

## ESG Now Podcast

# “Semiconductors aren't green?!”

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Mike Disabato: What's up everyone, and welcome to the weekly edition of ESG Now, where we cover how the environment, our society, and corporate governance affects and are affected by our economy. I'm your host Mike Disabato. And this week, we discuss why the darling semiconductor industry is unfortunately a heavy polluter and what the industry can do about it. Thanks, as always, for joining us. Stay tuned.

Due to the great supply chain panic of the COVID time, everyone started talking about the semiconductor industry, because semiconductors were scarce and they power everything from computers to cars to refrigerators to the entire energy grid. They even power the machines that make them like some weird technological matriarch. That means they are also vital to something we talk about all the time on this podcast, the transition of the economy to a low carbon system. They power our solar energy system to charging stations, wind energy systems, the systems that monitor home and factory environments to make them more efficient. They power everything. So if they're vital to the growth of the green energy solution and the transition of our economy to a low carbon one, we should figure out what sort of carbon emissions are emitted as they're being made, not because we want to rag on the semiconductor industry. It is just something we need to obtain, a thorough accounting of where the emissions in our society are and what we need to do about them.

And in 2023, not only is the great chip shortage over, but there is likely an oversupply of semiconductors due to the surge in production caused by both organic demand and demand, buoyed by regulations that are supporting the industry's growth, like the Inflation Reduction and the Chips Act in the US, or the European Chips Act that is going to buoy the semiconductor industry in the EU. Those are just a couple examples. The thing is though, semiconductor manufacturers, with their high greenhouse gas emissions footprint, they might be getting a free pass because of the role in the economy. Will they avoid the same sort of pressure other industries have been under to lower their emissions? To figure that out, I called up my colleague Siyu Liu, who covers the semiconductor industry for us, and first asked her to give us the breakdown of just how emissions intensive is the semiconductor industry right now.

Siyu Liu: In general, the manufacturing processes, which we call fabrication, is energy intensive in nature. Because of the complexity in the manufacturing processes, the more complex the chips are, the more energy intensive the processes to make them. To make it comparable to other industries, that those who have in-house manufacturing activities, their carbon intensity are in the range of 200 to 500 tons per USD million dollar cells. That's comparable to, for example, mining activities.

Mike Disabato: Take the hardware systems that you are using right now if you're listening to this podcast. It is not the operation of that computer or phone that causes the majority of the emissions associated with that hardware. It is the manufacturing of that small chip inside the hardware, which accounts for most of the carbon output attributed to these systems. And now this is according to the company data that we have collected, as well as a 2020 study by Harvard University, titled Chasing Carbon: The Elusive Environmental Footprint of Computing. And now, that emissions problem is the same for pieces of green technology that use semiconductors. Where most of the emissions come from in the semiconductor industry is from burning perfluorocarbons, PFCs, chemicals and gases that are released during the fabrication of a semiconductor chip. So the emissions aren't just carbon. They are a variety of chemicals put out during the manufacturing of semiconductors.

And now up until recently, those emissions were centered in a couple key markets, east Asia. Taiwan especially accounts for over 55% of the wafer fabrication, with the US and China both sitting around 15%, and the EU is under 10%. But what has changed is China, the United States, and the EU especially are trying to build out their semiconductor manufacturing operations. This is because they see the importance of the industry, because of the collapse of supply chain, because of geopolitical issues. There's a lot of reasons for this. But anyway, what China wants to do is it wants to bump itself up to about 25% of the manufacturing process of semiconductors by 2030. The EU's European Chips Act is putting 43 billion euros toward building a more resilient semiconductor supply chain. And those two acts in the US, the IRA, the Inflation Reduction Act, and the Chips Act are putting tax incentives and over 50 billion US dollars to support investment in facilities and equipment for semiconductor manufacturing.

TSMC, the Taiwan semiconductor company that we're going to talk about in a minute, they even are building a manufacturing facility in the US that we talked about on a previous podcast. So does this all put the semiconductor industry in sort of a rarefied air where it may get a pass and not have to deal with its emissions or get pressure to deal with its emissions, or is there a possibility that this growth is going to create a reputational risk for the companies in the industry that are manufacturing these chips and that they're going to have to try and lower their emissions? I asked Siyu about this.

Siyu Liu: So I would say it's not about the reputational risk, but rather these companies that are producing the semiconductor devices that go into the clean energy systems, are they having zero emissions in their scope one, two operational activities themselves? Given the high intensity of their manufacturing activities, if they are not setting targets to use renewables to decarbonize their own emissions, then their overall climate profile may not be aligned with global temperature goals. That could be a potential disconnect that investors may want to take a further look at.

