Episode Book

EPISODE #5787

Inside the Two Steel Industries

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SYNOPSIS

Roughly half the world's steel comes out of China, and the plants making it split into two almost unrelated industries: blast furnace ironmaking and electric arc recycling. That split explains why a mill in India looks nothing like a guided tour in Britain, why worker health outcomes vary by a factor of 77,500 between individual plants, and why sintering and blast furnaces pollute from completely different chimneys. This episode walks through the global production map, the documented health toll on steelworkers — hypertension, cataracts, bone density loss, pre-diabetes — and the hard question of whether wealthy countries actually make this safe or just make it managed.

TRANSCRIPT



Corn

Okay. You ever stand near something so hot it changes how you think about heat?



Herman

No.



Corn

Me neither.



Herman

That's the honest answer, and it's a strange thing to admit on a show, because most of what we talk about we've never actually touched.



Corn

Right. Okay. Daniel went down a rabbit hole. YouTube, steel mills, as he does. Two videos, and they couldn't have been more different. One's an Indian mill, and the shot is a man standing maybe three feet from molten steel coming out of a furnace, prodding it, keeping it moving, and the room is orange. The other one is a British facility, a guided tour, and the person filming is just repeating the word "enormous" in different tones.



Herman

I know the genre.



Corn

And what got him was the comments under the first one. Men who'd worked a summer in a mill saying you can't imagine the heat. Hosing themselves down with water to keep standing. Fire-resistant clothing that weighs you down. Molten metal that would put you in a burn unit if a splash got under your collar.



Herman

Right.



Corn

So he wants the bird's-eye view. Where the industry actually is, what the health and safety divide looks like between those two worlds, and whether there's a route to producing this stuff sustainably. And there's a personal thread too. He grew up in Ireland, in Cork, and there's a row of huge factories along the marina there that used to be the town's employment before it turned into a knowledge economy. He thinks that's the real policy knot.



Herman

It is the real policy knot. Everything else is a detail hanging off it.



Corn

Then let's start with the map. Where does this metal actually come from?



Herman

China. That's the answer, and everything else is a rounding error by comparison. Roughly half of all crude steel on Earth comes out of China. Somewhere in the low fifties percent, depending on the year you check. India is number two, and India's the growth story, the fastest-growing major producer, because they're building infrastructure and cities and they need steel for all of it. Japan, the States, Russia, South Korea, Germany, Turkey, Brazil, Iran, that's roughly the top ten. But the headline is China.



Corn

Half of it. One country.



Herman

And it's not spread evenly inside China either. Hebei, Jiangsu, Shandong, Shanxi, Inner Mongolia. A handful of provinces carry a huge share of the output and, as we'll get to, a disproportionate share of the damage.



Corn

And the UK, which is the second video?



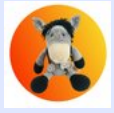
Herman

The UK is the counter-example and it's a striking one. A country that essentially invented the modern steel industry, now down to a couple of sites. Port Talbot in Wales, Scunthorpe. Port Talbot's blast furnaces shut down in 2024. That's the last of the traditional ironmaking in Wales, gone. The site is pivoting to an electric arc furnace, which is a recycling operation, it melts scrap. Which sounds like the happy ending, and it is not that simple.



Corn

Because an electric arc furnace doesn't employ the same number of people.



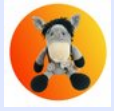
Herman

It doesn't. A blast furnace complex is a city. An electric arc furnace is a large building. And we'll come back to what that does to Port Talbot, because that's the Cork question.



Corn

Before we get to the towns, I want the two processes clear, because everything downstream depends on them.



Herman

Two routes. The dominant one is blast furnace to basic oxygen furnace. BF-BOF, if you're reading the industry literature. You take iron ore, you take coal, you essentially cook the oxygen out of the ore using carbon, and the carbon leaves as CO2. That's the traditional



Herman (continued)

route, it built the twentieth century, and it's still the majority of global production. The other route is the electric arc furnace. You take scrap steel, you melt it with an electric arc, and you pour it. That's the EAF route.



Corn

And the two have almost nothing in common when you look at them as environmental objects.



Herman

Almost nothing. Which is the thing most coverage gets wrong. Steel isn't one industry. It's two industries wearing the same word. And once you see the split, the health and environmental numbers stop looking random.



Corn

Okay. Now take us into the first video. The Indian mill, the man three feet from the molten steel.



