

SM101 | 12.24.2022**Holiday Special | Part 1****Robert Friedland, Founder & Executive Chairman, Ivanhoe Mines and
Josh Crumb, Founder & CEO, Abaxx Technologies**

This week, we present Part 1 of our end-of-year Holiday Special. SmarterMarkets™ host David Greely sits down with Robert Friedland, Founder & Executive Chairman of Ivanhoe Mines, and Josh Crumb, Founder & CEO of Abaxx Technologies, to look back at how the SmarterMarkets™ vision has developed over the last two years and discuss where it's going next.

Robert Friedland (01s):

We're gonna have to innovate ourselves out of this problem, the way we grow our food, and the way we make our buildings, and the way we build our cities. We've got 8 or 9 billion people scheduled to be on this little spaceship with us and Mother Nature is very, very fragile. The oceans are very, very fragile. The permafrost in Russia is very fragile. The fragility of the natural system is terrifying when you think in terms of your kids and your grandkids, and we're going to have to innovate our way out of this, and we're gonna need smarter markets.

Announcer (36s):

Welcome to SmarterMarkets, a weekly podcast featuring the icons and entrepreneurs of technology, commodities, and finance ranting on the inadequacies of our systems and riffing on ideas for how to solve them. Together we examine the questions are we facing a crisis of information or a crisis of trust and will building smarter markets be the antidote?

David Greely (01m 02s):

Welcome to part one of our special holiday episode of SmarterMarkets. I'm Dave Greely, Chief Economist at Abaxx Technologies. I have two very special guests here for the holidays, Robert Friedland, the Founder and Executive Co-Chairman of Ivanhoe Mines, and Josh Crumb, the Founder and CEO of Abaxx. We'll be looking back over how the SmarterMarkets vision has developed over the past two years and where it's going next. Hello, Robert and Josh, welcome back to SmarterMarkets. I wanna thank you both for sharing some of your holidays with us. We just released the 100th episode of our SmarterMarkets podcast, which makes this a special opportunity to look back with both of you to the beginning of the SmarterMarkets vision, how it's developed and where it may be going in the New Year. I'd like to, to start off with how it all began in, in one sense, it all started with you, Robert.

David Greely (01m 54s):

You were our very first guest on SmarterMarkets, and in that conversation you laid out a number of powerful ideas, including that decarbonizing our energy system was gonna disrupt the whole supply chain of our economy and create winners and losers in commodities across the periodic table, and new technologies and smarter market infrastructure were gonna be needed to incentivize companies to produce the resources needed for this energy transition and produce them in a cleaner and greener way and I wanted to start by asking you, you know, those ideas that you laid out in that first podcast, how have those ideas been received over the past two years, and how, if at all, is the industry acting on them?

Robert Friedland (02m 39s):

Well, it's been an interesting two years. We've been around the sun twice since we started SmarterMarkets and the world has changed in many ways with the ending of the pandemic intense phase of the pandemic in the Western world. I think there's a much broader understanding that everything comes from somewhere and that we need to organize smarter markets to really reorganize the supply chain with proper economic incentive and I think that we've had a tremendous amount of interest in the financial community, and now starting with people and governments to realize that it's not that easy to decarbonize the world economy but there've been changes and things we never imagined in the last two years. We've seen Russia, in some sense become the new ESG. We've seen a global energy crisis where the Europeans have to worry about freezing in the dark.

Robert Friedland (03m 35s):

And the tremendous increase in the importance of LNG as a transition fuel towards the decarbonization of the world economy, and still some of the old economies like coal exploded in value due to the energy shortages that came out as the world came out of, it's slowing that was caused so much by COVID and we're seeing this today in China as China begins to give up on trying to control the latest variant of the virus and its concomitant potential enormous impact on global supply chains. So no one can accurately predict the future, but the requirement for smarter markets and the tremendous new understanding that it's not gonna be that easy to stop burning hydrocarbon and goal to green the world economy is now I think, an idea that SmarterMarkets has done a lot to sort of bring to the forefront and to get people to pay attention and I think it's now part of the common dialogue in the financial markets.

David Greely (04m 40s):

Yeah, it really is and I'm, and I'm gonna want to return to that with you a little later in our conversation my head's still spinning a little bit because it's hard to believe everything you listed has occurred in just two years. It feels like two decades worth of action having happened. But Josh, I wanted to turn to you know, just a year ago, well, little less at the beginning of the year, you shared on one of our podcasts might have been episode 53, a bit of the SmarterMarkets origin story and now I'm talking about the broader SmarterMarkets vision, not just the podcast in particular. We can get to that a little later and part of that story was you and Robert recognizing that something important was missing in the market's conversation about the challenges that lie ahead for commodity investment and commodity production, and that something important was needed at the intersection of technology and commodity market infrastructure. Can you take us back to that beginning again and describe some of those original ideas and how they've evolved over the past year or two?

Josh Crumb (05m 45s):

Yeah, thanks, David. You know, really, you know, two of the first three episodes were really transformational for the evolution of the podcast and the whole SmarterMarkets vision. Of course, you had Robert on that first episode talking about the revenge of the minors and actually since then I've had, you know, the lead director of one of the largest banks in the world reach out and just said, you know, I had no idea of these things. I've never heard of this stuff before and this was a major in, you know, infrastructure investor that just really hadn't heard the story. So I think sometimes when we are, you know, very insular within, within the commodity industry, we sometimes forget, you know, how much knowledge we have on, you know, how the world works, you know, versus others and in the physical economy, particularly given there's been so much you know, focus on an investment world of cloud and mobile and, and the whole digital economy, you know, the last, in the last five to 10 years.