Mike Disabato: This is the paradox that we often see in the green transition. There are tools to lower our collective emissions, but the tools that make those tools are often carbon intensive. For manufacturing semiconductor chips, there are some

solutions out there that can lower the company's emissions. Using renewable energy to power semiconductor fabrication facilities, or fabs, is one great example. Now that isn't a silver bullet, but that same research report from Harvard that I mentioned earlier believes the industry could reduce its emissions by 30 times if it were to use green energy in the facilities instead of dirty fuels. But to do that as an industry, you need companies that have set a target to lower their emissions so they can account for what the problems are and how they can fix them. So how many semiconductor companies have set emissions reduction targets? I asked Siyu.

**Siyu Liu:** Across the MSCI AWCI IMI index for the semiconductor industry, which is about 300 companies in the universe, there's only 5 to 6% that have set targets that covering scope one, two, and three. So that's below the average of ACQI IMI peers. So in short, not a lot, very few.

**Mike Disabato:** Not many companies then. 5% of the semiconductor companies that have set a target, that Siyu just mentioned, to reduce their emissions are going to do so throughout their supply chain from the very end of their supply chain like the phone you're using right now or the chips powering ChatGPT or self-driving car software or the millions of other devices that make up our connector world, 5% of the semiconductor companies in the industry are trying to reduce those emissions. But only 7% of the industry has set targets to reduce their direct operational emissions, the emissions at their fab facilities. Intel is actually one of those companies that has set an emissions reduction plan for its direct operations. In fact, Intel already uses renewable energy to meet much of its demand. Around 90% of the semiconductor production used by Intel uses energy from renewable sources.

Now contrast that with the Taiwan semiconductor manufacturing company, the TSMC, one of the biggest manufacturers of semiconductor chips out there. It says that by 2025, renewable energy will produce 20% of the electricity used to power its new semiconductor fabrication plants, which seems low when you compare TSMC to Intel, which is already using that 90%. But Intel has access to more renewable energy where their fab facilities are located in the US, compared to the TSMC. The US has more renewable energy available than Taiwan that relies on imported oil and coal for a lot of its energy use. As with much, a company's choice of energy is often part of a larger question of availability and geographical policy, the policy of the area that they're operating in. There is another innovation that Siyu thinks could be useful, such as using what's called silicon carbide instead of straight silicon to make these semiconductor chips. Silicon carbide would lower emissions in the manufacturing process, which is a very difficult thing to do at the moment.

Still, 5 to 7% of companies setting targets seemed pretty low. Siyu mentioned that the emissions were similar to the mining industry in the semiconductor industry. And if you look at our data, around 29% of the mining industry has set a plan to reduce the direct operation emissions. There's scope one and two emissions. So this is much higher than the semiconductor industry. So I asked Siyu why she thinks that the semiconductor industry has such a low percentage of companies that have set a carbon or just greenhouse gas emissions

reduction target in general. And she said it might be because the semiconductor industry has not yet felt the pressure to set a emissions reduction plan as other sectors have.

Siyu Liu:

I think partially also may have something to do with their positioning the supply chain. They're in the middle, so they may be traditionally not necessarily getting the same type of pressure from investors. But that could change quickly when investor are looking at this industry, looking at all the growth opportunity or the clean energy opportunity in this industry, and also when they're cut customers, their end market customers are decarbonizing their supply chain. That pressure to decarbonize will eventually get to the semiconductors manufacturers because their products are consuming energy as well when they're at the use end.

Mike Disabato:

The pressure from its customers may become more pronounced as tech companies and utilities, and auto companies, and all the others that use semiconductors start to use more renewable energy at their operations centers. Remember I said, for hardware especially, that a majority of a company's operations are by that chip manufacturing process. So once those companies use renewable energy in their operations, they're going to say, "Okay, where are other emissions?" And they're going to push the semiconductor industry. They might push the semiconductor industry to lower their emissions somehow. And semiconductors would then likely join cement and steel and other manufacturers as these extremely important but hard to abate sectors that may have greater focus on them as the globe continues to push for decarbonization. And if only five to 7% of the semiconductor sector is conducting a thorough accounting of its emissions through carbon reduction plans, that means a small part of the industry is going to be at the forefront of providing guidance on how they can address their environmental challenges and trying to push forward on that.

It might be those players that come to lead the industry that is trying to help build low carbon solutions. Now, luckily for green tech, the semiconductors used in those products are much less advanced than those that are used in, say our computers. Less advanced means less carbon intensity to create those semiconductors, which means less of a hurdle for clean tech companies to pressure semiconductor companies to lower the emissions for their products. It might be some low hanging fruit for engagement by shareholders. Lower the emissions of less advanced chips first so our green tech can be lowered and powered by lower carbon tools. Until then, the paradox might remain, as we will need a steady supply of semiconductors to push our society away from the even dirtier fuels and processes that we rely on today.

And that's it for the week. I wanted to thank Siyu Liu for talking to me about the news with an ESG twist. I wanted to thank my colleague, Margarita Grabert, who was very helpful in creating this episode. She basically produced it. And I wanted to thank you so much for listening. I always appreciate it. If you like what you heard, don't forget to rate and review us. That helps us get higher on these podcast lists, especially the ESG podcast lists. And if you want to hear myself or

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Speaker 3:

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