Herman

The reason that video exists, and the reason it looks like that, is that a lot of the world's new capacity is being built where the industry is still in that mode. And I want to be careful here, because the danger isn't one dramatic thing. It's the accumulation. The research on Chinese steelworkers is the best-documented version of this, and it reads like a list of slow injuries.



Corn

Go through it.



Herman

Hypertension. A nested case-control study found an incidence of about thirty-four percent among steelworkers. Thirty-three point nine five, if you want the decimal.



Corn

I do not, particularly.



Herman

Fine. Thirty-four percent. And when you break it down, high-temperature exposure raised the risk about one point nine times on its own. Dust raised it one point three seven. Noise one point three three. Carbon monoxide one point three one. Shift work one point four three. Every one of those is a feature of the room in that video.



Corn

So the heat isn't just uncomfortable. It's a cardiovascular risk factor.



Herman

And it doesn't stop at blood pressure. Hyperuricemia, that's elevated uric acid, incidence of seventeen point three percent, with heat exposure and shift work as independent risk factors. Abnormal bone mineral density in twenty-seven point six percent of steelworkers, and the drivers there were night-shift work and combined exposure to heat, dust and noise.



Corn

That one surprised me. Bone density. I'd have guessed the bones were the one thing that survived.



Herman

The bones are not fine. And then there's the metabolic side. In a Tangshan cohort, pre-diabetes prevalence was sixty-three point four percent. Nearly two-thirds. And it rose with years of service and with heat, noise and carbon monoxide exposure.



Corn

So the longer you do the job, the worse every number gets.



Herman

Dose-dependent. Every single one of these is dose-dependent.



Corn

The cataracts.



Herman

The cataracts are the detail I'd put in front of anyone who thinks of this as "a hard job." It's a classic steelworker injury and it's been documented for decades. Intense infrared radiation from the furnace, and from molten metal, cooks the lens of the eye over years of service.



Corn

Cooks it.



Herman

That's the mechanism. The infrared lands on the lens and the proteins in it denature, the way a lens protein denatures in any heat cataract. You don't notice it happening. You notice it when you can't drive at night.



Corn

And that's the thing Daniel's commenters were circling. They kept saying "you can't fathom the heat," and the honest version of that is, no, you can't, because you've never had years of it.



Herman

Right. And the cumulative picture is what those comments were reaching for. It's not one burn. It's thirty years of a body being held at a temperature it was never built to run at, with dust in the air and noise in the ears and carbon monoxide in the blood.



Corn

Now, the same hazards exist in the British plant. So what's actually different?



Herman

The management of them. The technology is largely the same. A furnace in Wales is a furnace. What differs is enforcement, capital investment and regulatory pressure. In the UK and the EU you have exposure limits that are written down and inspected. You have heat-stress protocols, so there's a rule about how long a man can be in a given heat load before he's rotated out. You have ventilation capture systems pulling dust and fume at the source rather than letting it drift through the shed. PPE that's actually specified and actually replaced.



Corn

And that costs money.



Herman

All of it costs money. Which is the whole story.



Corn

I want to push on the comfortable version of this, though. Because the tidy story is "wealthy countries protect their workers, poor countries don't," and that lets everyone off. Is it actually that clean?



Herman

It is not clean. And there's a good study for this. A Romanian case on electric arc furnace plants, operating under Best Available Techniques, the EU's own standard for what a well-run plant should be doing.



Corn

Best Available Techniques. That's the regulatory ceiling, not the floor.



Herman

That's the ceiling in EU law. Dust capture, dioxin and furan capture, PCBs. And the finding was that even under that regime, workers in the field still show a considerable rate of morbidity.



Corn

Considerable.



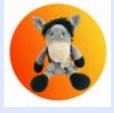
Herman

Considerable is their word.



Corn

So the developed-world model manages the risk. It doesn't remove it.



Herman

It manages it. You move from "this job will break you at fifty" to "this job will leave marks, and we are arguing about how many marks is acceptable." Which is a real improvement and it is not the same thing as safe.



Corn

And that's worth sitting with, because Daniel's second video, the awe-inspiring tour, the feeling in it is "look how far we've come." And the honest version is "look how much is still in the air."



Herman

Yes. The tour guide is looking at scale. Scale is impressive. It is also the thing that makes the hazard hard to control, because you're managing a heat load the size of a cathedral.



