

Exchanges at Goldman Sachs

The Path to Net Zero: Managing the Transition

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Recorded: November 17, 2022

Allison Nathan: Rising concerns over climate change are spurring investments into clean energy to help bring the world closer to net zero. But where are we in that transition? And how is that path to decarbonization affecting investments in traditional oil and gas projects?

Michele Della Vigna: We're at the beginning of a very long path. But at the start of that, we need to unlock investment. And more specifically, we think we need to unlock an extra 1 trillion dollars per annum of investment in energy over the next five years.

Allison Nathan: I'm Allison Nathan and this is Exchanges at Goldman Sachs.

[MUSIC INTRO]

Allison Nathan: To help bring down the economic path to net zero, I'm here with my colleague Michele Della Vigna who is head of natural resource research for Goldman Sachs in EMEA. Michele leads our resource on what he's called Carbonomics, which examines the economics of getting to a net zero carbon world. Michele, welcome back to the program.

Michele Della Vigna: Thank you, Allison, always a pleasure.

Allison Nathan: So, let's start with the macro backdrop. Europe is facing an affordability crisis as the continent struggles to secure energy supply. That largely owes to Russia's invasion of Ukraine that disrupted energy flows to the continent. But that supply shock also raised questions about energy sustainability and the tradeoffs needed to get to net zero. So, first, give us the background on how we got here.

Michele Della Vigna: So, Allison, I think you're right. Everything comes from the Russian/Ukraine invasion. But in many ways, this has just been a catalyst which exposes weaknesses of the energy system which have been built up

over the last 15 years.

And specifically, I think there are three problems here that we need to address. The first one is diversification of supply. Europe has been relying on Russian gas for 30 - 40 percent of its gas. And the main reason is that it has stopped signing long-term contracts for LNG supply a decade ago and before LNG was all contracted to Asia and not to Europe.

Secondly, we've been underinvesting structurally in the energy industry for a long time. If you take all the primary energy, so not only hydrocarbons, but also renewables and power networks, we used to spend 2 trillion dollars per annum on a global basis. And in the last few years, that number has come down to 1.5 trillion. So, despite the growing world population, we've reduced the level of energy investment. And this has consumed spare capacity across the system. We currently estimate we have the lowest OPEX spare capacity in almost two decades. The lowest oil inventories in almost two decades. And that we've effectively consumed half of the reserve life in the oil sector. So, underinvestment, lack of commitment on long-term supply contracts in gas, and lack of diversifications have

really been at the core of this problem.

Allison Nathan: So, amid this much tighter energy supply environment and higher price environment, we've heard a lot about the need to find a new balance between securing affordable energy and transitioning to a world without oil and gas. Where are we in achieving that balance?

Michele Della Vigna: We have not made a lot of headroom to achieve that balance. I think, first of all, but we'll probably come back to this, we need more investment in both traditional hydrocarbons and in renewables. And then on top of it, we need to invest on stability for seasonality and intermittency. And that's when green hydrogen and batteries and gas, as a back up, come in as well.

So, my sense is we're at the beginning of a very long path. But at the start of that, we need to unlock investment. And more specifically, we think we need to unlock an extra 1 trillion dollars per annum of investment in energy over the next five years.

Allison Nathan: And so, how do we do that? How do we

unlock that investment?

Michele Della Vigna: I think there are three main ways to achieve it. The first one is to create regulatory certainty around carbon on a global basis. Ideally with a framework on global carbon pricing. I see very few signs of that happening at the moment.

The second is to create specific incentives for new investments like the Inflation Reduction Act in the US, which make renewables and hydrogen and bio energy profitable through specific incentives. And then the third one is for the market to start to de-risk the growth profile of some of these companies through lower cost of capital.

Right now, we estimate the cost of capital for long cycle, new oil developments is about 20 percent. With that cost of capital, it's very difficult to unlock new investments. And so, my sense is we need these three drivers to unlock that incremental capital. And right now, I see little signs of it happening.

Allison Nathan: Where do you think that capital is most likely or needs to come from? Will it come from

government? Will it come from corporates? Investors?

Michele Della Vigna: I think most of it will need to come from investors and corporate, on the back of better regulation from governments. Let me give you an example. Right now, the three global largest emitting sectors, which are heavy industry, heavy transport, and oil and gas are reinvesting between 20 and 40 percent less of their cash flow in their business because of uncertainty around global regulation, especially on carbon and on decarbonization.

