Cast Iron Certainties: Steel supply on a finite planet

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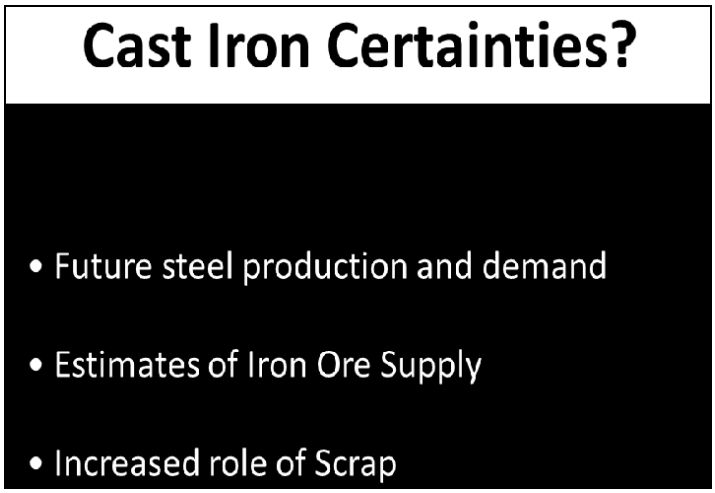
FOR SLIDESHOW AND DATA, PLEASE EMAIL adam@aimlesswanderer.org.

Good day. It's a pleasure to be with you all as a guest of EBY for their fourth Eurasia MENA Steel Summit. My name is Peter Mathews CMG, and I am the Managing Director of Black Country Metals Ltd, a scrap trading firm based in the English Midlands, which I founded 25 years ago. With my knowledge of secondary metals markets, I will be talking to you today on the future of our industry from a macro level. We're taking an Astronaut's view of the world and our industry, assessing its resources and its future prospects.

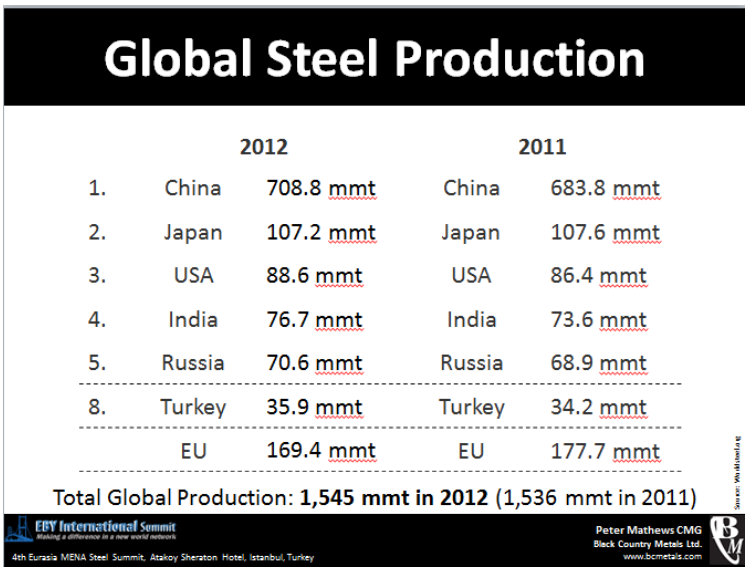
There are not many Cast-iron certainties in this presentation – much of it will involve predictions and estimations, but we can start with a few at least. Firstly, as we can see, the earth is finite – it is an island in a sea of empty space. Every resource we can ever use is on this planet, we're not going to get any more from elsewhere. Mining meteorites would be far too expensive for the resource *we're* all interested in, steel, all of which originally comes from iron ore found in the crust of this planet.