Corn

Hold on. I want to go back to something you said, because I don't think I followed it, and I don't want to nod along.



Herman

Go on.



Corn

You said sintering is the top air-pollution source and blast furnaces produce most of the CO2. So the pollution and the carbon aren't coming out of the same part of the plant?



Herman

And it's the thing that makes the policy interesting. Sintering is the step where you take fine iron ore and fuse it into lumps you can feed a furnace. It's the front end. And it's where the air pollution comes from. Seventy-one percent of the sulphur dioxide, seventy-three percent of the nitrogen oxides, fifty-four percent of the fine particulates, all out of sintering. Meanwhile the blast furnace is where eighty-one percent of the carbon dioxide comes out.



Corn

Different chimney. Different problem.



Herman

Different chimney, different problem, which means a plant can clean up its air quality and still be a carbon disaster, or cut its carbon and still be poisoning the neighbours. Those are two separate fights and they need two separate sets of rules.



Corn

Okay. So that's the human cost on the ground. Zoom out and there's a second ledger. The environmental one.



Herman

Steel is responsible for somewhere in the range of seven to eight percent of global carbon dioxide emissions. Put that next to the fact that aviation gets all the attention and sits at around two and a half percent, and you see the distortion. We argue about flying. We don't argue about steel.



Corn

Because we don't see it.



Herman

And in China specifically, the iron and steel industry alone emits about one point five six petagrams of CO2 a year, plus zero point eight five teragrams of fine particulates.



Corn

Those units are impressive and meaningless.



Herman

Then here's the one that isn't. That particulate load has been linked to about one hundred and forty-seven thousand premature deaths a year.



Corn

A hundred and forty-seven thousand. From one country's steel industry.



Herman

Per year. And here's the part I actually cannot get past. The health burden varies by a factor of seventy-seven thousand five hundred between individual plants.



Corn

Between plants?



Herman

Between individual plants. Same country, same industry, same product. One facility is thousands of times cleaner than another. Which means this is not some unavoidable consequence of making steel. It's a consequence of how a particular plant is built and run, and who is checking.



Corn

I want that number unpacked, because "seventy-seven thousand" sounds like a typo you'd let stand.



Herman

It's not a typo. The point is that the worst plants are doing something the best ones aren't, and the gap between them is what you'd get if you compared a hospital to a latrine. Think of it this way. Imagine two bakeries on the same street, same ovens, same flour, same bread. One of them vents its chimney into a scrubber and the other vents it straight into the playground next door. That's the scale of the difference we're talking about, except it's not bread, it's fine particulate, and the playground is a city of four million people.



Corn

And you grew up in Connecticut, you said. That's not a steel town.



Herman

No, Storrs is a university town. But I spent a lot of my doctoring years in Jerusalem, and I want to be careful not to moralise, so I'll just put the fact down. There's a second inventory of eight hundred and eleven Chinese iron and steel enterprises, and it found the sector added three point six micrograms per cubic metre to national population-weighted particulate levels, and that caused roughly fifty-nine thousand premature deaths in two thousand twenty.



Corn

Fifty-nine thousand.



Herman

In a single year. And that's the estimate for the particulate alone, without even counting the carbon.



Corn

So Daniel's question about "is there a path to sustainable production" isn't a climate question with a health asterisk. The health is the bigger number.



Herman

The health is the immediate number. The climate is the long number. And here's where it gets hopeful, which I don't get to say often.



Corn

Go on.



Herman

The mortality intensity of the two routes. Blast furnace to basic oxygen, versus electric arc furnace. Per unit of steel, BF-BOF carries one hundred and seventy-two deaths per thousand gigagrams. EAF carries forty-five. That's a factor of three point eight.



Corn

Almost four times the death rate for the same tonne of steel.



Herman

For the same tonne of steel. Same product. Different route.



Corn

And the policy consequence of that?



Herman

Relocating three point six percent of China's eastern blast furnace capacity to scrap-based electric arc furnaces, sited on the low-carbon grids in the southwest, would prevent about twelve thousand three hundred deaths a year. And generate twenty-four and a half billion dollars in combined climate and health benefits.



Corn

Three point six percent of one region's capacity.



Herman

Twelve thousand three hundred deaths a year. That's the argument I'd make to anyone who thinks decarbonisation is a luxury for rich countries. You don't have to believe a word about climate change to want that trade. It's public health with a carbon side effect.