Josh Crumb (06m 37s):

But that the other transformational moment was really in that third episode when Jeff Currie, you know, you know, gave really a shot around the world in the commodities world about putting a price on carbon. You know, I think this was something that was, you know, obviously, you know, around governments, around activists, but really to hear that from the inside of the commodity industry and really letting the world know how much the commodity industry is thinking about these things, you know, it's sort of unprovoked by just government action. I think really, you know, really, you know, change the way even as a company we really thought you know, where the world was at. But, but maybe stepping back to the, the markets vision itself, you know, even before, before the podcast, I would actually, you know, go back to Jeff and Robert again on, on two occasions.

Josh Crumb (07m 25s):

So first was early 2019, I believe it was at the Goldman Sachs annual investment conference in Zurich. You know, we had lunch with Jeff, you know, this was a year before the pandemic the markets were, I think, generally slowing at that point. You know, there was sort of a recession coming on even before the pandemic and commodity investing cycle itself was at kind of the tail end of probably a five year, you know, downturn in early 2019. So nobody was really thinking about commodity investment at the, at the time and at this time, you know, Jeff really told me, he said, kind of everything has changed you know, when, when he talked to energy companies, you know, around the time of that conference end of 2018, early 2019, you know, he was, he was telling me that he really felt that this time was different.

Josh Crumb (08m 12s):

That, that the, the companies, you know, big oil really was becoming, you know, big electrification and big decarbonization, that it wasn't just green washing anymore that the culture was actually changing in internally. But we had the conversation at that time, I think in, you know, CapEx investment was really at a trough in, you know, and it still is in many ways. It's still very much on the bottom. You know, we're investing about one and a half trillion a year right now in energy infrastructure, which is down from about 2 trillion a

year, you know, 10 years ago. So, you know, we're still, you know, we still aren't investing enough even though our demand is up about 25% since then, and we're trying to make this, this transition. So for me, there was a big question is, you know, how are we gonna do this?

Josh Crumb (08m 54s):

How are we gonna get the cost of capital for these resource companies to make the investments that are needed, so that was really the, the first piece of that puzzle and thinking about ESG and thinking about this upcoming investment cycle. The second piece of it, again, you know, going back to Robert was visiting Robert, I think it was that same summer, summer of 2019 that is beautiful Villa Tre Ville in Positano in Italy, and we were talking about block chain, we were talking about investment in commodities. We were talking about pricing commodities and again, this was after all of this software. I think there was a few companies talking about, you know, trying to raise money by selling an ICO of their reserves on the ground, right. So we were already thinking about how these new technology cycles could change investment, but that was always the biggest part of SmarterMarkets was the question, how in the world are we gonna get capital into these sectors when we need this, this capital?

Josh Crumb (09m 48s):

So I think the, you know, the final thing that, that I would want to say about that SmarterMarkets vision is it's always been one of these sort of blurry pictures or paintings that if you kind of squint at it or stare at it long enough, you kind of know what the future looks like but there's a lot of details to fill in and for me it was really about making SmarterMarkets that canvas and really open source it to the world. You know, let's smart people bring these conversations forward and not just have these on our own or try to be insular, but again, like those shots heard around the world of Robert's revenge of the minors and Jeff's putting a price on carbon. That was the point of the podcast and thanks to people like Jeff and Robert, it's really just take on a whole life of its own.

David Greely (10m 30s):

And Robert, what do you remember from those early conversations you know, as Josh refers to this kind of impressionistic painting that he was seeing of the future out there. What first really grabbed your interest in some of the ideas that Josh was thinking and, and, and articulating?

Robert Friedland (10m 48s):

You know, we go back two years, it's just incredible to think how much has changed. Two years ago, the chairman of the Federal Reserve Board wasn't even beginning to think about saying that inflation is transitory. Nobody was even thinking about inflation. Those of us in the natural resource business see a train wreck coming, we see a generation of underinvestment in critical raw materials. We think we live and breathe and touch and depend on something called the supply chain and the supply chain was almost a mystical concept two years ago. When you look back at the World War II period, the Germans invented the U-boat and the U-boats purpose was to disrupt the supply chain for the allies. Those nasty little U-boats were blowing up ships, crossing the Atlantic Ocean with oil or metals or critical raw materials for the war effort. So two years ago, we didn't have such an apparent initiation of war.

Robert Friedland (11m 57s):

We didn't have such a concern with inflation and, and now we're beginning to see global increases in food. We're seeing intense balkanization of the world economy. One mind-blowing piece of news just last week is that Japanese have formally agreed to rebuild their military with 2% of their G D P depended on military expenditure. The Germans didn't even have an army worthy of the name after World War II, and they've put down a hundred billion euro down payment to suddenly build an army. So we've gone from a period of complete naive about the supply chain. We've gone from a lot of people trying to dream about a carbon-free world without any really grounded reality in how to get there from here and so Jeff calling for a price on carbon, I mean, it's absolutely apparent without putting a price on carbon dioxide.