Regulatory certainty could bring back their reinvestment rates to the long-term history. And that, by itself, could unlock half a trillion dollars per annum on a global basis.

Allison Nathan: And so, if we managed to unlock that capital, where should it be directed to that will accelerate this process and be most efficient in getting us to affordable, clean energy supply?

Michele Della Vigna: I think in three main areas. First of all, renewables. I think renewable power has the ability to be a real revolution on a global basis from the point of view of new capex and new supply. But it will not be enough.

Renewable power, especially solar, has issues with intermittency. Think day and night. And seasonality. Think summer versus winter. And therefore, we need technologies who can ensure a stable stream of power when the consumer needs it. Those are batteries for intermittency. And green hydrogen for seasonality.

And then I still think we need more gas to just accelerate the substitution of coal, which is the largest global emitter at the moment. The problem of the current affordability crisis and high gas prices is that we're going back to coal. And therefore, emissions are rising again just when we need to start to see them declining if we want to be within two degrees of global warming as laid out by the Paris Agreement.

Allison Nathan: So, the current energy affordability and security crisis has led to new policies in Europe and the US. We have the Repower EU in Europe. We have the Inflation Reduction Act in the US. So, how significant are these policies? And how can they help accelerate the path to net zero?

Michele Della Vigna: They're very significant. For

instance, we look at the Repower EU regulations, it's effectively implementing the Fit for 55 strategy for a 55 percent reduction in carbon emissions by 2030. And it is implemented country by country. It offers some attractive incentives for some of the low carbon technologies.

But the real breakthrough in the last year has been the Inflation Reduction Act, which in the US has created a set of incentives for clean tech that reach almost \$400 billion. And which are a complete breakthrough in the economics of pretty much every decarbonization technology from electric vehicles and batteries to renewable power, hydrogen, carbon capture, bio energy. And especially for carbon capture and green hydrogen, two technologies which have struggled in the past with economics. This is a complete breakthrough in incentives and economics.

So, we think both of these initiatives are very important. But without doubt, the Inflation Reduction Act has been the revolutionary technology from a clean tech perspective. And the most important one we've seen in over a decade.

Allison Nathan: Let's dig a little bit more into that carbonomics cost curve that you and your team developed

and you just mentioned in terms of how the stack has been moving recently on the back of some of this policy. First, just give us a quick reminder of what that cost curve measures and how it works.

Michele Della Vigna: Allison, it's been a painful exercise to put it together. We've analyzed 100 different technologies of decarbonization. And we've estimated the carbon price at which each of those technologies would be profitable today. And so, effectively, it gives us a cost curve like for any other commodity, but where the reference point is the carbon price.

And we can use this curve in many ways. We can use it to try to think about the right carbon price to get us to net zero, which would probably be somewhere between \$100 and 200 per ton on our current curve. And we can also look at how this cost curve changes over time. Is it getting cheaper or more expensive to decarbonize? And which technologies are improving more than others on the cost curve?

So, for instance, this year we've seen the technologies that substitute natural gas making the biggest improvement on

the cost curve. So, green hydrogen, biogas, energy efficiency have tremendously improved on the cost curve. But interestingly, those that substitute oil, mostly electric vehicles and biofuels, have actually deteriorated and moved higher on that cost curve.

So, there's a lot that we can do on the cost curve. But the foundation of it really is the modeling of the economics of decarbonization through these 100 different technologies available.

Allison Nathan: And so, what drives that shift towards, you just mentioned, natural gas related technology looking more affordable, oil ones less? Give us a flavor of the economics that drive that relative shift.

Michele Della Vigna: A few years ago, when we started to introduce this curve, the biggest move was driven by the cost of FinTech that was becoming cheaper, mostly through standardization of technologies like solar and wind. Unfortunately, in the last two years, that was no longer the case. Actually, we've seen severe cost inflation in places like batteries, solar panel, and wind.

So, what's driving the improvements in the economics of decarbonization is just the higher cost of hydrocarbons. The higher cost of oil, of gas, or coal. In many ways, I would say hydrocarbon prices are doing the job that carbon prices should do. But unfortunately, we've seen very little policy momentum on that front.

Allison Nathan: And so, what I'm hearing you saying is that it's not that the cost of these clean energy technologies has come down. It's that their substitutes, their competitors, the cost of hydrocarbons have come up. So, on a relative basis, these technologies are looking for attractive.