Corn

So what actually gets you there? Because "electric arc furnace" only works if you have scrap.



Herman

That's the constraint, and it's a real one. The near-term pathway is scrap-based EAF plus energy efficiency, and it works, but it's limited by how much scrap steel exists in the world at any moment, and by the fact that scrap is a globally traded commodity with its own market.



Corn

Which means the countries with the most scrap are the countries that already built everything.



Herman

Which is the developed world. So the near-term fix is a fix for countries that already have the steel in their buildings and cars and bridges. For India, building out from scratch, the scrap isn't there yet. The medium and long-term answers are hydrogen metallurgy, hydrogen direct-reduced iron, and carbon capture and storage.



Corn

Hydrogen DRI. What's the actual mechanism?



Herman

You reduce iron ore with hydrogen instead of carbon. The hydrogen takes the oxygen off the iron and you get water instead of CO2. The physics works. The problem is that green hydrogen at scale is expensive and the plants that make it are being built slowly. And there's a middle option. Natural gas direct-reduced iron feeding an electric arc furnace, which doesn't need scrap and carries about half the mortality of the blast furnace route.



Corn

Half.



Herman

Half. So even the compromise route, the one you'd get if you couldn't afford the good one, is a large improvement on what's running now.



Corn

And the demand side, which I notice you skipped.



Herman

I skipped it and you caught me. The demand side is the one everybody skips. Material efficiency and scrap recycling. Using less steel per building, designing so the steel can come back out again, not over-specifying. The literature is explicit that this is equally critical, and it's the cheapest lever, and it's the one with no new technology in it at all.



Corn

Because it's not a technical problem, it's a procurement problem.



Herman

It's a procurement problem, and procurement problems don't get ribbon-cuttings.



Corn

Give me the example, though. Because "use less steel" sounds like a slogan.



Herman

Fair. Here's the concrete one. A building's structural frame is usually specified to a standard load, and then engineers add a safety margin, and then the fabricator adds a margin on top of that, and then the supplier rounds up to the nearest available section size. Each step is rational on its own. Stacked together, you can end up with a frame that's thirty or forty percent heavier than the physics actually requires. Multiply that across every office block in a city and you've built a steel mill's worth of demand that nobody needed.



Corn

And the fix is just someone checking the stack.



Herman

Someone checking the stack, and a client willing to pay for the checking, and a code that rewards it rather than treating the extra tonnage as free. No new furnace. No hydrogen. Just arithmetic.



Corn

So now bring it back to the towns. Because all of this is a spreadsheet until you put it in Cork.



Herman

Port Talbot is the live case. The blast furnaces are down, the site is moving to an electric arc furnace, and the honest arithmetic is that an arc furnace employs far fewer people than a blast furnace complex. So you can decarbonise a steel town and shrink its workforce at the same time, and both of those are true.



Corn

Which is the thing Daniel's actually circling. He's not asking about steel. He's asking what a town does when the thing it was for goes away.



Herman

And the answer from every steel town on Earth is: badly, at first. Pittsburgh, Gary in Indiana, Scunthorpe, Tangshan, Port Talbot. The identity is built into the place. The whole town is arranged around one gate.



Corn

And the knowledge economy that replaces it doesn't want the same people.



Herman

It doesn't want the same number of people, and it's often not in the same place. Which is why the transition literature keeps saying "region-specific pathways," which is policy language for "there is no general answer and someone is going to have to do the hard job town by town."



Corn

And the carbon trading and green finance levers you mentioned.



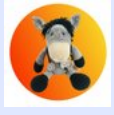
Herman

Those are the tools. A carbon price makes the dirty route cost more. Green finance makes the clean route cheaper to build. But neither of them writes a new identity for Port Talbot, and neither of them answers a man who's fifty-four and has done nothing but tap a furnace.



Corn

Which is why the neat version of this, where the technology solves it and the towns sort themselves out, is wrong.



Herman

The technology is real and the towns don't sort themselves out. And Daniel got to that in two sentences about Cork, which is why I wanted to do this one.



Corn

Right.



Hilbert

You keep saying "sintering" like it's a noun that means something. It's a mat. It's a slab of hot ore and it comes off the line and it's still glowing.



Hilbert

My uncle tapped at a mill, and he said the colour told you everything. Cherry red, that's a cold pour, you're going to fight it. Salmon pink, that's a good heat, that's where you want it. White hot, it's running, and if you're smart you step back and let it run. He could read a pour off the colour from twenty yards.