And what else do we know? Well, iron and steel make up 95% of all the metal used in modern society. It is the second largest raw material market in the world, behind only oil, and the industry is worth hundreds of billions of dollars a year to the world economy. Indeed, without steel it's hard to imagine a modern world at all – no cars or trains, no major bridges, no skyscrapers…

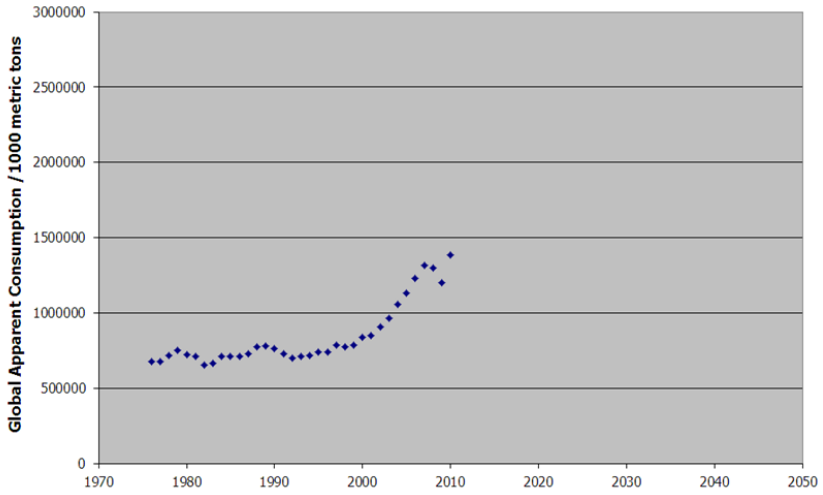
What is less clear is how much of this resource sits in the ground below our feet, and how much we could conceivably extract. We've surveyed the world with satellites and sonar yet we still don't know with any certainty how much iron ore exists. What we do have are estimates, and so I'm going to show you what these best estimates say about the future of our industry.



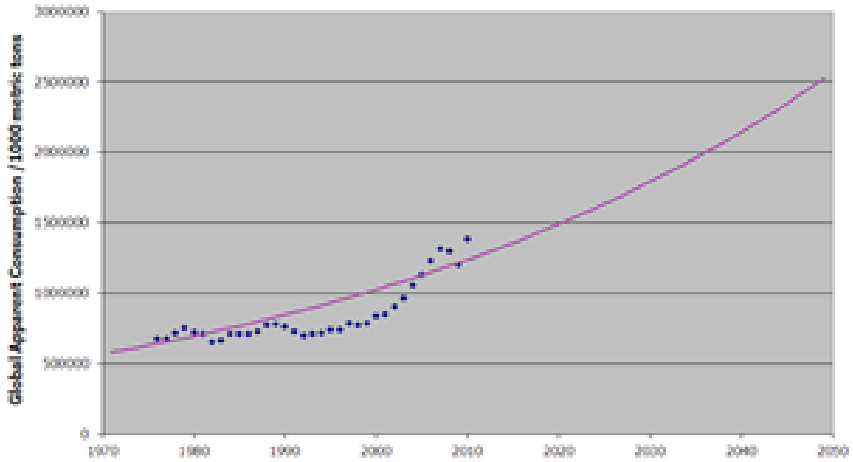
Using past data, as well as growth projections for the future, we will look first at current trends and forecasts in global steel production and demand, before moving on to our best estimates of accessible iron ore supply, then finishing with a discussion of the role of scrap metal as a future feedstock for steel mills.



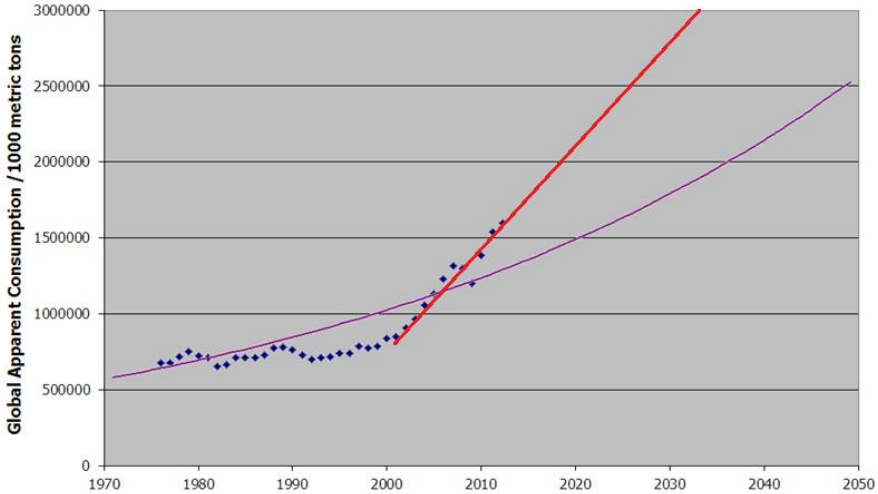
These are the latest available figures on steel production. They show that, on the whole, global steel production continues to rise year-on-year. This growth is, of course, led by China, where production increased by over five hundred percent in just the twelve years from the turn of the millennium. In 2012 the world made *eighty percent more* steel than it did in 2000, reflecting a shift in the balance of trade away from the old powerhouses of Japan and the United States, both of which are far from reaching the production heights they achieved just six years ago, and the European Union, where production continues to fall year-on-year from a pre-crisis high of 210 million metric tons in 2007. At the same time, crude steel production in China, India and Turkey, amongst others, continues to power ahead, although at a slower annual rate than in recent years, possibly reflecting a general slowing-down in the world economy.



