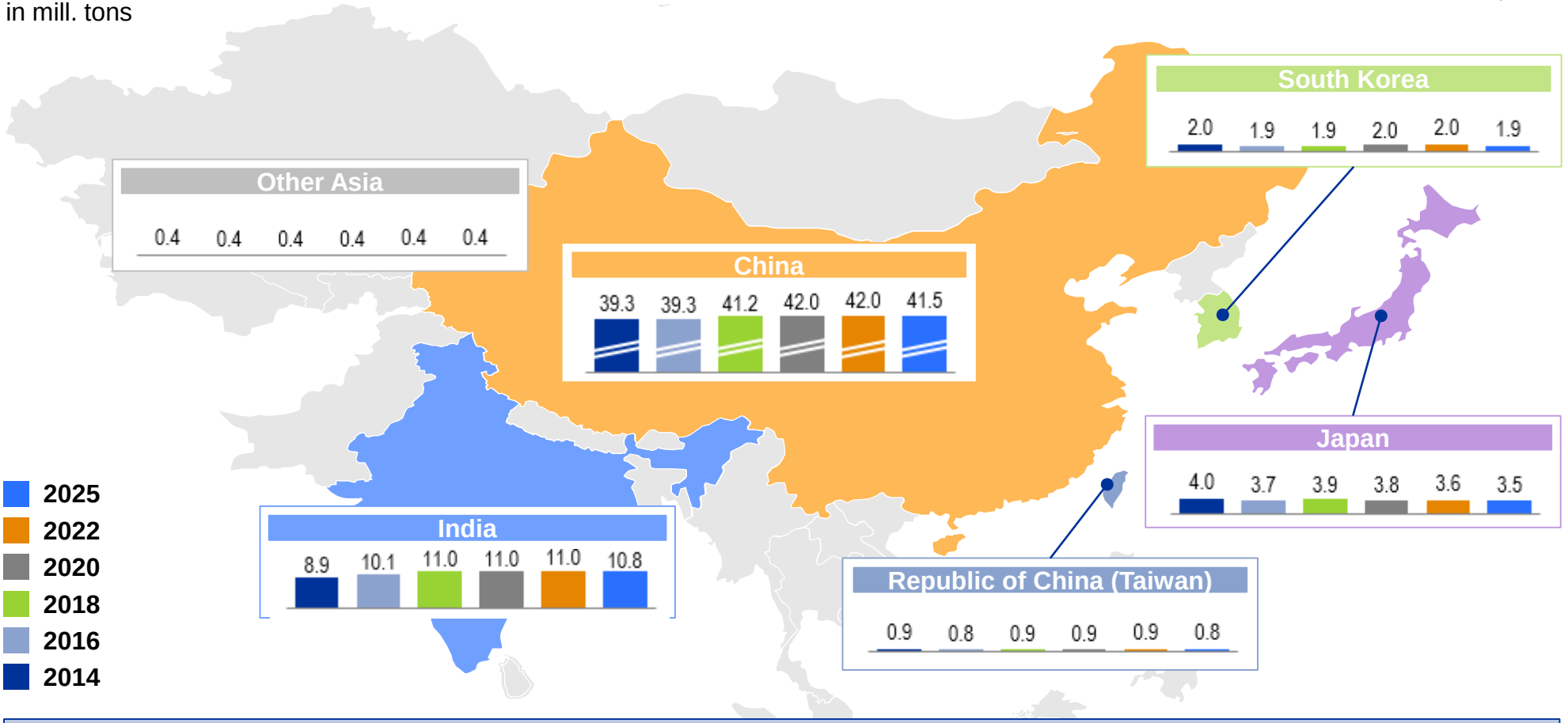
The global foundry industry is facing increased investment requirements. In combination with technological changes this should intensify industry consolidation

Agenda

1	Macroeconomic Environment	3
2	Forecast 2025 for the Global Foundry Industry	14
3	Future Challenges for the worldwide Casting Industry	22
4	Appendix	25