Robert Friedland (12m 55s):

And even more importantly, methane, we'll never get to a, a carbon-free world without pricing that accordingly with smarter markets. And so the software part of the system is pricing in the financial markets and the way the financial markets price human activity in a more intelligent way. That's as fundamental revolution as anything I can imagine, because financial markets may have started in ancient Babylonia, but they definitely need to be, you know, rebuilt and then on the physical side, we need a transition fuel before we go through the thorium cycle, or we have clean nuclear modular power, or we develop geothermal energy in a revolutionary way to find stable baseline electrical generation. I mean, we can't literally pave the world with solar cells, and we can't literally put up

windmills everywhere and chew up every bird on the planet flying into those windmills. You know, windmills are, are, they only have a 20 year life.

Robert Friedland (13m 58s):

They have to be rebuilt and so the whole womb to tomb, cradle to grave sperm to germ system has to be looked at. Kids have to be taught in the school to think systemically. We have to move beyond one dimensional cartoons and we have to pay homage to the miners, because there's only six or seven critical elements we need and it's gonna be like trying to get the contents of the Hoover Dam through a garden hose to find the right raw materials, especially if the world slides into war. So we're gonna need to spend a long time talking about war later in this broadcast.

David Greely (14m 34s):

Yeah. When you said that Russia's the new ESG, I was thinking I thought ESG was the new ESG, you know, we, we just kind of mainstreamed it and now, now there's we're moving on already the world is, is moving fast and one thing I'd love to hear you guys, you know, talk about with the, the beginning of the SmarterMarkets vision is you kind of hear of, you know, three people, the two of you Jeff Currie, kind of looking at the world from your own perspectives and coming to the same conclusions in a way, and then finding each other and having a conversation and saying, you know, oh, we need to do something about this. This is not sustainable and what I'd like to talk with you both about now is that that community building around a SmarterMarkets vision because that's really been a lot of what the podcast itself has been about and so I'd like to turn to the origins of the idea to do a podcast. I mean, for myself, since I've been hosting it, I think of the podcast as our way of shining a light on problems that we think are important, crowdsourcing insights and building a network, building a community of pragmatic problem solvers who want to work together to try to find solutions and so I wanted to talk a little bit, Josh, about how did the idea to do a podcast come about and what were some of your ideas for it?

Josh Crumb (15m 57s):

Yeah, I think the main thing was again, we just didn't hear enough of those conversations happening. Sometimes you sit back and again, you look at the tail end of that five to seven year, you know, downturn in mining, you know, mining equities and oil and gas, you know, companies and you hear the rhetoric coming from, you know, a lot of political talk about, you know, where the world's heading and sometimes you just sort of think, you know, there is got to be more people out here that think that's all crazy. We actually need to invest in these resources. So, so how do we, you know, maybe this is a boring niche conversation, but how do we, you know, how do we at least start having that, that conversation and I think the other thing was really just the, the evolution of the podcast, sort of long form conversation in the, you know, the cultural zeitgeist, you know, that that really is only, I mean obviously there's been podcasts for decades, but really where, you know, every week people are tuning into these things, you know, to get nuanced difficult, you know, information is really only a multi, you know, only the last, last few years.

Josh Crumb (17m 01s):

So one of the things that I've found most amazing since we started this podcast is, you know, Robert and I, coming from institutional capital markets, you know, you have a lot of smart conversations, you know, the investment bankers, the investment conferences, they kind of become the glue to connect, you know, what different corporate visions or different corporate conversations, you know, it sort of happens there, but that's not happening in the public, right. Those conversations, unless you're in that sort of elite investor institutional class, you don't get to, you know, hear what, how everyone's thinking and I think over the last 5 to 10 years to be able to have those deep conversations in a much more open forum, I think has been very important and I actually think it will speed this investment cycle and, and make it go in different directions that maybe, maybe we've had in past, past investment cycles.

Josh Crumb (17m 51s):

Because all of a sudden, you know, whether it's on SmarterMarkets or other podcasts, you start hearing that, oh wait a minute, there's someone that thinks just like me sitting in this big energy company, there's someone that thinks just like me sitting in this mining company or in this, you know, government policy office, you know, and so I think we're starting to connect the world in a much more open social media friendly world by having these types of conversations in a way that probably didn't happen go, you know, 10 years ago in the last investment cycle and we can talk about some of the specific examples and amazing stories that have happened over the last couple years since we started the podcast, but that for me is what's been so important about, you know, having this forum.

David Greely (18m 30s):

Yeah, and I'd love to get back to some of those stories. You know, when I worked at Bridgewater one of the CIOs there, Bob Prince told me that, you know, you just need to say what you think as clearly as you can and have faith that there are people out there who will

respond to what you say and that they'll find you and I think of that often with this podcast and I think it's fair to say that all of us involved have been surprised and humbled by the response that we've received to it and I'm curious, you know, Robert, I think you've been on this probably be your fourth time on, I think if I counted right, I'm curious like what the response you've received. I know you talk about, you know, many of these themes in many forums in addition to this podcast, but I think it must be very gratifying to see your views on the importance of, say, the lack of metals and minerals for the energy transition have really now entered the mainstream.

Robert Friedland (19m 21s):

You know, it's incredible that this technology becomes ubiquitous and is actually global in some small way. I think this podcast had an impact even in Saudi Arabia. The Saudis now have started a new forum called The Future Minerals Forum once a year we've had conversations in Saudi Arabia that have been most remarkable. I met very senior people in government ministers in the royal family and I said, you guys are obviously responsible for a huge chunk of the energy that built the modern world. I went on a pilgrimage to the number seven Prosperity Well, which was drilled in 1938 that discovered the Arab oil zone in the birth of Saudi Arabia and people started listening to this podcast and thinking, well, one of the most remarkable conversations I had with the most senior ministers, I said, you guys are long haul the crude oil and you're maintaining the stability of the world energy system.