The financial crisis of 2009 can be seen on this graph showing Aggregate Global Steel Production from the 1970's to 2010. Despite that blip in production, however, a clear upward curve can be seen. So the question is this; what happens if we continue that trend?

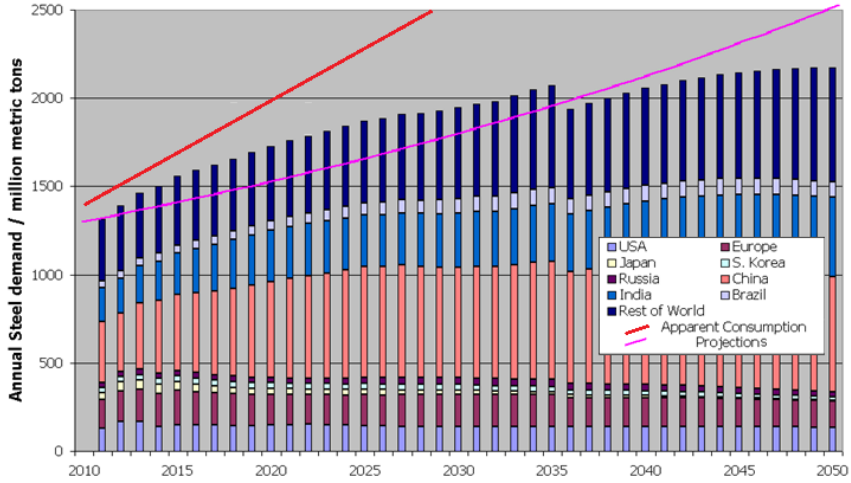


Global production doubled between 1997 and 2011. A conservative estimate would say that the next doubling of production may not happen for another 50 years…



… but if we add the data points from 2011 and 2012, and continue the growth trend upwards

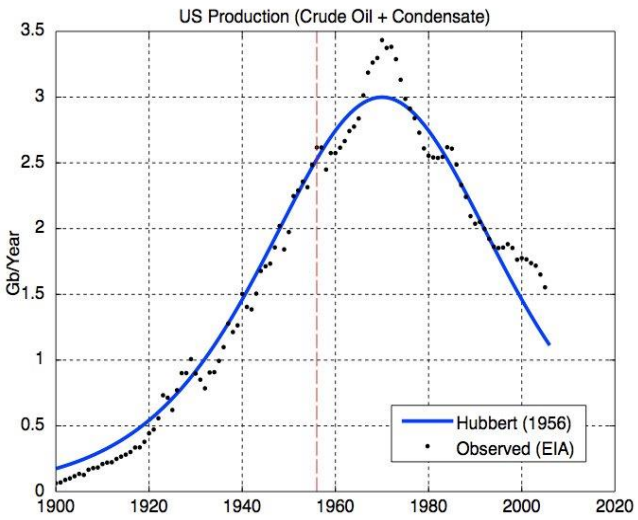
from the turn of the millennium, we could see the next doubling in steel production before 2030. So the question is, which one of two these lines is more realistic? What do we estimate demand to look like in the future? Would we *really* need to produce 3 billion tonnes of steel a year in 2030? The answer is probably not.