Michele Della Vigna: Exactly. And this is what in many ways we refer to as the revenge of the old carbon economy. Effectively through underinvestment, the prices of oil, gas, coal are going higher. And that ends up accelerating the energy transition. So, it all happens through higher hydrocarbon prices, which we believe will probably be a reality that will last for most of this decade.

Allison Nathan: Michele, after sitting here talking, there are a number of broader efforts and discussions underway

to address climate change. The COP 27 International Climate Conference in Egypt is wrapping up. And you have an imminent conference on carbonomics taking place. Let's start with COP 27. What are some of the big themes coming out of that summit?

Michele Della Vigna: So, COP 27 is trying to address one of the key issues that was not really in focus at COP 26 which is loss and damage, and more specifically, how the Western world can help finance the emerging markets efforts to adapt to climate change and to react to climate disasters.

So, it's more about climate adaptation, something that, to be fair, the previous COPs did not spend a huge amount of time on. And more about social justice between DMs and EMs, which are really important themes, especially as the likelihood of keeping global warming below one and a half degrees are becoming increasingly unlikely each year that we continue to see emissions rise.

My sense is that next year's COP, so COP 28, will come back and focus more on decarbonization and on clean tech technologies. But this COP held in Cairo, I think, was

mostly about adaptation problems and about loss and damage.

Allison Nathan: And what do you hope to achieve at the Goldman Sachs Carbonomics conference?

Michele Della Vigna: We're very excited. We will have about 1,000 investors in our London office meeting with 30 corporates and some of the key policymakers. And the core of the discussion will really be how can we unlock the potential from capital markets and corporate capex to improve the economics of decarbonization, faster clean tech innovation, and ultimately help to achieve net zero carbon in a way that is just, that is economically affordable, and that is as quick as possible and consistent with the aims of the Paris Agreement.

And we are going to have two main tracks. On one, we're going to have the CEOs of some of the world's largest companies thinking about energy transition and financing. And then we're going to have a track of clean tech innovators who are the leaders in green hydrogen, in bio energy, in carbon capture, in fusion, in circular economies. So, we think it's going to be a really exciting day with,

hopefully, a lot of ideas coming out that can help us on an affordable path to net zero.

Allison Nathan: It's clear given the degree of complexity of this problem that it really is a global problem and it requires a global solution. That said, how are regional differences playing out in this move towards decarbonization? Is one region much more ahead? It used to be Europe was always leading the way. Is that still the case?

Michele Della Vigna: It's definitely a global problem that needs a global solution. But there is no global solution at the moment. There's been zero progress towards a global agreement on carbon pricing, including a potential framework for border adjustment. And so, each country is going its own way.

You are correct. Europe was at the forefront from a regulatory and incentive perspective. I think, actually, the US with the Inflation Reduction Act is now becoming the country where clean tech applications are most profitable and will be done in the largest scale. So, the US has a real chance of regaining leadership in clean tech technologies

have been a little bit on the side for the last ten, 15 years.

Allison Nathan: And so, just to end where we started, as you think about this, you've spent so much time, Michele, thinking about this problem and how to solve it, in your view at this stage, given everything you know, how can we best leverage this current crisis to create a better energy system in the long term and eventually achieve that goal of net zero which is so important to our future?

Michele Della Vigna: I think every key technological innovation tends to come from a crisis and tends to come from an issue of affordability of the existing technologies. So, in many ways, this crisis could be the beginning of a new energy system, which is renewables based and with hydrogen bio energy and circular economy making it sustainable and allowing a path to net zero that is more affordable, more local, and more sustainable.

So, my sense is probably in ten years time we will look back and this will be the beginning of a major technological change that can bring us towards net zero. But to get there, we need better regulation. And I think we need better coordination on a global basis, including on a global carbon

price framework.

Allison Nathan: Michele, thanks for joining us. It's always great to talk to you about these important issues. I'm sure this won't be the end of our conversation. And good luck with the conference.

Michele Della Vigna: Thank you, Allison.

Allison Nathan: And before we go, I want to share news about a new podcast that Goldman Sachs is launching. It's called The Markets from Goldman Sachs. Every Friday, we break down the key issues driving markets that week. Make sure you're following and listening to The Markets, for unmissable market analysis. It's the sharpest way to stay ahead. Available wherever you listen to your podcasts.

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