Robert Friedland (20m 27s):

Why don't you buy the mining industry as a hedge you know, just, you know, all this electrification and talk about global warming and a better new world is critical on these metals and the responsible ministers said, that's a great idea. How do we do that, so people that are long oil and gas people that are long LNG people that are literally keeping the lights on globally are saying to have the same conversation, which is the kingdom of Saudi Arabia imports a lot of their metals. They're developing a steel industry. They're developing an hydrogen industry. They're very concerned with both blue and green hydrogen. They're very concerned with solar power. They're, they're building electric cars. They've invested lucid motors, for example, one of the best electric car companies and even the oil and gas people, even the LNG people are realizing that you need metals to get there from here.

Robert Friedland (21m 23s):

And, and so there's a broadening sense that we really desperately need to have a more serious conversation about where things come from and what's required to actually get there from here and I'm most amazed to see that this kind of thinking has definitely permeated Washington DC, the Department of Defense, the Army, Navy, the Air Force understanding that America has to worry about others having hypersonic missiles. What are these hypersonic missiles made out of, what raw materials do you need to defend yourself and so this this been this remarkable outburst of inflation balkanization of the world economy war that looks a lot like the late 1930s like old-fashioned war, thousands of troops killing each other in trenches, one major nation openly invading another broadcast worldwide and the thinking that it's like, well, you know, in the old pirate movies, when the pirate ship is sinking at old peg, like Pete is standing on the deck of the ship, he's got a little green parrot on his shoulder.

Robert Friedland (22m 37s):

And that little parrot says, wha wha every man for himself. Remember when the pirate ship sinks, all of a sudden every nation is worried about their supply chain. They're worried about where their energy's coming from. They're worried about LNG or heat, or not freezing in the dark or feeding their population at a decent price and we've seen the price of food explode. Now, all of this has happened since we started SmarterMarkets. So it feels like we're living through a real seismic change in the world economy and we're probably beginning a 30 year period where the demand for real things comes to the forefront. Physical commodities, physical reorganization of the world economy and I think the way the upheaval and the volatility coming in the world economy, I agree with Goldman Sachs commodities themselves are probably the best single financial haven.

David Greely (23m 37s):

And Robert, it seems like the reality and the potential for war is really on your mind recently and you know, we've talked in the past that with the energy transition, it means energy security is increasingly a matter of metal security. So when you're looking out on just the shifting geopolitics of the world, I think we're all used to, you know, the world order resting on oil, is it now gonna rest on metals and, you know, when you talk to people in Washington, is there that increased realization?

Robert Friedland (24m 09s):

No, it's going to continue to rest on oil. I mean, every day we should fall down on our knees and thank the creator that the Saudis have maintained stable oil production without Saudi Arabia maintaining stable oil production, we're not gonna have an energy transition and this is the understanding is that we need to continue to produce a lot of the traditional forms of energy, especially if you don't want

to burn coal. We need hydrocarbon, we need oil, we need we need LNG in order to finance or sustain an energy transition but the problem is everybody's throwing these two words around and nobody understands what they mean. Let's start with the word energy. What is energy. How do you want to define energy, you can put a thousand physicists in a room and you can start to argue what that word means.

Robert Friedland (25m 01s):

I would say it probably means that transmission of electrons to do useful work, that's a pretty good definition of energy insofar as we use it as human beings and transition to what, transition from what and transition to what everybody understands what it's like to freeze in the dark. Do you recall a major nation bomb, another major nation to force those people to freeze in the dark 40, 45 million people consciously being bombed in the winter to freeze in the dark, can you ever think of a bigger ESG issue than that and if I'm a minor I can't go mining in Russia. Take a look at how much of the world's crust that is and I can't mine in Ukraine with bombs falling in my head and for other environmental reasons, they're very large parts of the crust of the earth where you have a positive water balance, where it rains more than it evaporates, where you have to worry about the sanctity and integrity of tailing stamps.

Robert Friedland (26m 06s):

So we can't mine in wet places. We can only mine in relatively dry environments, and so we need more and more critical metals, but there's a smaller and smaller fraction of the earth's crust that has minors we can raise the capital in mine and once you start to distrust the enemy, once it's a question of the other, there's 1.3 billion Chinese that need to feed themselves. They're concerned only with the Chinese. I would do the same if I was Chinese but that creates a lot of pucker factor for the Japanese. They have their historical reasons not to like the Chinese, they want their own supply chain for everything and then the Koreans are caught in the middle and they say, we can't trust either of these two guys by the way, there's two Koreas and they both want their own supply chain and what about the Europeans?

Robert Friedland (26m 57s):

They're gonna freeze in the dark if they're not careful. They need their own supply chain and as energy prices rise, the price of food skyrockets in Pakistan, in Egypt, in Nigeria, and we see all of Latin America being becoming quite unstable and so these are incredible changes that I believe are just beginning a more or less exactly what we saw, the sort of the fantasy that just software could solve all the world's problems without concern about the global hardware system and so we do have inflation. We do have a balkanized world economy. We still have the overwhelming demand to green the world economy. This is not gonna change. We still are concerned about global warming and that's gonna be an issue that humanity will grapple with for generations. It won't be as easy as we think and that means there's gonna be a broader and broader audience for SmarterMarkets for this podcast is you have got to get smart people talking to each other, especially those that direct capital.