Iron Cast in Asia: India with high Growth Potential[1)]

in mill. tons

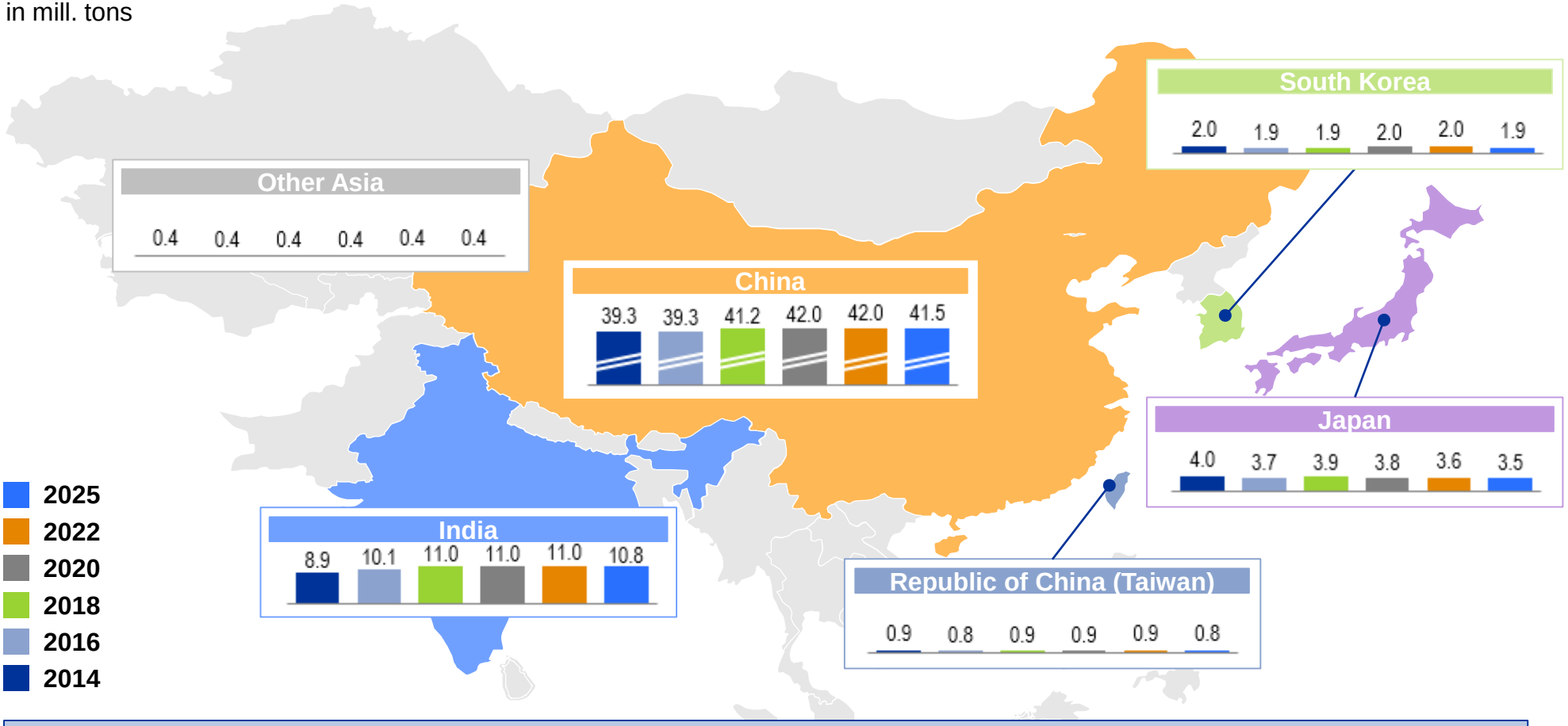


- **The Indian foundry industry will have a high growth potential: The infrastructure has an enormous investment backlog in relation to China and an improving car production will induce a rising demand for foundry products**
- **The loses of car manufacturing in South Korea and Japan to Chinese car production plants result in a declining iron cast output, which cannot be compensated by other customer segments**
- **From 2020 on the increasing importance of electrical vehicles will reduce the casting output in China**

Sources: World Census, CAEF, IKB forecast; including steel cast

Asian Aluminum Cast Production on further Growth Path

in mill. tons



- **The Chinese aluminum cast production shows a continuously strong growth. The main driver is the demand from the car manufacturing industry. In addition we see a substitution of iron cast by aluminum foundry parts in the mechanical engineering industry**
- **India will catch up, but will start from a relatively low level**
- **The production level in Japan and South Korea will remain relatively constant**

Sources: World Census, CAEF, IKB forecast

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