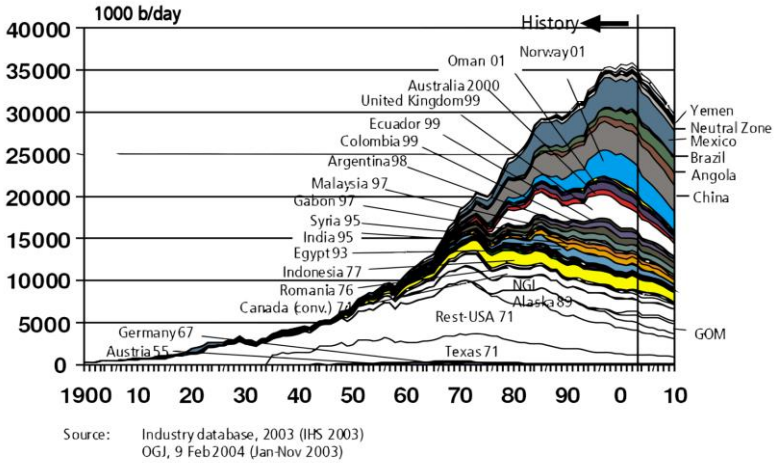
These bars show forecasted demand for new steel every year, based on World Bank GDP forecasts and a model of the relation of in-use ferrous metals to the economy at national or regional levels. The pink and red lines are the trends shown in the previous graph, such that up to around 2035 the demand for steel sits somewhere between the two, albeit at a gradually slowing rate of annual growth. Then after a simulated economic crisis and predicted relaxation in growth levels, demand for new steel may eventually plateau-off. By that point we can imagine that prolonged infrastructure investment in Asia will have built economically developed countries without such a requirement for new steel.

We've looked at production and demand, and I will now draw your attention to supply of raw materials. Iron ore is the most common metal element on the Earth, making up around five percent of the Earth's crust. However, at least 20% of the Earth's iron resource lies under the sea or other inaccessible places, so we also need to bear that in mind. Today around two thirds of new steel is made from iron ore. That rate varies widely between countries, but from our perch above the Earth we would say that overall iron ore remains vital to steel making.

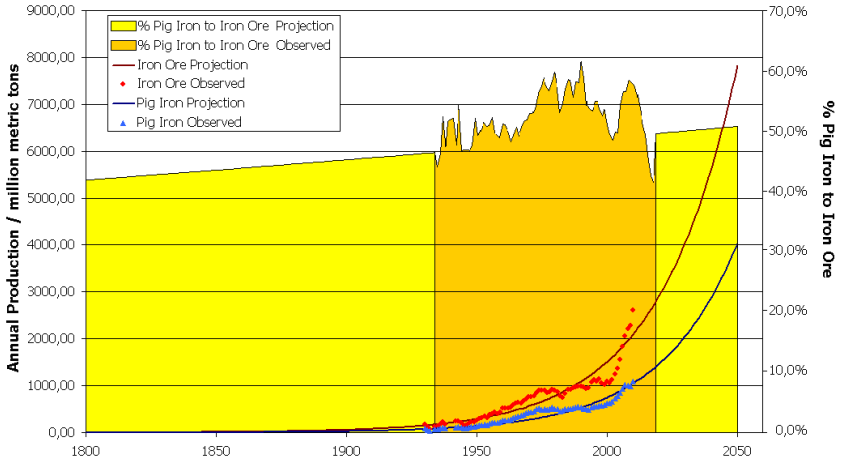
We also remember that the Earth is finite. We know that at some point the output of raw materials will peak and then decline. Ironically for a model so disliked by the oil industry, the idea of peak resources came from an employee of Shell Oil in 1950s Texas.



He predicted that oil production in the state would peak around 1970 at the point where they had used up half of the total available resource in the earth, and it would then decrease. This prediction proved to be pretty accurate actually and this same pattern has been seen in oil drilling all over the world.