Robert Friedland (28m 03s):

The ultimate capitalist was probably Stalin. You know, Stalin would say, you give me gold to mine and 3 million people would be ordered through the direction of capital to go to Siberia and mine him. Gold capitalism works in a different way. You, you have to attract to people's intellect and to their sense of self-preservation, maybe beneficial self-interest, but it's apparent now, if you want to protect your wealth, you don't want to own Netflix, you don't want to own Facebook, you've seen these things down 30%, 40% down in a day, right and you see these warning strokes in some of these ridiculously overvalued technology shares that are really dependent on stupid things like crude oil. I was in in Boston and I met the wife of one of the most prominent fund managers in America, one of the greatest human beings. I know somebody that directs as much capital as any human being.

Robert Friedland (29m 01s):

And it was a bad day that Dow was down a 1,000 points. It was a Monday morning and as the wife of the fund manager came into the lobby of a building, she bumped into me and she said, I said, be careful your husband's having a bad day. He is down about 20 billion and market cap on his portfolio and she said, I told him to hide in big cap oil and gas shares and I said, that's funny, that's exactly what I told him, you know, but if you got caught in Netflix and you got caught in Facebook, there's just no place to hide and, and so these kinds of disruptions are opening soon at a theater near you and that means that getting really smart people onto this broadcast is critical and we have created sort of a cosmic community that I can assure you reaches all the way to Saudi Arabia and other very important places.

David Greely (29m 53s):

Yeah. One, we did some of our year end stats for the podcast and one of the ones that most impressed me was we had listeners in, I believe 186 countries at which point I had to look up how many countries there were in the world and it seems to be a matter of some contention, but it's around 195. So I was pretty impressed how many places this little podcast has gotten downloaded to and I couldn't agree with you more, Robert, because you paint quite a picture of like, the stakes for getting this right or getting this wrong really couldn't be greater and you know, Josh, I think of you as one of those people who's always out meeting new people, building new connections, working on problems and you know, I'm curious, as you've been out trying to build support for this SmarterMarkets vision, how's the podcast increased your ability to do that?

Josh Crumb (30m 44s):

Yeah, of course you know, Jeff and Robert and the early conversations were key, but one that I saw resonated with the Abaxx community is the first time I was on, I talked about a concept of the 29ers. It was really a call for the entrepreneurs within the companies that perhaps think similarly to us and of course the, you know, the 29ers, what I was really riffing on was, was the John F. Kennedy moonshot speech in 1962, which he said very specifically that we need to put a man on the moon before the end of the decade, which of course happened in 1969. So, you know, I put out the call the 29ers, not that I think that we're gonna solve, you know, all of the, all of the problems by 2030 or 2050, but, you know, understanding that building a mine like Roberts, which you know, will be, you know, the second largest copper mine in the world.

Josh Crumb (31m 38s):

That was a 20. Well, yeah, we talked about this last episode, a 27 year endeavor. So what we need to do is we need to get serious about doing an actual feasibility study, you know, as a global community of what this actually means, right and that's both the physical infrastructure and the market infrastructure and of course you know, again, tying back to that, to that moonshot speech, a lot of the technology didn't exist when he made that, that speech in 1962 and I think that's a big part of this CapEx cycle too, is that a lot of the technologies that we need again, let's assume that we've defined what transition means and I can get to, you know, I totally agree with Robert's points that that all, you know, maybe riff on here in a minute, but even assuming that we know what that transition means, you know, a lot of those technologies where we think about, you know, direct air capture or hydrogen or some of the technologies they're gonna need be needed in geothermal or modular nuclear, you know, a lot of these don't even exist yet, yet we're expected to put trillions of dollars into them.

Josh Crumb (32m 40s):

And the last time I checked, if you look at, you know, just sort of the culture of the banking and you know, the heavily financialized capital markets you know, they're not really willing to take those types of risks on physical infrastructure that that may not scale you know, which, which is, which is very, very different than, you know, writing some lines of code, you know, testing fast and putting it into the wild, right. This is a very different type of R&D and in physics that we need, you know, we need to scale. So I think when we, when we put out that call to the miners, you know, again, you know, the people that wanted to take market based solutions to invest in these technologies and try to incentivize, you know, capital to flow this way.

Josh Crumb (33m 20s):

Yeah, we've got a lot of amazing feedback really from some of the biggest companies in the world, you know, calling us to talk about our ideas and how we're going about this. Which, you know, and I'm an entrepreneur that started a number of companies, you know, that that never happens, you know, where these companies are calling us, you know, you spend your whole entrepreneur life, you know, trying to wander the hallways and try to get into certain rooms, but again, I think, you know, that shared vision and creating that community is I think how we go about this a little bit different. You know, I think that call to the, you know, that riot call to the 29ers I think, I think has been important and, and that's what we want to keep trying to do with increasing that visibility.

Josh Crumb (33m 59s):

But, you know, may maybe one thing, you know, drawing, you know, beyond just the net zero and the energy transition goals, I also totally agree with Robert and how the world has changed and we think about the physical needs, not just from a return on investment, like the world has looked, you know, from, you know, the 90s and the end of history, you know, through the 2000s thousands and into this tech cycle you know, this was all a very similar geopolitical environment for the most part and I agree with Robert that everything has changed and yet in the commodity markets, we still see things as very financialized people still using the old investment models that they used 5, 10, 15 years ago and so all while maybe the narrative has changed, maybe we helped influence that in some way in

many companies and many countries, if you look at the price of these commodities, the price of these equities, what they're pricing, the forward pricing in the oil and gas industry is really pricing zero terminal value after about seven years.