Corn

A furnace tapper.



Hilbert

Thirty-one years. And he'd have laughed at the idea that the heat was the worst of it.



Corn

That's the bit I want.



Hilbert

He said it was the dust. Fine grey dust, gets into the weave of your shirt, into your hair, into your teeth. He coughed up little grey pearls every morning. That's what he called them. Little grey pearls. Said he could tell how heavy the week had been by how many he got.



Herman

That's silica.



Hilbert

That's what the doctor said, eventually.



Herman

And the mill would have had it in the fume off the charging floor and the tapping floor, and without capture it goes everywhere, because it's fine enough to behave like a gas.



Hilbert

It went everywhere. My aunt used to find it in the cups in the cupboard.



Corn

In the cupboard.



Hilbert

Sealed cupboard.



Corn

How does it get in a sealed cupboard?



Hilbert

Nobody ever explained that to me and I've stopped asking.



Herman

Dust of that fineness carries on clothing and hair and it goes home with you. That's a known thing. It's how take-home exposure works. The mill doesn't stop at the gate. There are documented cases of workers' families showing elevated heavy metals, because the dust rides home on the coveralls and gets into the laundry and the carpets. The plant follows the man.



Corn

That's a hell of a thing to bring home with you.



Herman

It's the part of the story that gets left out, because the exposure doesn't end when the shift does.



Hilbert

He had a yellow crane. Number four. If four was down, they didn't pour. That was the rule, and nobody wrote it down, and it was the rule.



Corn

Why?



Hilbert

Four was lucky.



Corn

The crane was lucky.



Hilbert

The crane was lucky and you didn't argue with it. There were eleven cranes on that floor and four was the one you wanted on the pour, and if four was down you found something else to do that shift.



Corn

What happens when you need four and four is down and the heat's ready?



Hilbert

You don't pour. You wait, or you lose the heat. I saw them lose a heat rather than run it with nine.



Corn

That's a lot of steel to throw away over a paint colour.



Hilbert

It wasn't the paint. It was four.



Corn

He sang, you said?



Hilbert

Part-time. He was in the pub choir and he did the Anvil Chorus. Il Trovatore. He said the mill was good practice, because you learn to project over an orchestra and a mill floor is louder than an orchestra.



Herman

The Anvil Chorus is literally about striking an anvil.



Hilbert

He was aware of that. He thought it was funny. The foreman would put it over the loudspeaker sometimes when a heat was going well. Just the one recording, he had a tape of it.



Corn

The foreman would play an opera recording over the plant loudspeaker.



Hilbert

On a good pour, yes.



Corn

And nobody stopped him.



Hilbert

Nobody stopped him.



Herman

So the two things worth keeping from that are the pearls and the crane.



Hilbert

The pearls are the thing. He died at seventy-six, which everyone said was old for that floor, and he'd say it was the pearls that got him and not the heat. He was probably wrong about that.



Corn

Probably.



Hilbert

He'd have told you he was right.



Corn

Hilbert, the one number I want to keep is that thirty-one. Thirty-one years is longer than most of this conversation has been alive.



Hilbert

That's right.



Corn

So all of that, and then we get to the closing. Which I want to keep short, because I think the honest thing here is to leave it unresolved.



Herman

Then here's my one thing. The technology to clean this up largely exists. The scrap route, the gas route, the hydrogen route, the capture systems. The question isn't whether we can. It's whether the economics and the politics will let it be deployed before the men in that first video have finished their careers.



Corn

And mine is the thing Hilbert's uncle would have recognised. The forty-five deaths per thousand gigagrams against the hundred and seventy-two. That's not a climate argument, it's a worker argument, and it's the strongest case anyone has made for the transition. The towns are the difficult part. The furnaces are not.



Herman

There's a version of this where green steel preserves the community the way the old industry did, and I want that version to be true.



Corn

You want it to be true.



Herman

I don't know that it is.



Corn

That's the honest place to leave it. Steel built the modern world with physics that hasn't changed since the nineteenth century, and we have the route to make it humane and we're not sure we have the route to make it fair.



Herman

And we'd like to thank our producer, Hilbert Flumingtop. This has been My Weird Prompts.



Corn

If you've got a minute, a review wherever you listen helps other people find the show.



Herman

And stay warm, or whatever the correct version of that is.



Corn

Go inside.



Herman

We'll be back soon.