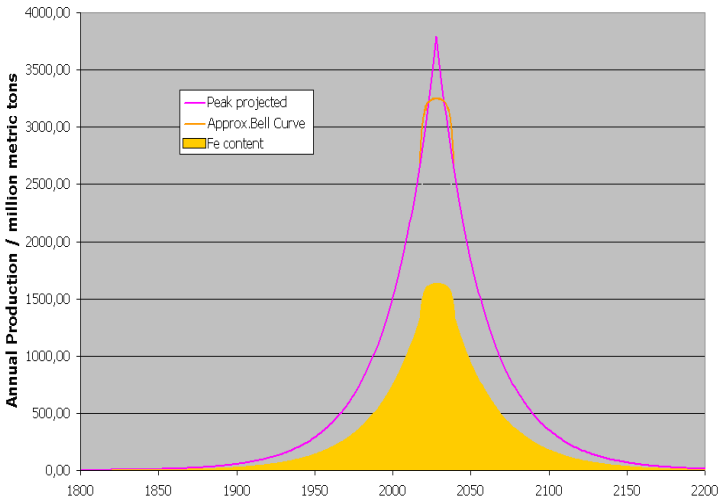


Excluding unconventional oil reserves in tar sands and deep sea reservoirs, cheap oil may have peaked towards the middle of the last decade, around the time steel production really took off. It will of course be some years until we can see with enough hindsight to say what will happen with the oil situation, but for our purposes we know this Hubbert Peak Theory is a reasonably good one, so we applied it to Iron Ore reserves as well. Firstly, though, let's look at the recent trend in Iron Ore extraction.



This red data points at the bottom of this graph shows global iron ore production every year since the 1930's, which fits quite well to the exponential curve we've fitted to it. It's all very well knowing the amount of iron ore produced, but without knowing how much iron is in the ores this is a bit meaningless. In the United states, for instance, Ferrous content of iron ores has decreased from 50-60% during the second world war, to just 25-30% today. A main ingredient for steel making is pig iron, purified to around 95% ferrous content. Global Pig Iron production is shown in blue, and the yellow background tells us that iron ores continue to average about 50% ferrous content, although as we mine the best reserves first, it'd make sense to imagine that this ratio will decrease over time on a global scale.

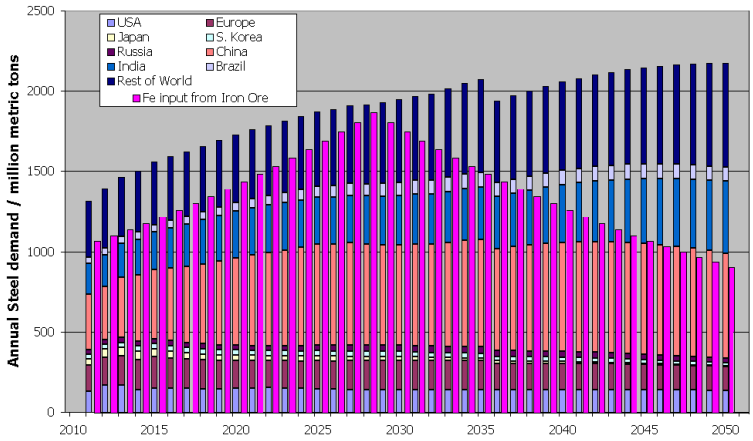
The United States Geological Survey puts the remaining ferrous reserve in the earth's crust to be some 80 billion metric tons. There is no cast iron certainty in this figure at all, but it's just about the most reliable estimate available, so adding that to a prediction of the amount of iron already taken out of the Earth, and the current trend in extraction.



We estimate that peak iron ore extraction could occur before 2040, in less than 25 years or well within the lifetimes of many of us in this room today. I would stress again that these

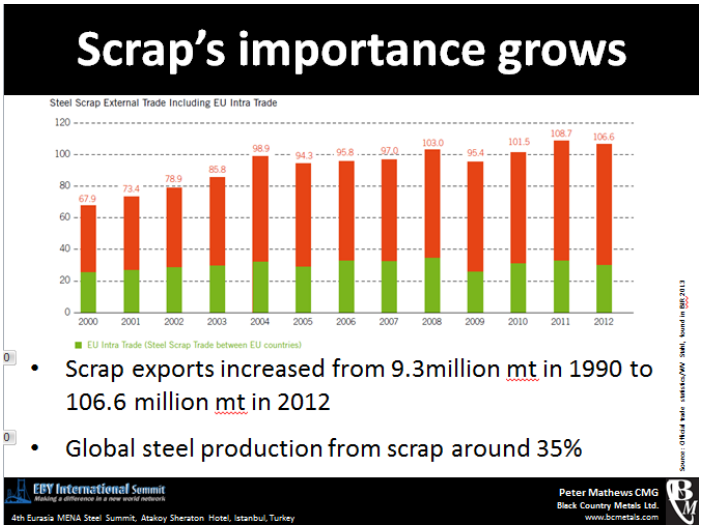
figures are just estimates, but they're from the best available data so we should bare it in mind at least.