Josh Crumb (35m 00s):

Right you know, if you look at the cash, you know, the valuations of these companies versus there, you know, their free cash flow yield, they're running it somewhere between 12% and a half to 15%, which means you pay back your capital in, you know, six, seven years and then they're worth nothing. If you look at the mining companies, and, and again, like, you know, we, we, we talked about this a lot during the summer with Daniel Jurgen's and SNP plats, you know copper reports, none of that is being priced into the market. So while it's very, very, you know, while, while it's important that we're having these conversations, we still haven't seen that really hit the capital markets yet, which is obviously, you know, the, the bigger part of what we're trying to do to, to move the ne needle here.

David Greely (35m 41s):

Right and since you brought up the moonshot, I feel like it's a great time to turn to talk a little bit about rocket science and some of the new technology that hopefully in league with SmarterMarkets can help deal with some of these problems. I always enjoy talking with you, Robert, in part because you have your pulse on new technology and the industrial and resource sectors and I wanted to ask you, what are you seeing now in terms of, you know, industrial technology that could be a game changer and how is the resource industry embracing or not venture capital for developing these new types of technologies?

Robert Friedland (36m 17s):

Well, that's a huge subject you know, there are some famous entrepreneurs in computer science like Steve Jobs and Bill Gates that changed the world. They created a reality distortion field that made us into cyborgs. All of us are sort of addicted to our headphone and the information that comes into our headphone. Bill Gates should be saluted for starting breakthrough energy ventures. He put together a fund with a lot of deep pocketed people willing to lock up their capital for a long period of time, trying to finance energy related startups that could knock the cover off the ball. Crazy ideas, early capital for say direct capture of carbon or new ways to fertilize plants rather than using chemical fertilizer, new ways to make edible protein, for example, without animal husbandry and I attended Breakthrough Energy Ventures Annual Meeting, Bill Gates, was there a lot of other people I know and listened to entrepreneurs give their five minute pitch on moonshots things that can really make a difference, because somebody's gonna have to do this because the supply chain needs moonshot breakthrough technologies.

Robert Friedland (37m 32s):

And the problem is, none of us have a superconducting, super colliding super computer that can actually track all of the world's technological breakthroughs. When you look at CNN, that's constantly negative news, you'd get the idea that humanity has faded to fail but if you had a superconducting, super colliding super computer that knew what all the young new Steve Jobs is and Bill Gates of the world were cooking up, maybe there would be grounds for optimism and you mentioned Dan Jurgen you know, I've known Dan for 30 years. I ran into Dan in Riyadh, Saudi Arabia and we had a seminar together talking to some people about these very same subjects. So first I'd like to tell you that even when you go to Aramco, which is the largest energy company in the world, and I believe at the moment it's the largest company by market capitalization in the world, although they are maintaining our energy stability globally, they are deeply involved in disruptive technology.

Robert Friedland (38m 34s):

When you go to EXPEC, which are their R&D labs which are near Hobar, near where the first oil was first discovered, you see astonishing technological advancement at Aramco. You see a culture of some of the smartest minds all over the world interested in unconventional oil and gas, interested in developing hydrogen and hydrogen economy and they have the capital, the scale, and the intention to do it. So it's amazing that you can actually go to Hobar and touch the prosperity. Number seven well drilled in 1938, which started it all and less than a mile or two away, you can go to EXPEC's R&D labs where they are looking to reinvent the future and Saudi Arabia is actually run by extremely young people's, a very young dynamic new leader in Royal Highness Mohammed bin Salman.

Robert Friedland (39m 34s):

And these people are in their 30s and they're driving the future even at Aramco and and so from the two ends of the spectrum, from a Silicon Valley kind of guy like Bill Gates all the way over to people that, that controlled the largest hydrocarbon endowment, there's intensive interest in disruptive technology and there's huge grounds for optimism that we actually can get there from here with more of these conversations. Now, we have taken an investment recently with Breakthrough Energy Ventures after a couple of years of due diligence on a new way to use electrical energy resulting in a completely new way to crush and grind rock. That sounds like a really

stupid thing, but the crushing and grinding of rock is responsible for approximately 4% or more of the world's total global warming gas. So if you want to change the world and you're worried about global warming gas, there's agriculture, there's methane from, you know, the growing of meat.

Robert Friedland (40m 41s):

There's methane and carbon dioxide gas from the way we make cement, the way we fertilize crops the steel industry, probably 9% of global warming, gas, crushing, grinding rock and starting to focus directly on these big industrial processes is critically important. I think we want to all recommend everyone Bill Gates' favorite book, how the World Really Works by Vaclav Smil, great reading for everybody, sort of a primer on the supply chain, where our food comes from and so yes, we should talk about disruptive technology, you know, that's worth another hour or two of podcasts because that's where the hope lies. We're gonna have to innovate ourselves out of this problem, the way we grow our food and the way we make our buildings and the way we build our cities. We've got 8 or 9 billion people scheduled to be on this little spaceship with us and Mother Nature is very, very fragile. The oceans are very, very fragile. The permafrost in Russia is very fragile. The fragility of the natural system is terrifying when you think in terms of your kids and your grandkids and we're gonna have to innovate our way out of this, and we're gonna need smarter markets and when it comes to the environment, we definitely need a price on carbon dioxide and methane.