And what would be the consequences of this? What happens if iron ore *does* peak and what would it mean for the scrap industry?



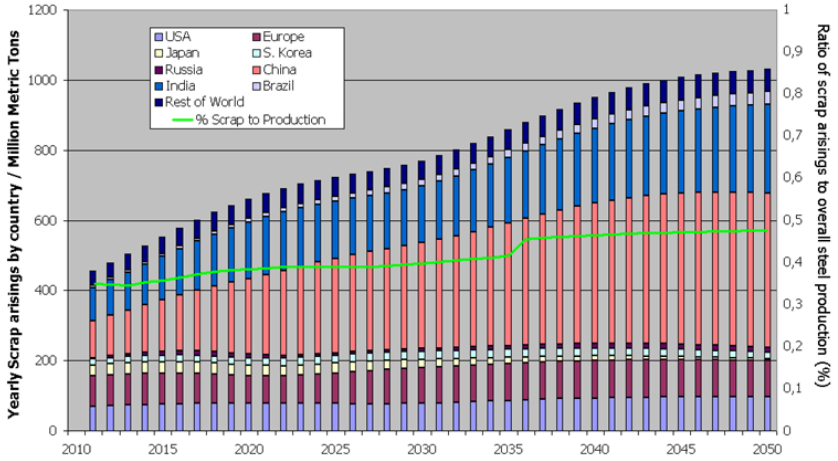
Well, iron ore production, shown in the pink bars, could easily keep up with increased demand until 2030 or so, but then the supply drops away sharply, so that by 2050 it could provide for less than half of all the ferrous metal required to satiate our increased appetites.

But there is a major difference between models for oil and iron ore, as the latter is extremely recyclable. So, could scrap bridge the gap?

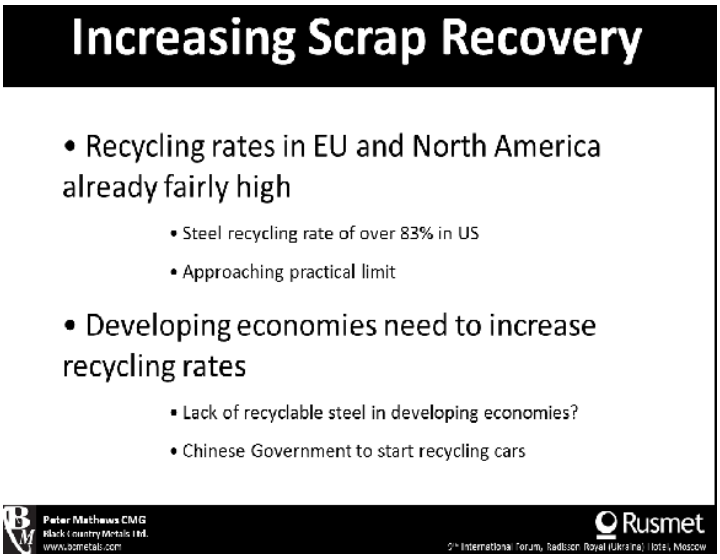


Well, global trade in scrap steel has increased at an even faster rate than steel production itself, from under 10 million metric tons exported in 1990 to over 100 million 20 years later. Even though steel production has doubled since 1997, scrap still makes up about a third of total crude steel feedstock. Surely this means we're recovering more scrap than ever?

Taking into account turnover times of a number of the major uses of steel, from cars to bridges, we can estimate the amount of scrap steel the planet might expect to produce over the next few decades.



And we see that by 2050 the total amount of scrap we could hope to produce is around a billion metric tons, which is something like the gap that we estimated before. So all's well, isn't it? Not exactly, as it's here that the devil lies in the details. This estimate is for the *total* amount of scrap produced in the world, which is not the same as the amount that actually gets recycled.

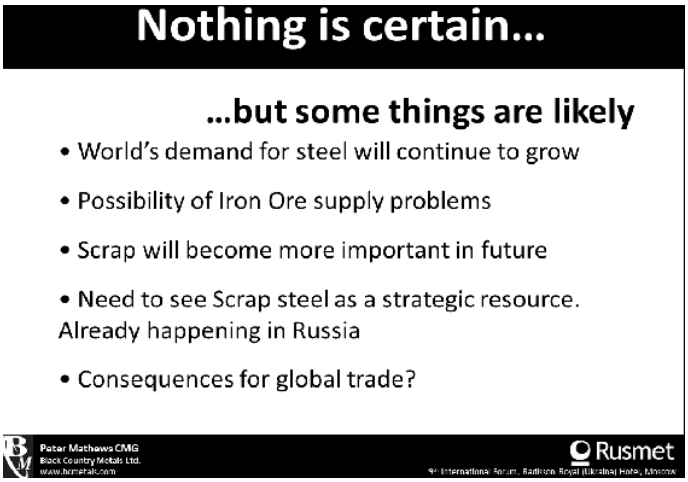


At the moment that recovery rate varies from a high of about 85% in the United States to rates of about 15% in China, where domestic scrap arisings remain low. Therefore in order to get anywhere near this figure we're going to have to start considering steel recycling even more seriously than we currently do. Throughout the world, scrap is already starting to be seen as a strategic national resource, and I predict this will become true for more and more countries as time goes by. For a country like Turkey, the reliance on imported scrap as the major feedstock for crude steel production could be a double-edged sword – while iron ore

might become more difficult to source in the future, so mostly probably will steel scrap.

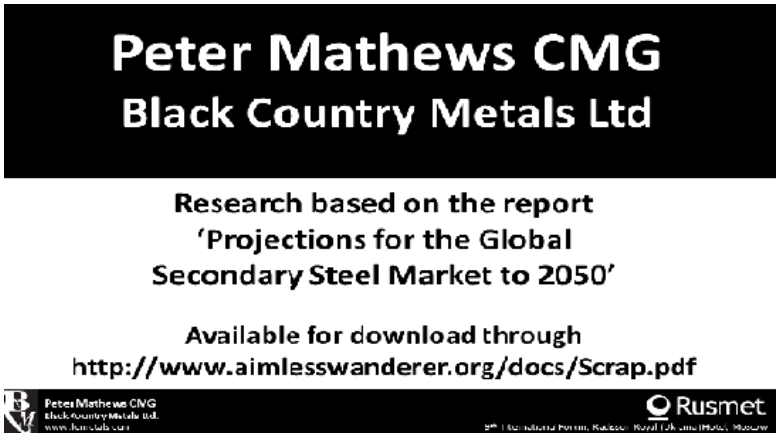
Seeing secondary steel in such a way will help governments to take better care of their scrap resource and should result in higher recycling rates. There is little room for improvement in Europe and North America, so the onus is on developing countries to increase their domestic recycling rates. Of course, while China, India and Turkey continue to grow, domestic scarp arisings will not be sufficient to cope with demand, but governments are beginning to see this, and have already instigated some programmes to help alleviate the situation. In Turkey, as in China and Russia, domestic scrap recovery is being increased all the time, but the question remains as to whether these efforts will be enough.

There are many uncertainties involved in these projections, but there are also some things that appear likely, especially if the world continues to evolve as it has done since the industrial revolution. Firstly,



We can easily imagine that demand for steel will continue to increase. As long as the likes of the Chinese, Brazilian and Turkish economies keep growing, they will most likely drive extra demand for iron products. At some point, however, this supply will become less easy to find, especially if we need more and more every year. Dates and times are very difficult to predict, but a reasonable estimate based on current data suggests we may start having iron ore supply issues as early as the 2030's. That means scrap will become increasingly important as a feedstock for steel mills, so we can expect other countries to follow Turkey's lead in increasing Electric Arc Furnace capacity, while governments will increasingly act to make

exports of scrap steel more difficult. This, however, will create big questions over the future of global trade in scrap steel. Export restrictions may well distort international markets and so alongside greater demand we could reasonably expect the price of internationally-traded scrap to increase for the foreseeable future.



If you wish to find out more about this research you can download the report through this link. I've been Peter Mathews CMG and I'd like to thank you all for giving me your time.