David Greely (42m 11s):

Yeah, and I want to come back and talk with you in a little bit about some of that eye pulse technology, but it's a great because Josh, you know, you're so tuned in to technology's role in helping create pricing and markets to build better market infrastructure, better markets and of course the news flow recently has been dominated by the, the collapse of FTX and the resulting chaos in the crypto markets. So, you know, not exactly making smarter markets there. So I was wondering to, you know, get your thoughts on where do you see the most important role for, you know, technology and making smarter market infrastructure right now, and have the events at FTX and in the broader crypto world do you think helped or hinder progress in getting this new technology to work?

Josh Crumb (43m 00s):

Yeah. So one, one thing as we go through this conversation that I find, you know, really, really interesting, if I want to really simplify the kind of work that, that Robert does and, myself at Abaxx do, you know, we're looking at two, you know, very parallel systems. You know, one is the, the distribution and production of energy and the real, you know, physical, you know, the world of atoms and so when we talk about technology, you know, I think Robert made some great points about how this cycle's a little bit different in, in the way people are investing in these, you know, industrial technologies and then of course, you know, the way that people think about technology, you know, particularly in capital markets over the last 10 years of course is software technology and so really what we're doing at, Abaxx is really the distribution of information, right?

Josh Crumb (43m 50s):

So these are both very similar systems in in some ways and, and very, very different in in others but of course, what Abaxx is trying to do is build better information systems so that we have the right information and the right market signals to drive capital, you know, to build better, better physical energy systems, so that's really where they overlap. But, you know, getting to your question about FTX and, and really, you know, that was really pegged by many people as the next sort of iteration of the software is eating the world theme is this, this whole concept of cryptocurrencies and, and crypto markets. And then know how is that gonna change capital markets

Josh Crumb (44m 41s):

By using software and just intermediate, you know, a whole another, you know, set of of services, you know particularly financial services and so, you know, I think that was the path that the world thought maybe we were on up until o over the last, you know, the last 6 to 12 months. So, you know, to answer your question, you know, directly about FTX, you know, I think that in many ways this is a very, very good thing. I think we were starting to head down a very, very bad path with this new technology. I talked about this a little bit, the last podcast I was on where if you look at the capital markets, you know, you've got the debt capital markets, you've got the equity capital markets. So you have, you know, a very different risk profile as you move through that capital stack.

Josh Crumb (45m 25s):

But one thing that was very interesting about the ICO and the token, this was basically a no liability asset, right. It was basically trying to price the, the externalities, the positive externalities you know, we talk a lot on this, on this podcast about negative externalities in resource production and, you know, environment or the water that doesn't get priced but there's also a positive externalities in network effects and in information and that positive externality, of course, is what's built the market capital of so many of these great

companies where their physical investment doesn't match the intellectual property or asset, you know, the, the marketing or brand of their network effect, you know, in their information assets. So this was a whole another path that the world was exploring, but it really, in my view, got very, very off track because it wasn't actually utilizing the decentralized community building, you know, technology of the block chain.

Josh Crumb (46m 19s):

And really what it was, you know, as with a lot of these technologies, it just led in to a lot of grift and in fact the market structure of something like FTX, and we, we talked about this even before the collapse, it was just a terrible idea for market infrastructure. You know, we went away from all of the work that capital markets had done to separate an exchange from a clearing house, from a custodian, from a broker dealer you know, we created all of these different regulatory and, and business frameworks to try to remove that confluence, that interest in capital markets and all of a sudden you have this, you know, essentially this gambling casino of, of these tokens that just centralized everything. They became a broker dealer, they became an exchange, they became a custodian and of course, there was no transparency in any of it.

Josh Crumb (47m 12s):

So even though the technology of block chain was supposed to decentralize and bring better information, the sort of false path that we took down you know, in the crypto markets actually went the completely opposite direction and it created this highly centralized sort of cartoon and even worse version of finance. Right, you know, I would say it's a good thing that we finally are starting to get that kind of grift out of the way, and hopefully the builders that are actually focusing on what decentralized computing, what a decentralized data store that's not held in one company's, big servers where, where they can, you know, sort of access everybody's information or lose everybody's information, like there's all these big problems in the internet and I think these technologies can help that, you know, and again, we can talk about what that means for, for markets and commodity markets with this inter intersects, which is of course where, where Robert and I are focused. But, but yeah, again, you know, to answer your question, I think it's a good thing that we got distracted. You know, we, we got distracted. I think we can get back on track now.

David Greely (48m 11s):

And Robert, one of the, the initial hopes for block chain in the commodity sector was that it could be used to track the provenance of commodities that are mined and energy so that producers who are producing in more environmentally responsible ways might be able to charge a premium for the commodity they produce, you know, whether it's green steel or copper or what have you and also to be able to put a price on things like carbon emissions that, you know, you've said a few times is so central and so important to any energy transition. So I was curious from your perspective, have we made much progress towards your original goal of being able to put a price or to put a green premium into commodities mind and produce an environmentally responsible ways or do we still have a long way to go?

Robert Friedland (49m 00s):

We've taken the first baby steps and those baby steps are going to transition to teenage steps. There's, there's no doubt that the major European automakers are very concerned about their supply chain. Now, people that are intelligent consumers they not only want to know how much hydrocarbon per kilometer you're burning or in a transition to electric cars, how far you go with a unit charge, but they want to understand the entire supply chain that built that car and how that car will be recycled, for example. So we have taken early steps in looking at the basic pricing of commodities, but most commodities are still grossly mispriced. I'd say the most mispriced of all commodities is water. Water is going to become a giant global issue, how we produce water on this planet. The water apparently came from asteroids and struck the planet long ago.

Robert Friedland (50 m 00s):

That's current scientific thinking, but 97.5% of the water on this planet is saline, only 2.5% of the water is fresh. So water is a very important commodity. Electricity is a very important commodity. We're coming back to energy transition. If energy is the useful movement of electrons to do work, we're transitioning to what and going into the basic commodities, we need to generate the energy in order to transition how we make the energy. This is just a enormously important subject. We have to go back to a young politician, AOC, the young lady who was in the Congress, she said she'd like to stop the building of hydrocarbon in 10 years, so it's not gonna happen in 10 years and we're gonna need the cooperation of the hydrocarbon producers, the British Petroleums of the world, the big integrated oil companies are critical that they set a path towards being a different type of energy company in 10, 20, 30, 40 years. The national oil companies like Aramco, they're critically important. Aramco has the cash flow and the vision to actually do it and so I remain quite optimistic. I'd like to spend a little time telling you about what I pulse does and how fundamental it is, but you'll have to

give me a chance to come back later and explain the difference between direct, current, alternating current and pulse power, because that's a fundamental technological change in how the supply chain is gonna be reorganized.

David Greely (51m 36s):

Oh, I absolutely will again I can't wait to hear all about that, but you know, before I wanted to turn back to Josh for a moment because I love that division you talked about of, you know, the technology for producing the goods and distributing them, operating the real economy and then the market infrastructure that pulls it all together there and the information technology and software and the other thing that's been in the news recently has been recent investments by, you know, Microsoft and the London Stock Exchange and this is extending a bit of a pattern. We're seeing, like last year Google investing in the Chicago Mercantile Exchange and I'm curious, you know, from your perspective, what do these investments tell you about the growing importance of technology in the future of exchanges and other market infrastructure?

Robert Friedland (52m 28s):

Yeah. Well, again, I think the markets, the, the history of markets really evolves with the history of information technology. They run in parallel and, and always have and so, you know, from going all the way back to you know, one of my, one of my favorite books is Tom Standage's The Victorian Internet, and I was talking about the history of the Telegraph and how, you know, really from, from, you know, military times and, you know, flashing these, these you know, using, you know, basic accrued version of information theory, you know, all of these signals on a battlefield and how that turned into, you know, information signals and a telegraph, and then how we, you know, completely connected the world through the Telegraph as sort of the first Victorian era internet. I would definitely recommend that book for, for thinking about our progress and the movement of information.

Robert Friedland (53m 13s):

But at that same time, you know, what, you know, I, I connect that to the way markets were developed at, that time and the, you know, in the limited liability company in the, you know, the joint stock companies and the equity trading and the Telegraph was a big part of, of that market infrastructure and in one of the highest value use cases for that early telegraph, of course, was, you know, international stock quotes and, I'd probably say probably more bond quotes at that time. So we've always, you know, our, our information technology and our market price signals have always sort of, you know, developed in in parallel. So where we are today, and again, this was one of the big themes that that led me to, to, to build Abaxx Technologies, was thinking about that next iteration of the internet and how that was gonna affect markets.

Robert Friedland (54m 00s):

So you saw that the 90s bubble, you know, information technology bubble, you know, really brought about things like e-trade and, and really revolutionized, you know, retail trading. We got away from the, you know, the floor trading pits for most of the exchanges. We got away from the floor trading pits and into the electronic, you know, pricing on your screen, you know, driving down the cost of all of that human infrastructure of settlement and trading and clearing. So we went through that whole cycle, but we think actually a whole another cycle's gonna evolve in this sort of next generation of the internet which is what we call, you know, the commoditization of trust. So, you know, first we, we commoditized the personal computer and those, you know, early applications. Then we commoditized through cloud and mobile, these big network companies, you know, whether it's Google and all of the advertising markets that happen in a Google ad auction, you know, we created these network effect companies like Uber and, and Airbnb, which are, you know, real time markets that really you know, turn up on, on the mobile phone, you know, to, to take all of this excess inventory in the personal economy.

Robert Friedland (55m 00s):

So all of these, you know, this growth of information technologies really has changed markets as as it goes along. So to get your, to your question of where we see the next and why we see companies like yeah, Google investing in, in the CME and Microsoft investing in the London Stock Exchange, they're like everybody else. They're the data economy and the transition of the data infrastructure that's always evolving these exchanges. It's very hard to change your, your technology stack within a financial institution once you have these live real-time markets. So they need to go through this very long transformation to the cloud and really up upgrade their infrastructure, see that, have you have even more real time data available to people. So I think that's just a, it's an ongoing evolution of markets that follows very, very closely to the evolution of information technology And I'm happy to, to talk about where we think the next iteration goes and kind of what, what Abaxx is doing. No, we can talk about that, you know a little bit later.

David Greely (56m 00s):

We hope you enjoyed the first half of our special holiday conversation with Robert Friedland, the Founder and Executive Co-Chairman of Ivanhoe Mines, and Josh Crumb, the Founder and CEO of Abaxx. Please join us next week for the second half of the conversation. We hope you'll join us.

Announcer (56m 17s):

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